21M.380 Music and Technology
Sound Design

Lecture №24
Thunder

Wednesday, May 4, 2016

Table 1. Student groups

A	B	C	D
■	■	■	■
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■	■	■	■
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1 Research

- Identify isolated thunder strikes, including acoustic 'afterimage'
- Look for sounds with good low-frequency rumble

2 Analysis of real-world thunder

- Let's listen to the online example(s) we found.
- Class discussion: What characterizes the sound of thunder?
- Actual thunder strike
  - _____
  - _____
  - _____
- Environmental acoustic effects
  - _____
  - _____
  - _____
  - _____
  - _____

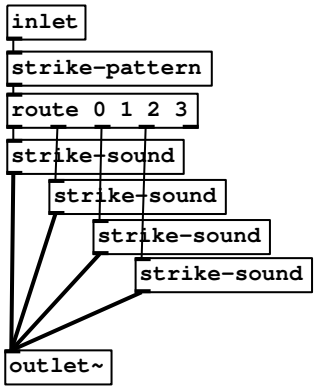

Figure 1. Polyphonic strike sound generator (Farnell 2010, fig. 40.7)

3 Reverse-engineering Farnell's thunder patch

- Download the code tarball from http://mitpress.mit.edu/sites/default/files/titles/content/ds_pd_examples.tar.gz and unpack to your local hard drive.
- Open the patch at PUREDATA ▸ THUNDER ▸ thunder4.pd

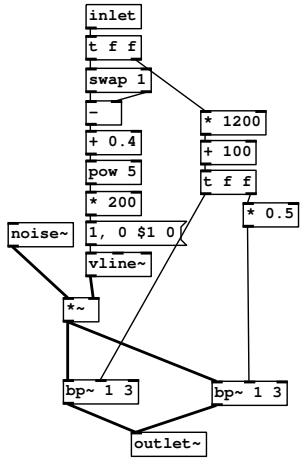

Figure 2. Strike sound generator (Farnell 2010, fig. 40.6)

3.1 Group A: Thunder strike generator

Edit the main patch to listen to `[pd strike sound]` in isolation.

- Which acoustic aspects of the complete scene does it contribute?
- Which signature sounds of real-world thunder are missing?

In `[pd strike sound]`, disconnect all but one `[strike-sound]` abstraction and connect the outlet of `[strike-pattern]` to a `[print]` object. Listen to the supatch again in isolation while observing the printout in the main Pd window.

- How can you interpret the printout?
- What are the respective roles of the `[strike-pattern]` and `[strike-sound]` abstractions?
- How does the sound change over time?

Analyze the `[strike-sound]` abstraction.

- What is the sound source, and what kind of processing is it being subjected to?
- How is the change of sound over time achieved?
- Which real-world acoustic effect might this simulate?

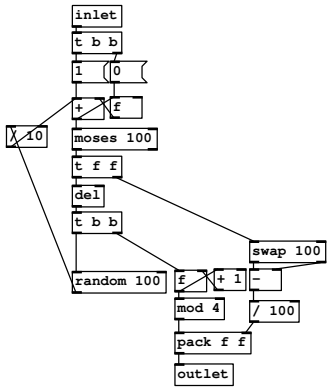

Figure 3. Strike pattern generator (Farnell 2010, fig. 40.5)

3.2 Group B: Distance filter

Edit the main patch to listen to `[pd rumble]` in isolation.

- Which other sound sources do you need to omit and what's the quickest way to do so?

Compare the output of `[pd rumble]` with and without being subjected to the `[distance]` abstraction.

- How does the `[distance]` abstraction change the sound?
- Which real-world acoustic effect might this simulate?

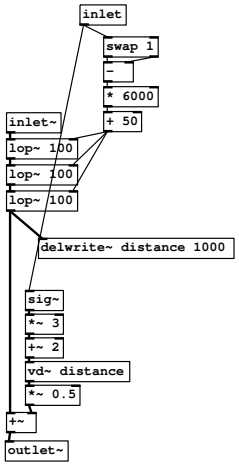

Figure 4. Distance filter

3.3 Group C: Deep noise

Edit the main patch to listen to `[pd deep]` in isolation.

- In which frequency range does this subpatch produce sound?
- Which loudspeaker in our setup does this subpatch target?
- What is the sound source, and how is it being processed?
- Which synthesis technique that we have discussed is effectively used in this patch?

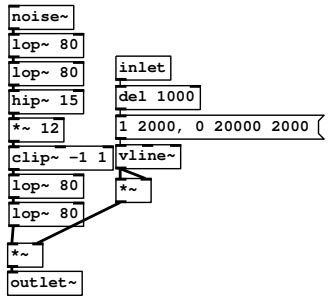

Figure 5. Low-frequency texture (Farnell 2010, fig. 40.10)

- Why does Farnell use two [lop~] objects in series?
- What can we say about the shape of the [vline~] envelope?
- How does the sound develop over time? How can this behavior be explained in the real-world experience of thunder?

3.4 Group D: Reflections

Analyze the [pd box of delays] subpatch.

- What is the role of the [switch~] object? Use Pd's context help to find out.

Analyze the [udly] abstraction used in [pd box of delays].

- In the top left corner of [udly], why is $1 first multiplied by 10000 and the resulting random number then divided again by 10000?

Edit the main patch to listen to its [pd afterimage] subpatch in isolation.

- How long does it take this subpatch from the initial go signal to actually create any sound?
- Quantify the physical distance that this time delay corresponds to.

Figure 6. A box of delays (Farnell 2010, fig. 40.11)

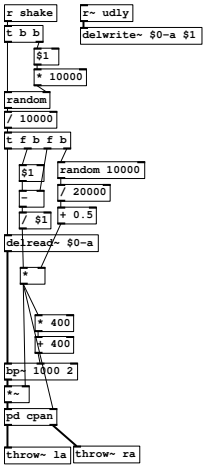

Figure 7. A single reflection (Farnell 2010, fig. 40.12)

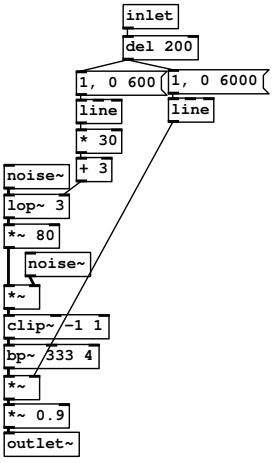

Figure 8. Mid-range afterimage (Farnell 2010, fig. 40.9)

4 Group presentations

5 Class discussion: Possible improvements

- Adding wind and rain
- Multichannel output
  - How to generate multiple channels?
  - Would different frequencies be distributed differently in space? Why?

References and further reading

Farnell, Andy (2010). *Designing Sound*. Cambridge, MA and London: MIT Press. 688 pp. ISBN: 978-0-262-01441-0. MIT LIBRARY: 001782567. Hardcopy and electronic resource.

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