IDMT Final Project
Interfaces for granular synthesis

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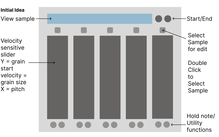


What is a good interface for granular synthesis?

Inspiration

MetaMuse

Figure 3: The mute is realized with a running rain, a lightning rain and another of graphite.

GrainPlane

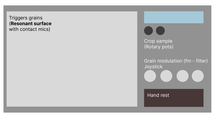
Figure 4: GrainPlane Wood

PebbleBox

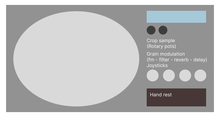
Figure 5: The PebbleBox.

All three of these papers map a physical grain to a synthesised grain.

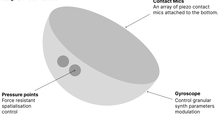
Design 1 - Flat plane



Design 2 - Bowl embedded in frame



Design 3 - not embedded



Bowls Investigation

Flat Bottom Metal bowl

Hammered Bowl

-Make sure the bowl is big enough and experiment with different sizes.

-Experiment with different form factors and surfaces.

-Experiment with non metal bowls and bowls with holes in them.

-Flat bottom bowl might work best for impulse localisation.

Why is the bowl preferred over other forms?

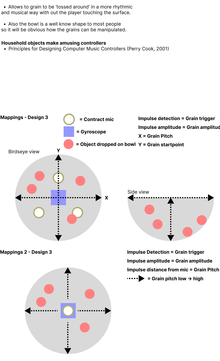
- The bowl shape provides a more gestural way to move the grains around.

- Allows to grain to be 'tossed around' in a more rhythmic and musical way with out the player touching the surface.

- Also the bowl is a well know shape to most people so it will be obvious how the grains can be manipulated.

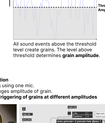
Household objects make amazing controllers

- Principles for Designing Computer Music Controllers (Perry Cook, 2001)



Grain detection

When an object hits the resonant surface a grain should be triggered. The amplitude of the impulse determines the amplitude of the grain.



All sound events above the threshold level create grains. The level above threshold determines **grain amplitude**.

Prototype 1 - Grain detection

Impulse to grain triggering using one mic.
Amplitude of impulse changes amplitude of grain

Input Impulse → Output Triggering of grains at different amplitudes

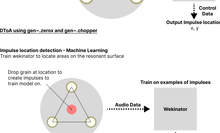
Impulse localisation detection - Acoustic localisation via triangulation

Locate where on the bowl the impulse occurred.
Location changes the pitch of the grain.

Idea

Using the Different Time of Arrival (DToA) of sound to an array of microphones to triangulate impulse location.

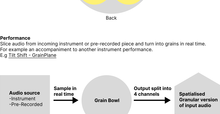
In this example all DToAs should be equal since the impulse is exactly in the centre or the bowl.



DToA using gen~ zerox and gen~ chopper

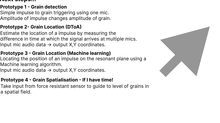
Impulse localisation detection - Machine Learning

Train wekinator to locate areas on the resonant surface



Spatialisation

Control the level of areas in the spatial field



Performance

Slice audio from incoming instrument or pre-recorded piece and turn into grains in real time.
For example an accompaniment to another instrument performance.
E.g Tim Stoth - GrainPlane

Next steps...

Prototype 1 - Grain Detection

Simple impulse to grain triggering using one mic.
Amplitude of impulse changes amplitude of grain.

Prototype 2 - Grain Localisation (DToA)

Estimate the location of a impulse by measuring the difference in time at which the signal arrives at multiple mics.
Input mic audio data → output X,Y coordinates.

Prototype 3 - Grain Location (Machine learning)

Locating the position of an impulse on the resonant plane using a Machine learning algorithm.
Input mic audio data → output X,Y coordinates.

Prototype 4 - Grain Spatialisation - If I have time!

Take input from force resistant sensor to guide to level of grains in a spatial field.

Risks?

Fragile contact mics.

Accuracy of acoustic localisation on a rounded surface.

Reduced range of movement with lots of wires connected to the bowl.

Complex combination of techniques.

- Granular synthesis
- Acoustic localisation
- Spatialisation

Granular synthesis techniques

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References

Instruments/interaction design

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