Simulating Music using R

Andrea Lanz

Git repo:

https://github.com/ST541-Fall2018/andrealanz-project-musicsim.git

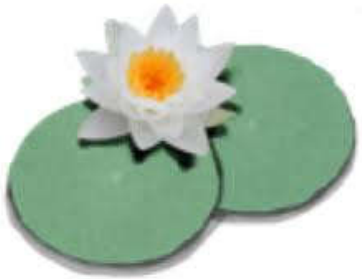
Purpose/Goals

- Explore how music is related to numerical information (frequency)
- Create a formal definition of music
- Use this definition to simulate music

Guiding Questions:

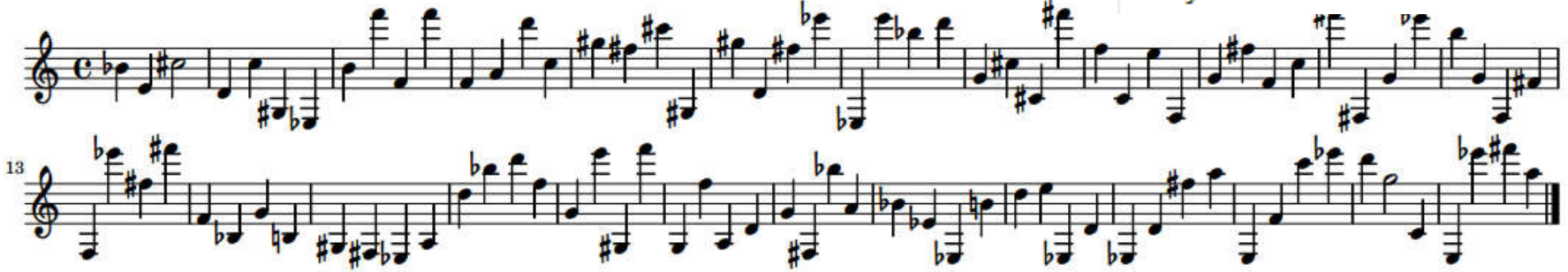
- Are there properties and patterns in music that can be used to generate it?
- How can music be expressed in terms of a numerical definition?
- How can this numerical definition of music be simulated?

LilyPond



- A program that generates sheet music
- Written in text format and compiled to produce .midi, .txt, and a pdf of sheet music (see below)

```
#(set-global-staff-size 14 )
\header{tagline = ""}
\melody = {
    \time 4/4
    \key c \major
    \clef treble
    fis4
    bes'2
    b'4
   \bar "|."
  }
  \paper{
    textheight = 220.\mm
    linewidth = 150.\mm
    indent = 0.\mm
  }
   \score{
   \melody
   \layout{ }
    \midi{
      \tempo 2 = 60
  }
   }
```



Method

- Take a random sample from a list of fundamental frequencies tuned to 440 Hz (108 total)
- Using tuneR functions, create a lilypond file

Note	Frequency (Hz)
C_0	16.57
$C^{\#}_0/D^{b}_0$	17.56
D_0	18.60
$D^{\#}_0/E^{b}_0$	19.71
E_0	20.88
F_0	22.12
$F^{\#}_0/G^{b}_0$	23.44
G_0	24.83
$G^{\#}_0/A^{b}_0$	26.31

Generate a random sample of notes:

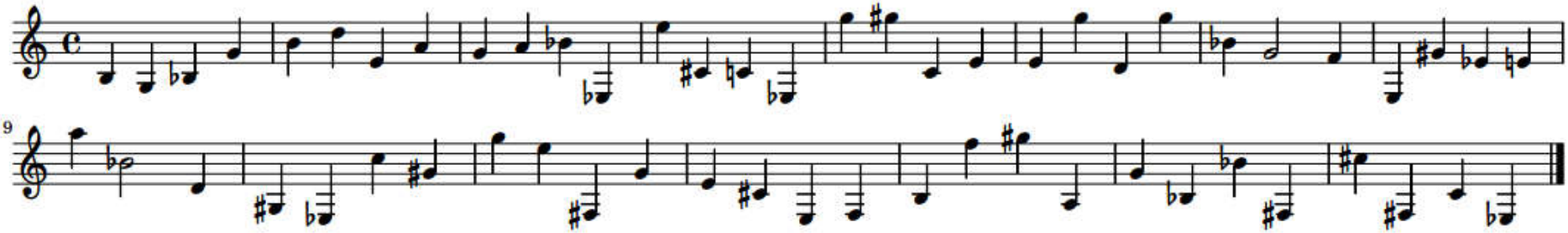
```
generate_sample <- function(num_notes){
  notes <- (readxl::read_xlsx("data/note_freqs.xlsx"))$`Frequency (Hz)`
  samp <- sample(notes, num_notes, replace = TRUE)
  map(samp, sine)
}
```

Generate a LilyPond file, given a sample:

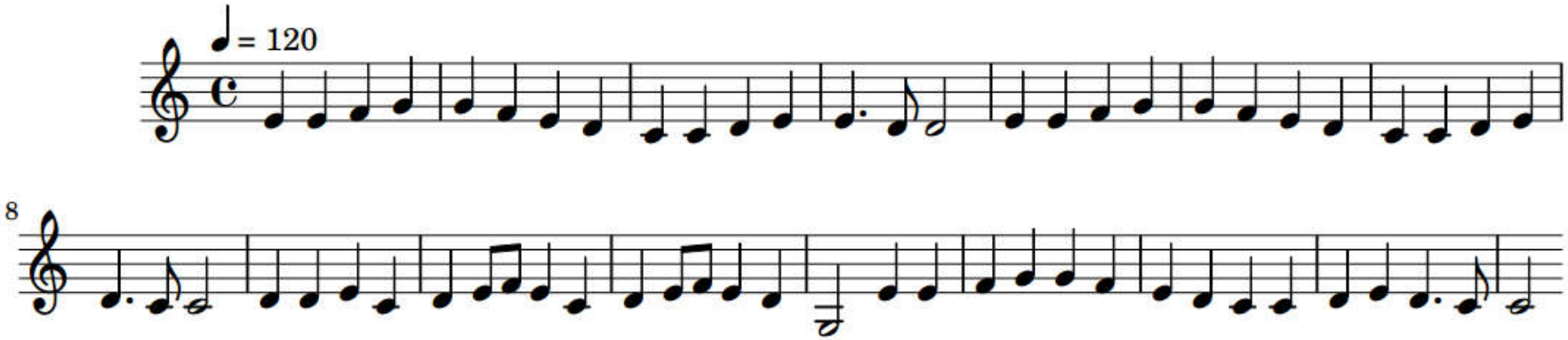
```
generate_ly <- function(sample, file_name = "my_song.ly") {
  n <- length(sample)
  Wobj <- sample[[1]]
  for(i in 2:n){
    Wobj <- bind(Wobj, sample[[i]])
  }

  if(n <= 4){
    bars <- 1
  }else{
    if(n %% 4 == 0){
      bars <- n/4
    }else{
      bars <- n %/% 4 + 1
    }
  }

  WspecObject <- periodogram(Wobj, normalize = TRUE, width = 1024)
  ff <- FF(WspecObject)
  notes <- smoother(noteFromFF(ff))
  melodyplot(WspecObject, notes)
  qlily <- quantMerge(notes = notes, bars = bars , barsize = 4, minlength = 4)

  lilyinput(qlily, file = file_name)
}
```

Results

Randomly generated notes:



Notes for “Ode To Joy”



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