Trinity College Dublin

A Picture Paints a Thousand Sounds; Visual Content in Computer Music Interfaces

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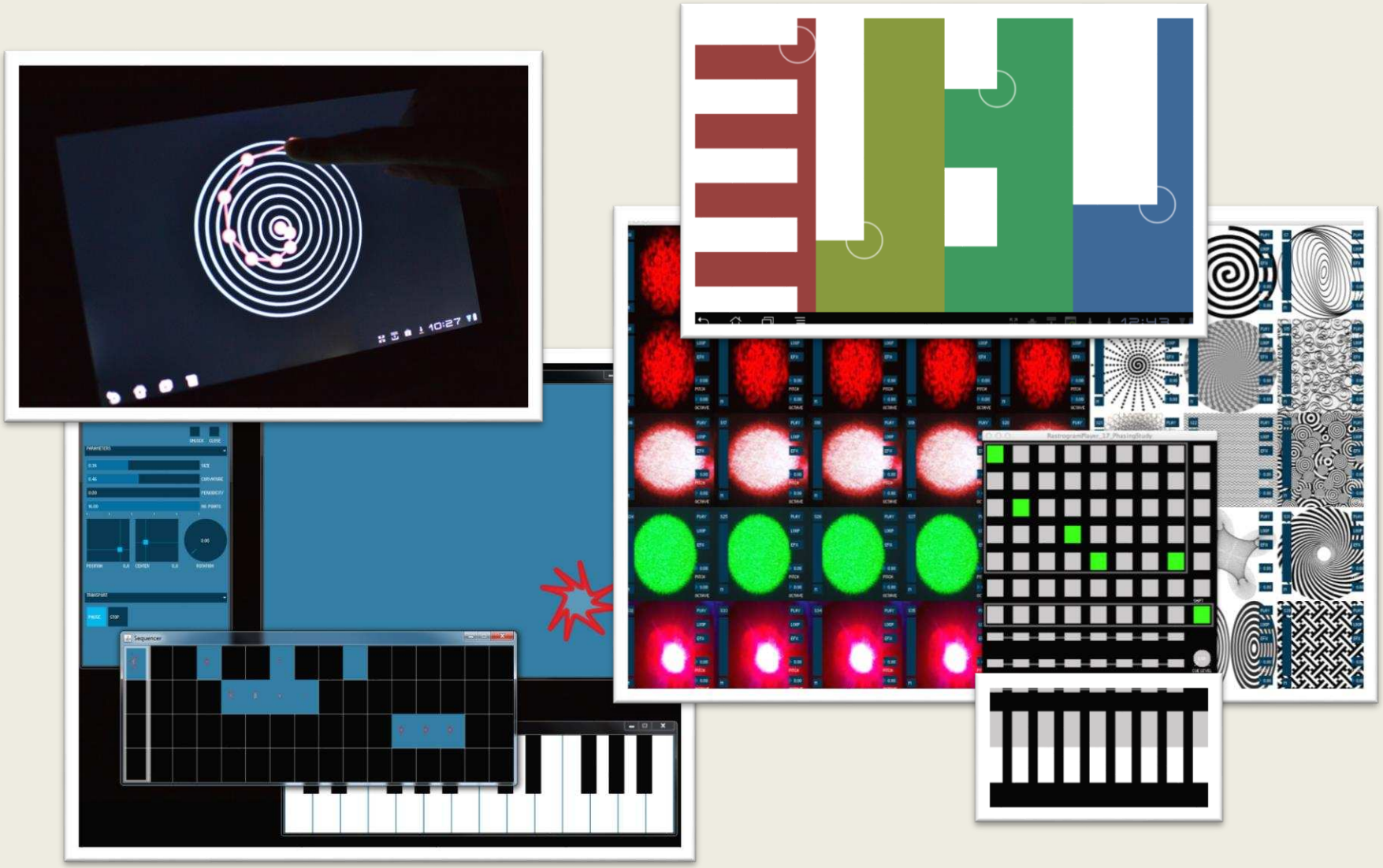
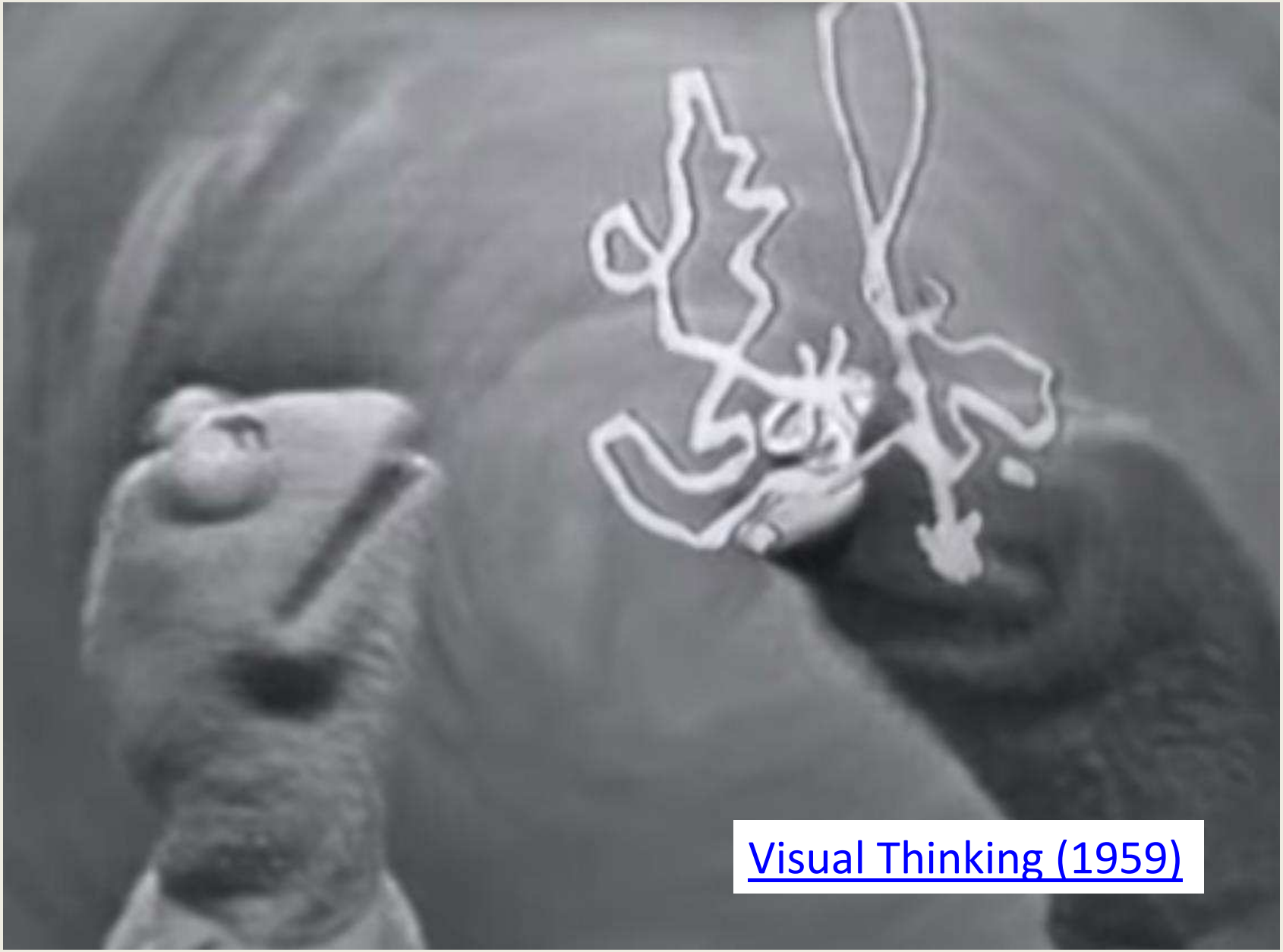
A bunch of interfaces…




Visual Thinking (1959)

Mapping of musical parameters to graphical parameters.

Mutability of data; revise, undo.

Spatial manipulation.

“Copying an instrument is dumb, leveraging expert technique is smart.”

-Perry Cook

Research Questions

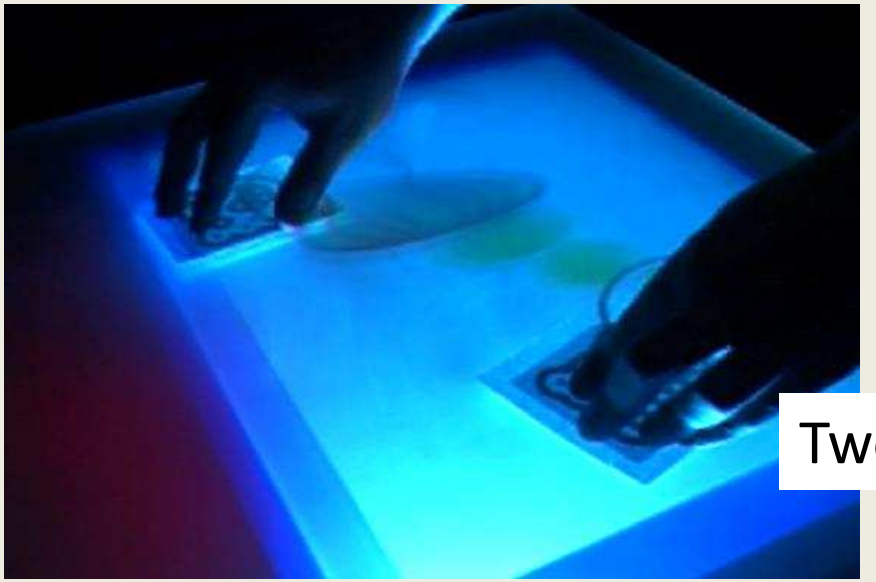
- What novel visual representations of musical material can be used to more effectively control sound in GUIs, including timbre?

- Can the interface serve as part of the audio-visual performance and enhance simultaneous creation of sound and visuals?

Graphic Synthesis

"Graphic synthesis follows a visual and sculptural strategy for sound specification"

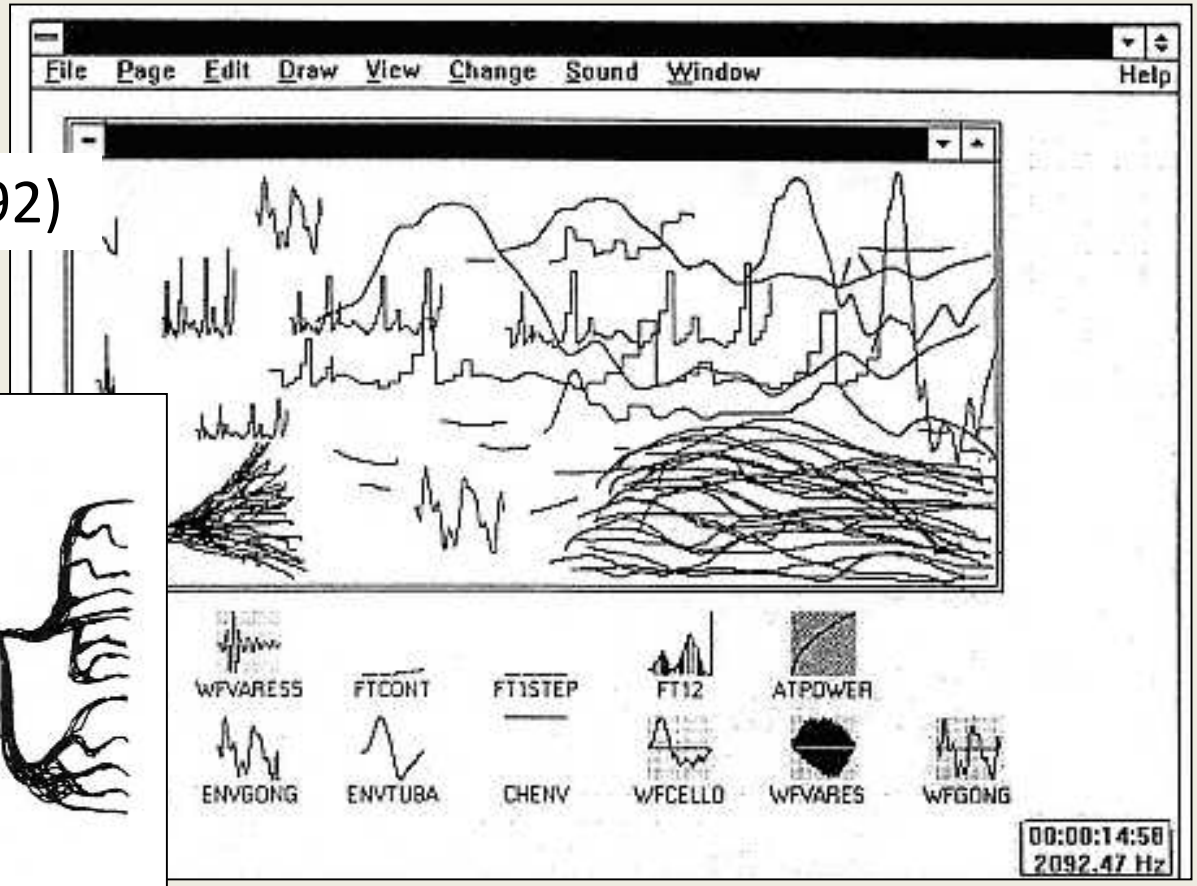
[Roads, 1996].

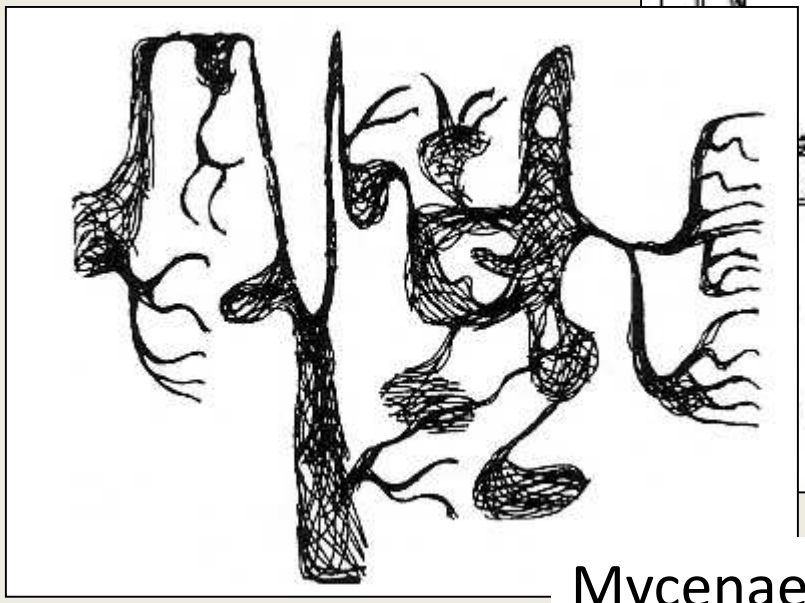


TwoHand (2008)

Graphing Musical Parameters

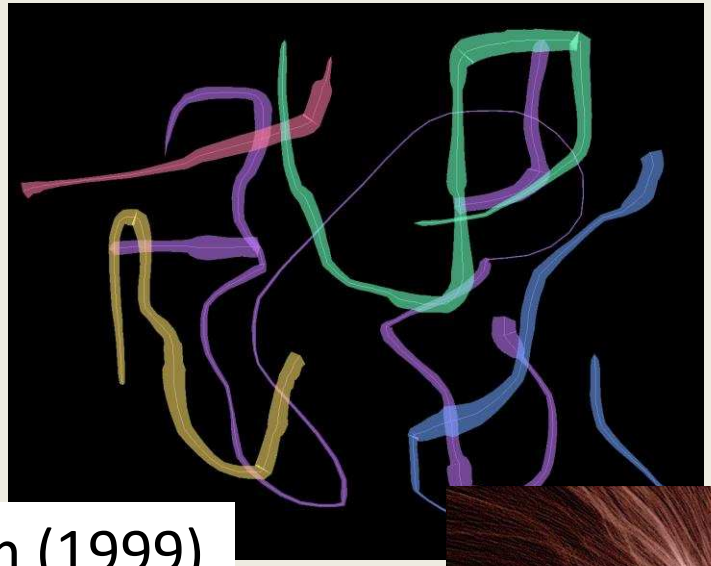
UPIC Score by Pape (1992)



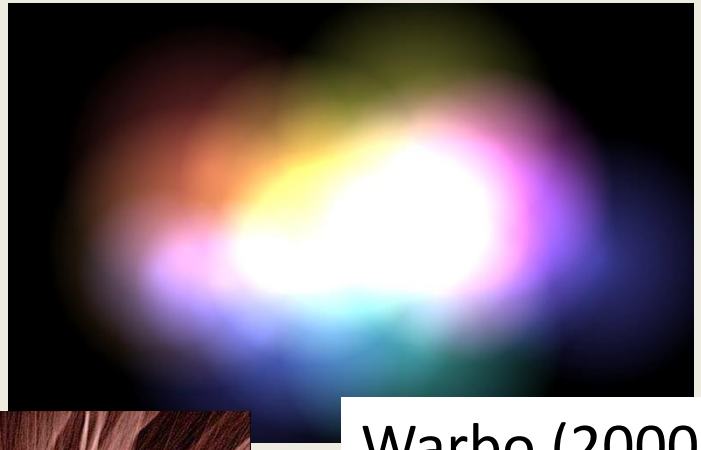


Mycenae Alpha by Xenakis (1980)

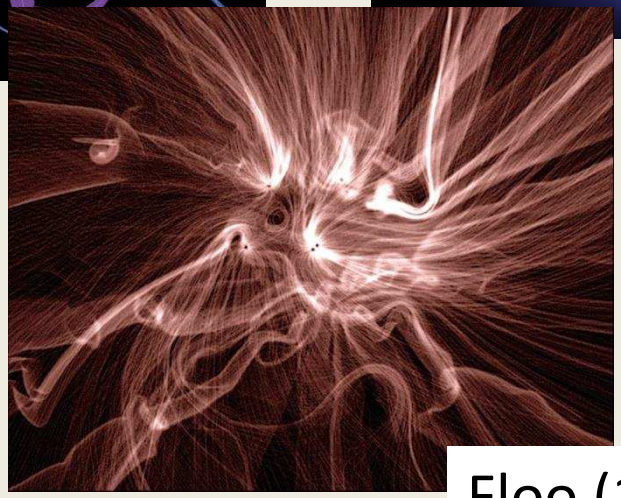
Golan Levin AVES



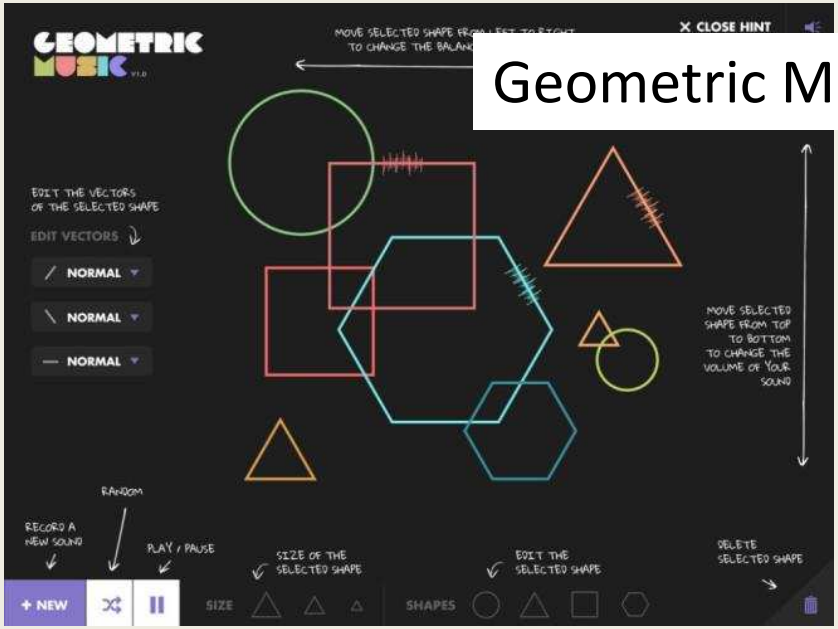
Loom (1999)



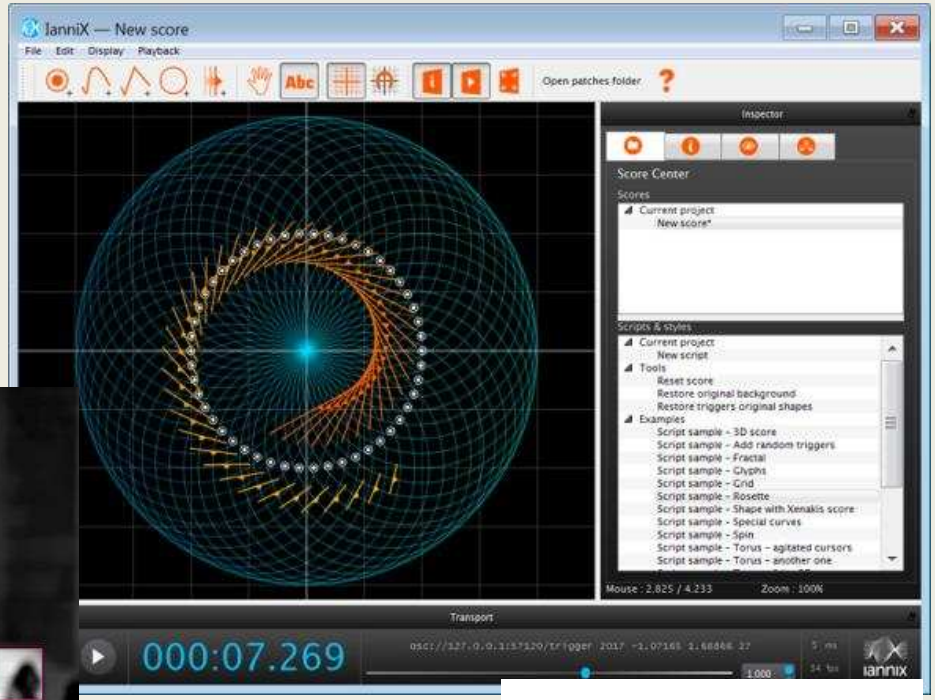
Warbo (2000)



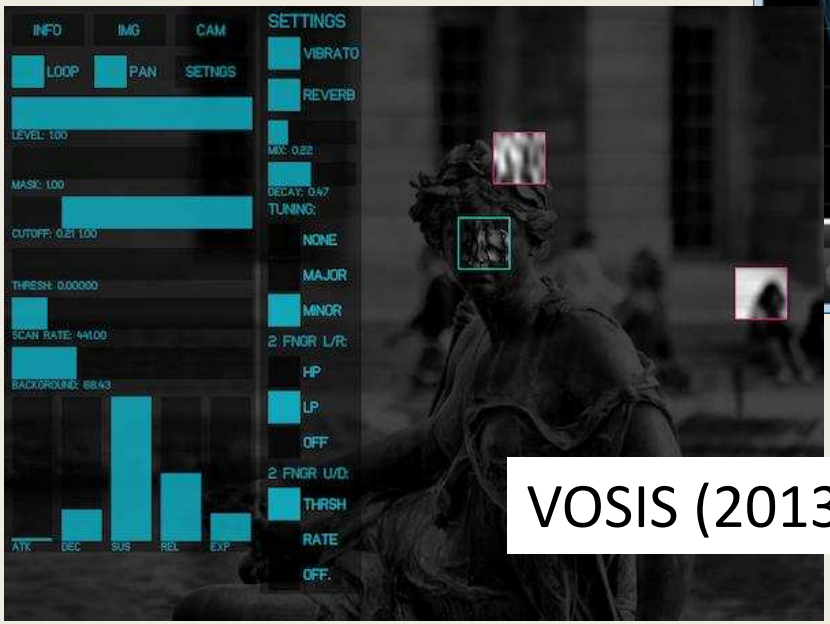
Floo (1999)



Geometric Music (2014)



Iannix (2012)



VOSIS (2013)

How to relate images to sounds?

1. Inspiration from Visual Music works.
   I. Synchromy Android
   II. RDTD Android

2. Perceptual cross-modal mappings and metaphor.
   I. ShapeSynth
   II. TextureSynth

3. Image audification via raster scanning.
   I. Rastrogram Player

1. Visual Music

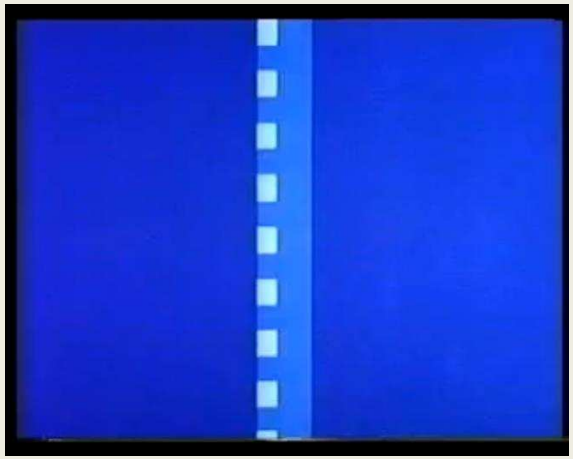
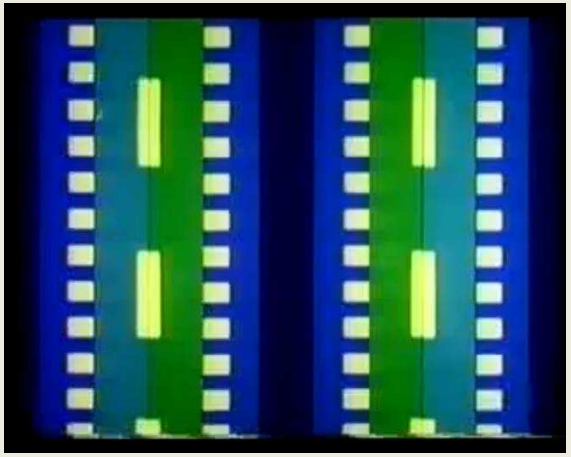
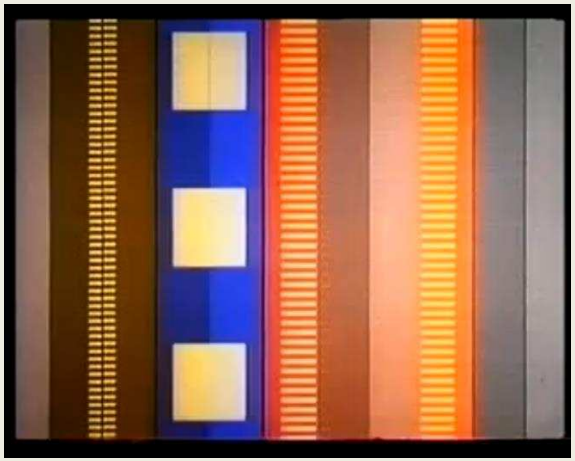
- Non-representational imagery that attempts to elicit similar feelings as ‘sonic’ music.

- Approaches the same level of temporal complexity in the manipulation of visual characteristics (e.g. spatial distribution, motion, colour modification etc).

Norman McLaren- Synchromy (1971)

- Used **Direct Method** and other techniques to "give the intellect a rest".

- Stencil cut-outs were exposed on to film and optical soundtrack to provide tightly-coupled audiovisual output.

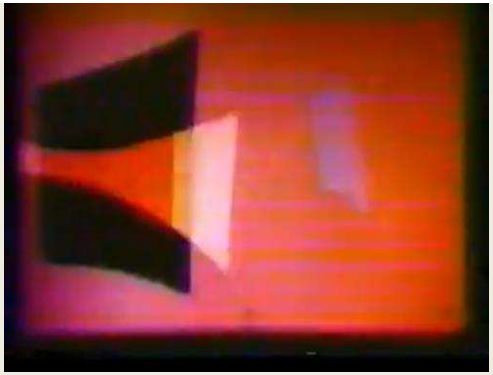




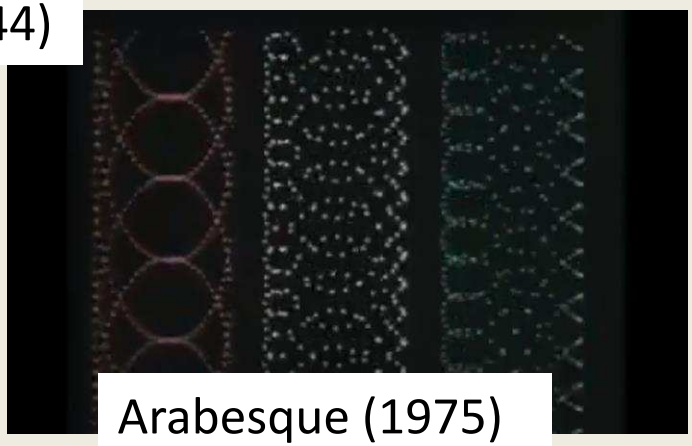
- Essentially 4 x 2-D sliders controlling four oscillators.

John Whitney

- **Radial Differential Time Differential (RDTD)** technique.
  - Evolution of patterns over time, order/disorder.
  - Successive pattern elements (e.g. dots) move at some multiple of (e.g. angular) speed.

Five Film Exercises (1943-44)

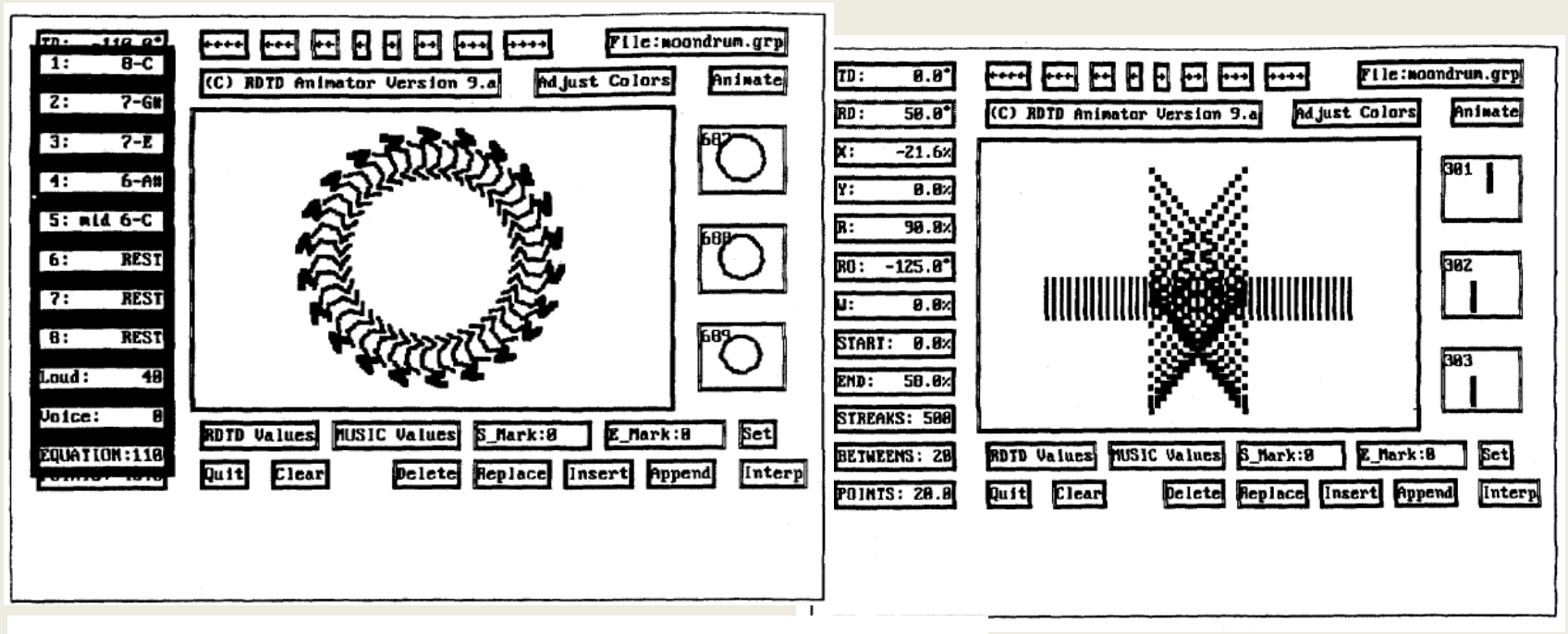


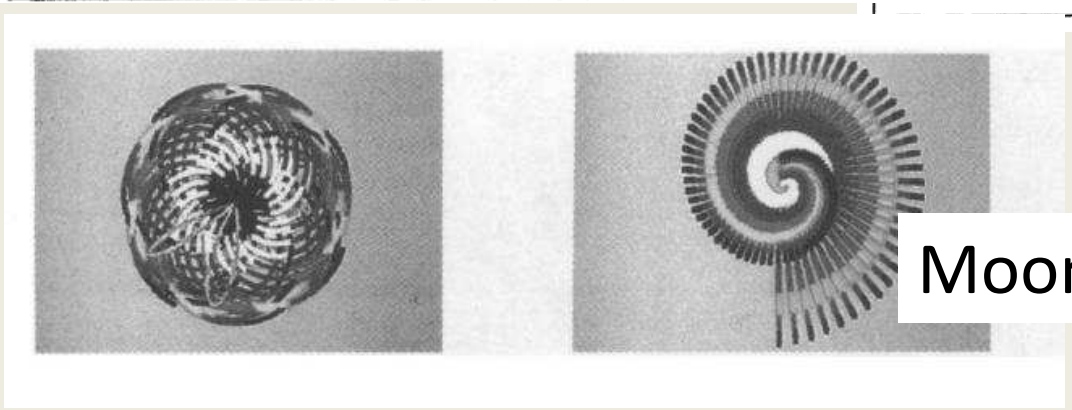


Arabesque (1975)

Matrix III (1972)

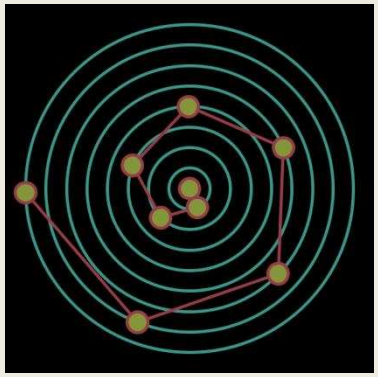
- Number boxes to change shape parameters, saved to frames and rendered to sequences.

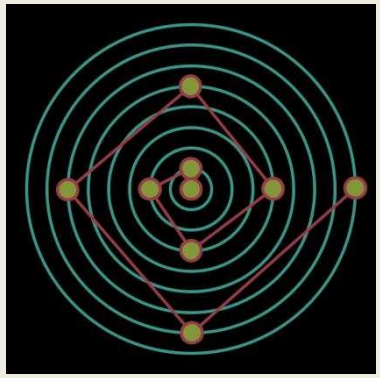


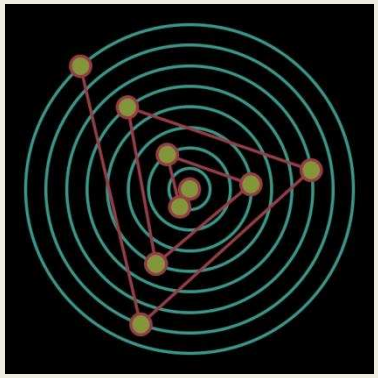


Moondrum (1991)

RDTD Android



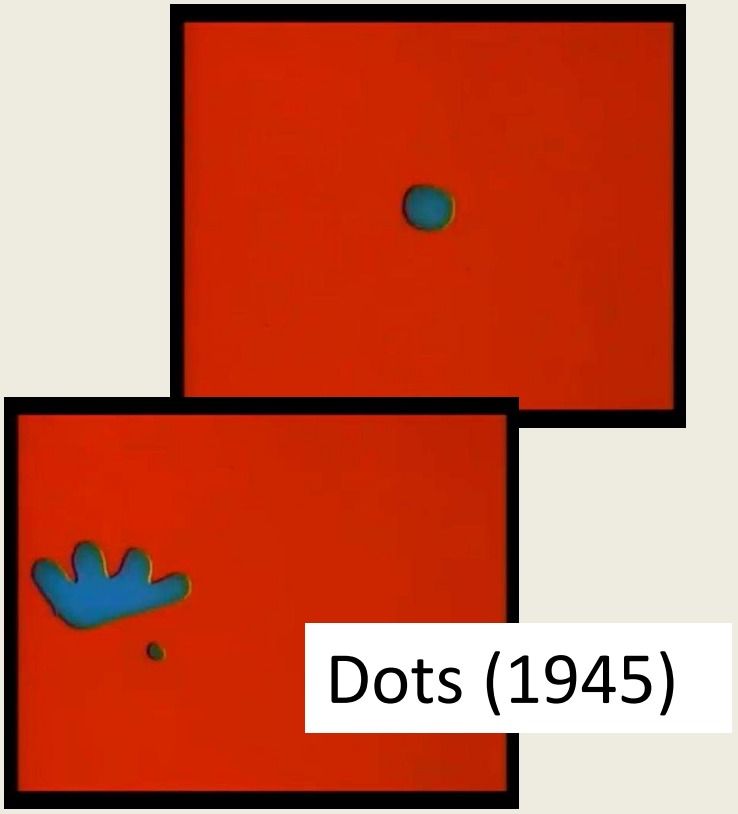




Visual Music Mappings

- Norman McLaren- Dots.

- Reactive mappings:
  - Size to pitch.
  - Size to duration.
  - Shapes ‘move back’ from screen with time (amplitude, time to depth).

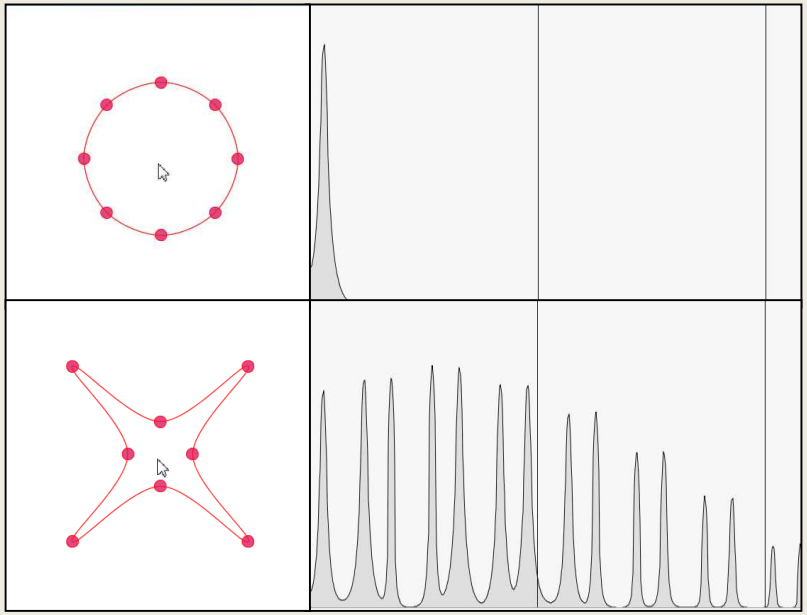


Dots (1945)

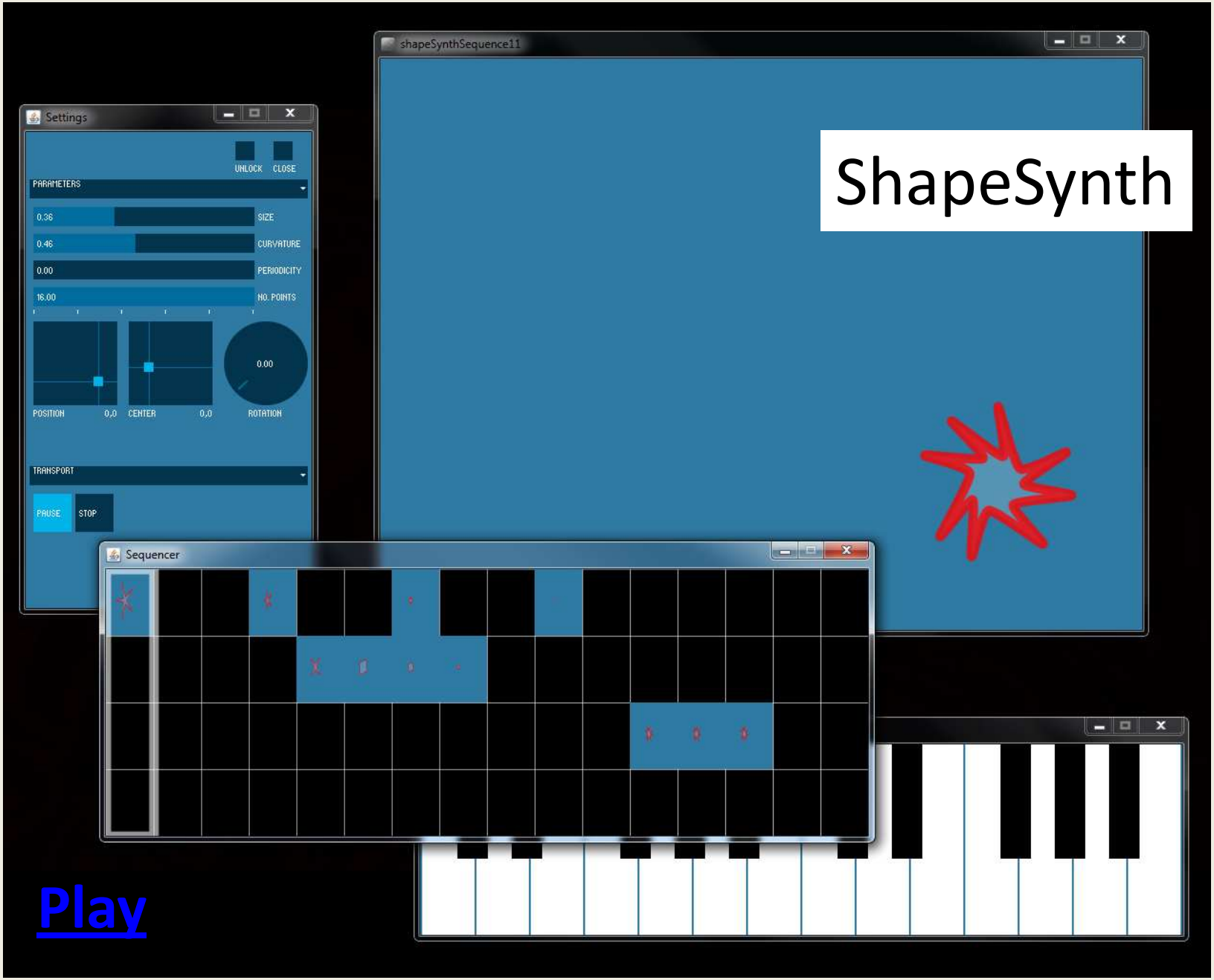
2. Perceptual Cross-modal Mapping

- Can use common perceptions to map qualities of a sound to visuals or vice-versa.

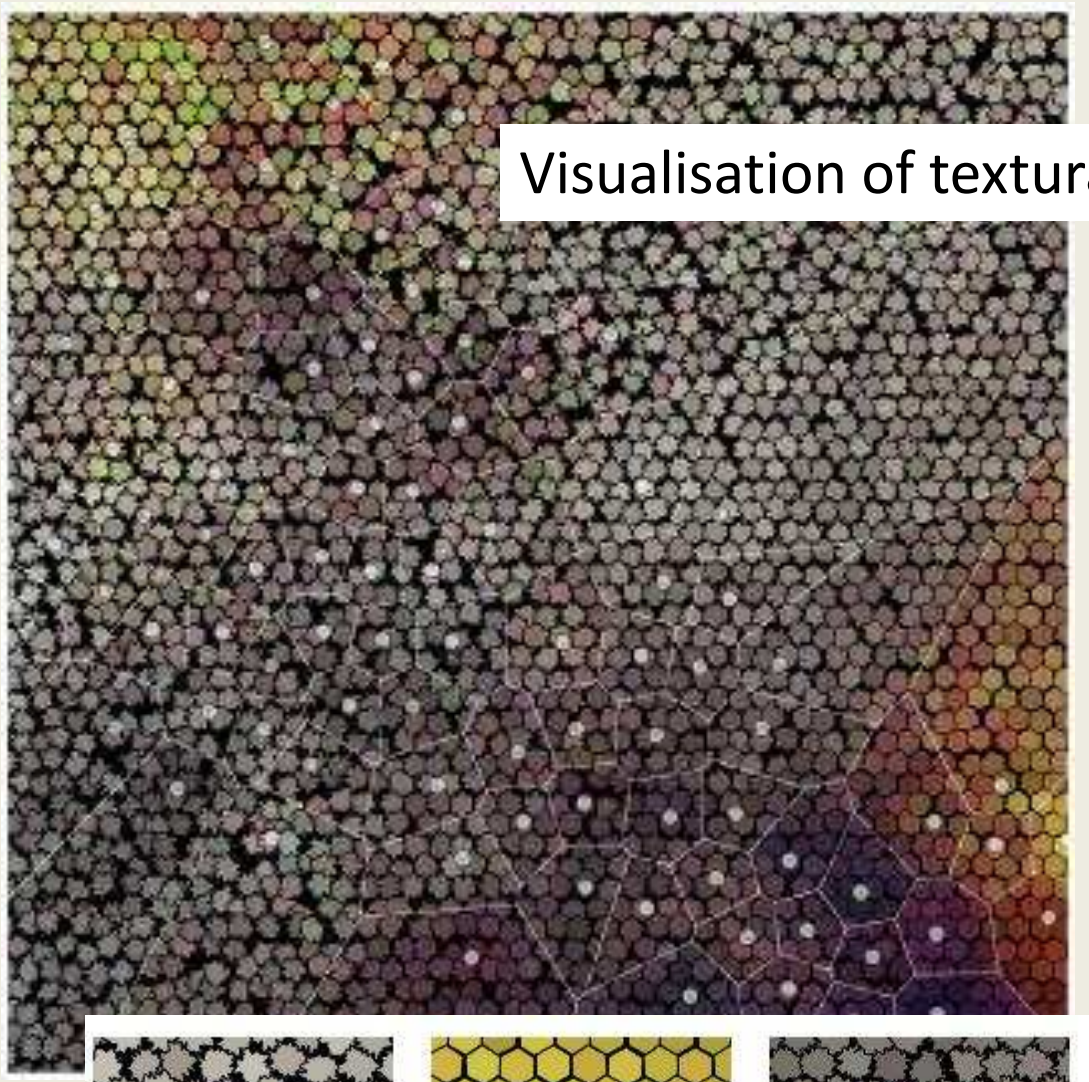
An example relationship between the shape of a virtual controller (left) and output sound spectrum (right) for prototype audiovisual system .



Sound Symbolism

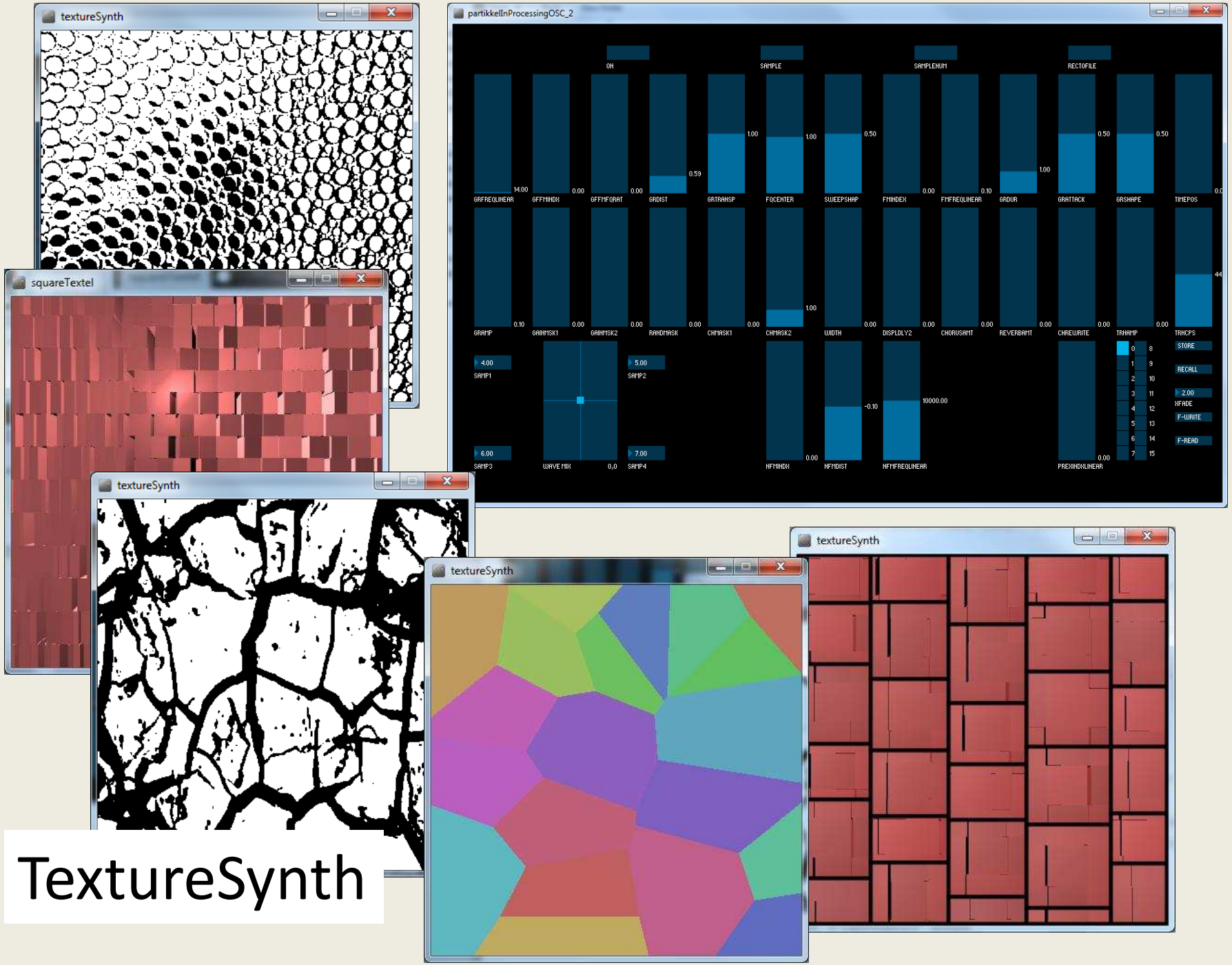

shapeSynthSequence11
Settings
UNLOCK
CLOSE
PARAMETERS
0.36
SIZE
0.46
CURVATURE
0.00
PERIODICITY
16.00
NO. POINTS
0.00
POSITION
0,0
CENTER
0,0
ROTATION
TRANSPORT
PAUSE
STOP
Sequencer
ShapeSynth
Play

Visualisation of textural sounds [Grill, 2012]



Texture & Metaphor

- Metaphors can associate experience in one domain with that in another.
- Granular synthesis produces sonic textures, which can be represented by their visual counterpart.
- Can view as spatial grid of parameter presets- essentially a multidimensional parameter space.
- Interact with the material that drives the output sound- allows the performer to improvise by exploring routes through the timbre space, with a visual indication of what to expect.

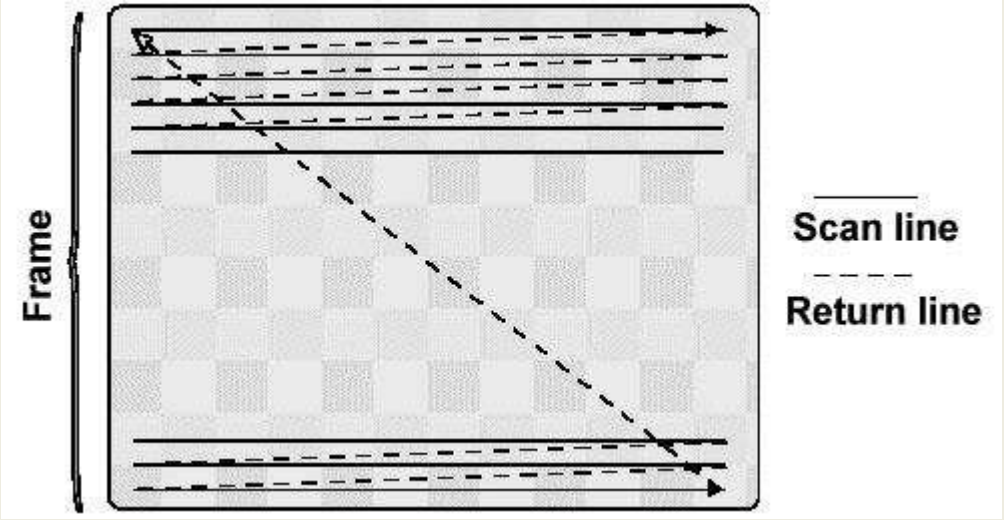

textureSynth
partikkelInProcessingOSC_2
squareTextel
textureSynth
textureSynth
textureSynth
TextureSynth

3. Image Audification

- Scan digital image by accessing the graphics buffer and pulling colour values for each pixel.
- These values can be mapped to the audio domain e.g. brightness -> digital audio sample magnitude.
- A wavetable can be created which can be scanned at audio rates by an oscillator to generate sound.
- Visualisation of the input ***rastrogram*** synched to the audio oscillator can produced tightly coupled graphics.

Raster Scanning

- A **raster** is a line that scans an image from top-left to bottom right and has its origins in data transmission and display [Yeo & Berger, 2006].

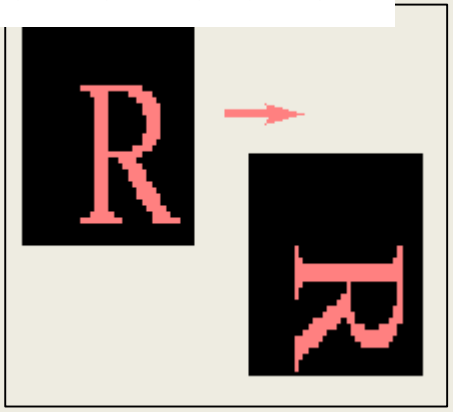


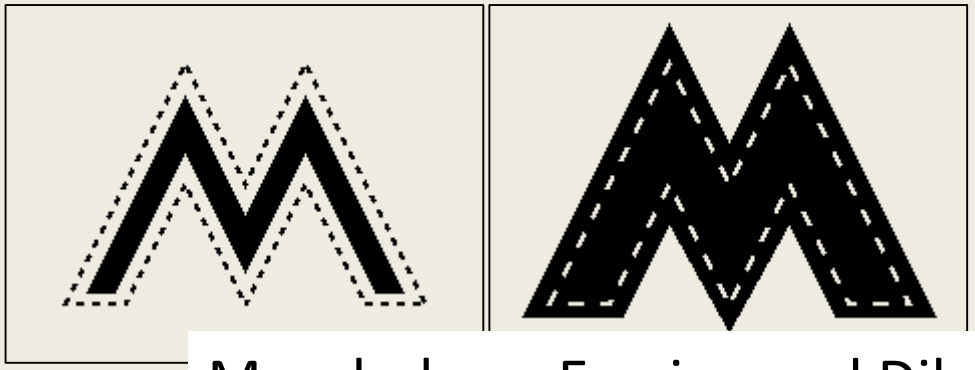
Perceptual relevance

- With patterned/ textured images, it becomes possible to predict what the image will generally sound like.
- The finer details introduce a stochastic element, but there is an apparent perceptual correspondence between domains.
- This is useful from an interface/ control standpoint.
- In addition, the application of certain image processing effects also produce characteristic changes in the audio that seem ‘to make sense’.

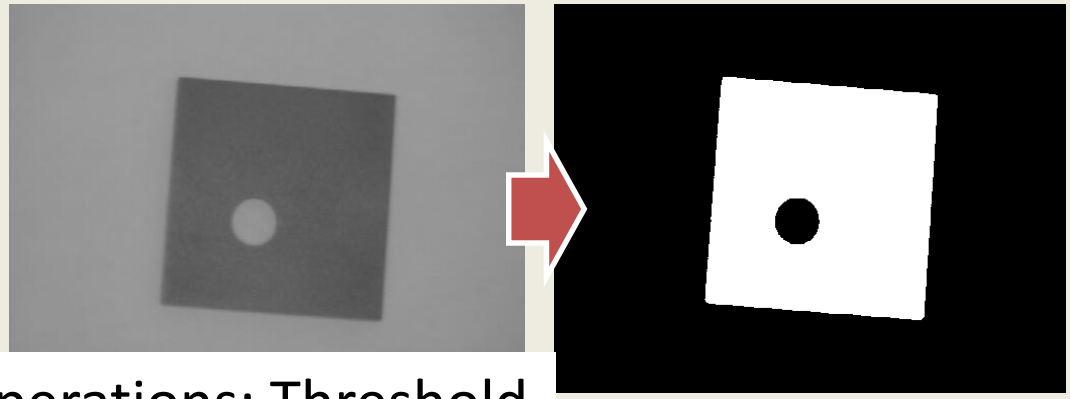
Image Processing

Geometric: Rotation

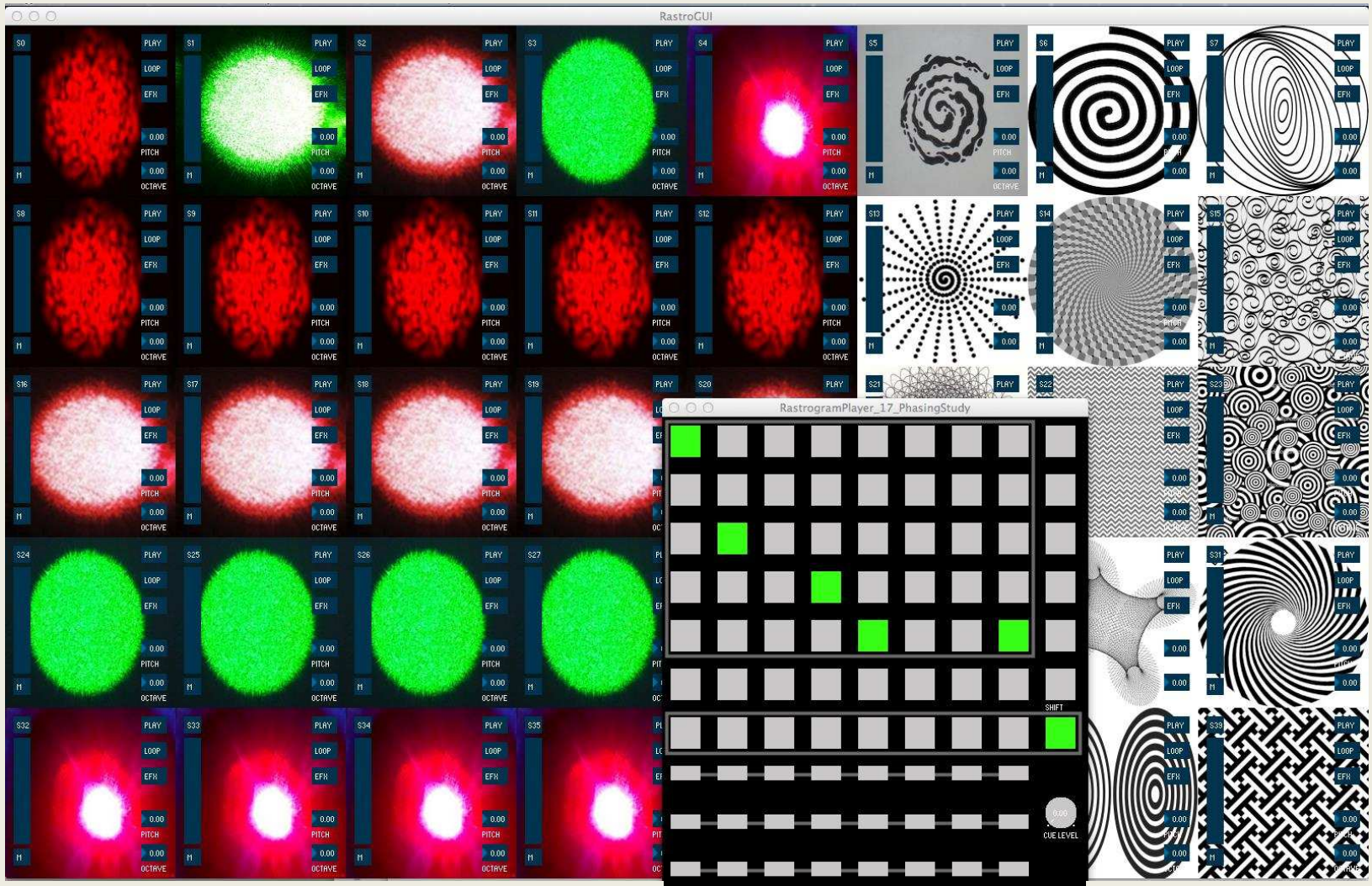


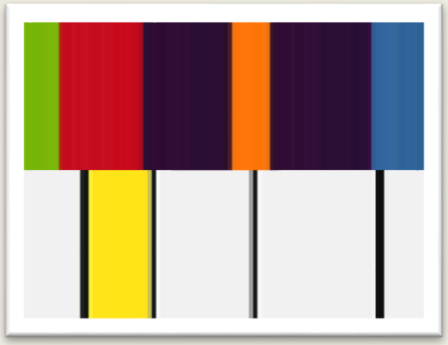


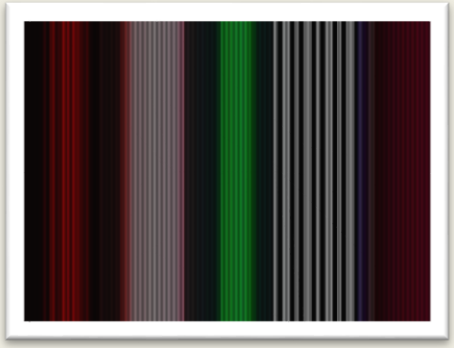
Morphology: Erosion and Dilation



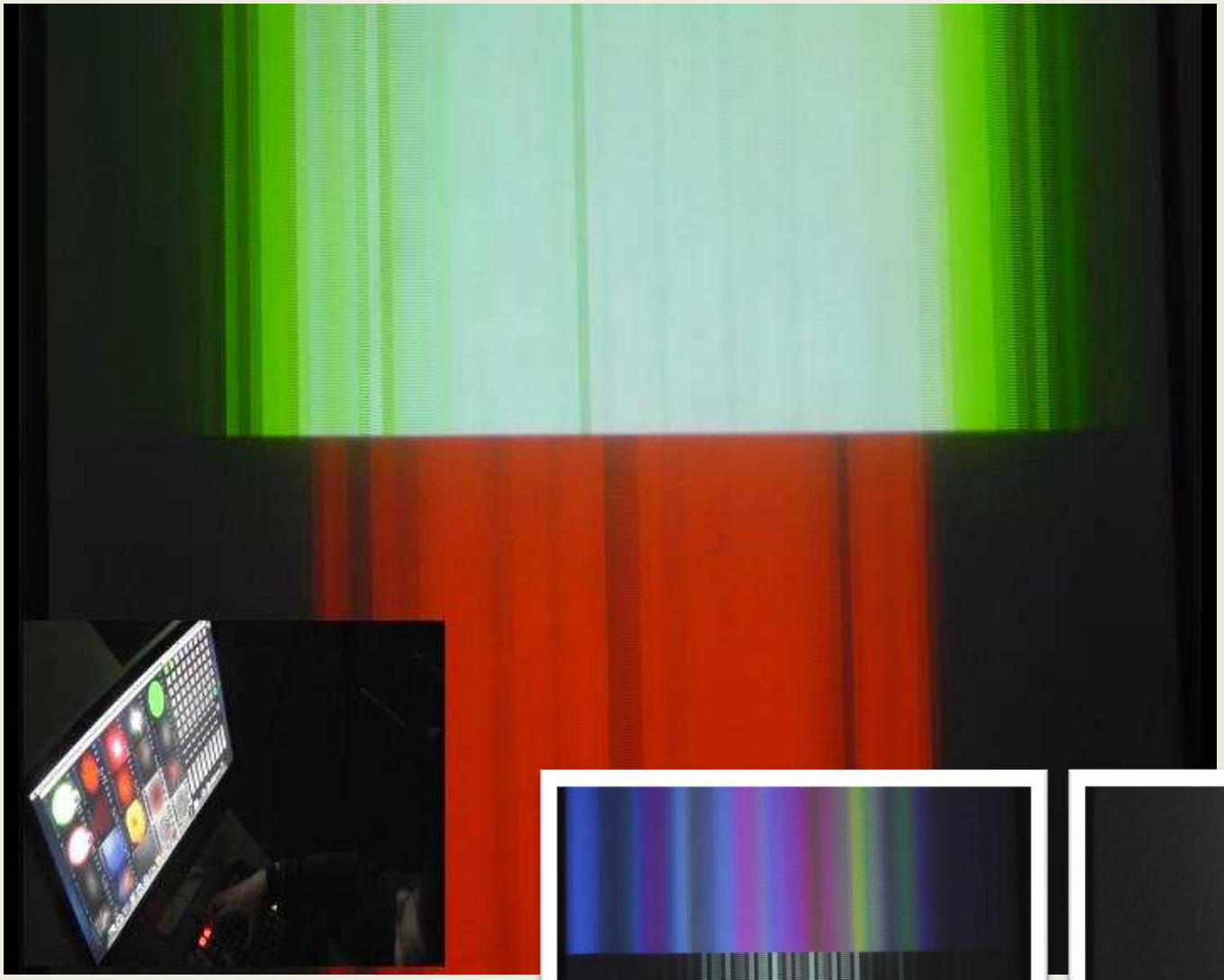
Point Operations: Threshold

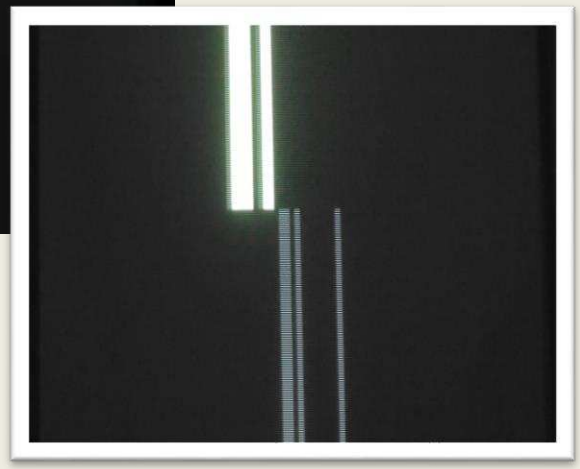






Rastrogram Player





Play

Interfaces: Next steps

- Adaptation into Natural User Interfaces for multitouch platforms.
  - Feels natural to the user, having been learned.
  - Use full bandwidth of human input.

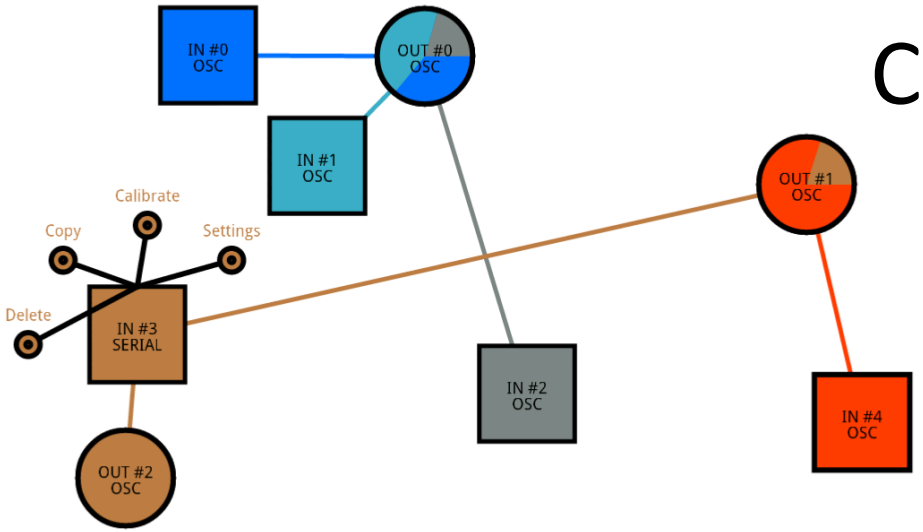
- Convert *ShapeSynth* to use multitouch interactions, complex mappings, additional image effects.

- Macros and sequencing for *Rastrogram Player.*

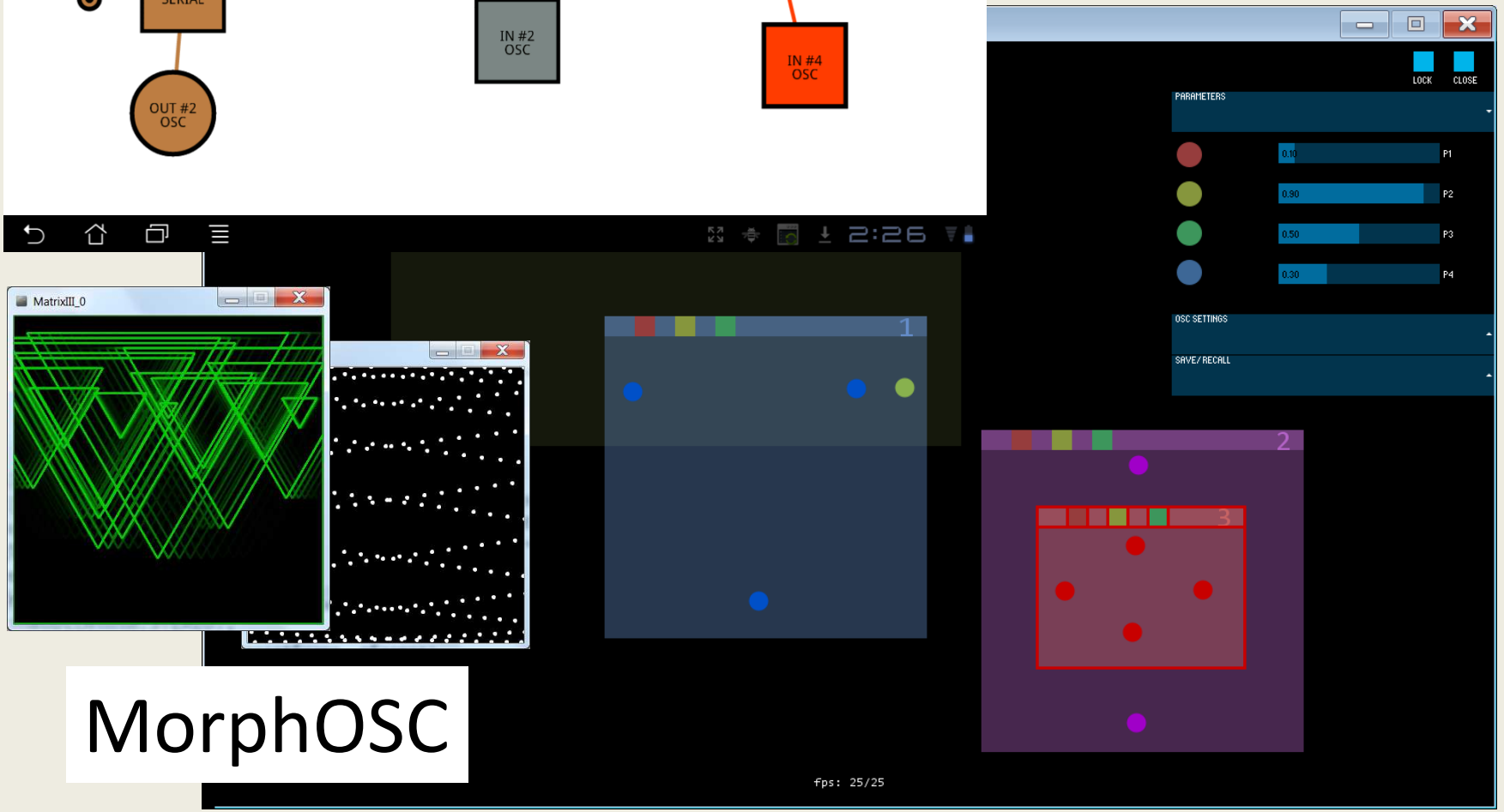
Challenges & Future Work

- Mapping of many synthesis parameters, in complex ways.
- Inclusion of standard effects plugins for visuals -> richness of output.
- Integration of encapsulated functionality as modules with rich interaction potential.

CrossMapper



MorphOSC



*Thanks to **Music & Media Technologies**, Electronic & Electrical Engineering, TCD for sponsorship.*

…and thanks to you!

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