

Simulating Music using R

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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)

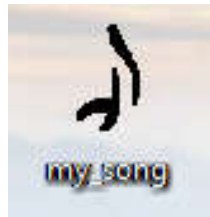
```
%(set-global-staff-size 14 )
\header{tagline = ""}
\melody = {
  \time 4/4
  \key c \major
  \clef treble
  fis4
  bes'2
  b'4
  \bar "|."
}
\paper{
  textheight = 220.\mm
  linewidth = 150.\mm
  indent = 0.\mm
}
\score{
  \melody
  \layout{ }
  \midi{
    \tempo 2 = 60
  }
}
```



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:

https://github.com/ST541-Fall2018/andrealanz-project-musicsim/blob/master/data/my_song.mid



Notes for "Ode To Joy"

