



# Making MIDI Real: Parametric Music Boxes

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# Problem and motivation

- Inspired by project idea shown in class: Thingiverse object allowing users to create music boxes parametrically
- Custom music boxes very expensive (>\$200!)
- Manual input of notes into Thingiverse is very tedious, especially for long songs

# Technical method: generation

- Need a scriptable way to produce solid models
  - OpenSCAD to the rescue
- First part: cylinder
  - Read MIDI file to find note events, create corresponding cylinder pins
- Second part: comb
  - Given list of notes and material properties, determine length of tooth that gives correct frequency

# Technical method: fabrication

- Cylinder and mechanism
  - Initial plan: use MakerBot
    - Too unreliable for large parts
  - Stratasys uPrint SE arrives just in time
    - Heated chamber/material, precise components - get what you pay for
    - Prints large parts perfectly
- Comb
  - Stainless steel
  - Laser-cut by Pololu
  - Very precise

# Technical method: interface

- OpenSCAD is great, but too complex for end user
  - We parametrize to remove unnecessary complexity
- Enter OpenJSCAD
  - JavaScript port of OpenSCAD
  - Makes building a web app much easier
- Three components
  - Static STL files of mechanism
  - OpenJSCAD-generated cylinder STL
  - OpenJSCAD-generated comb DXF

# Music Box Generator

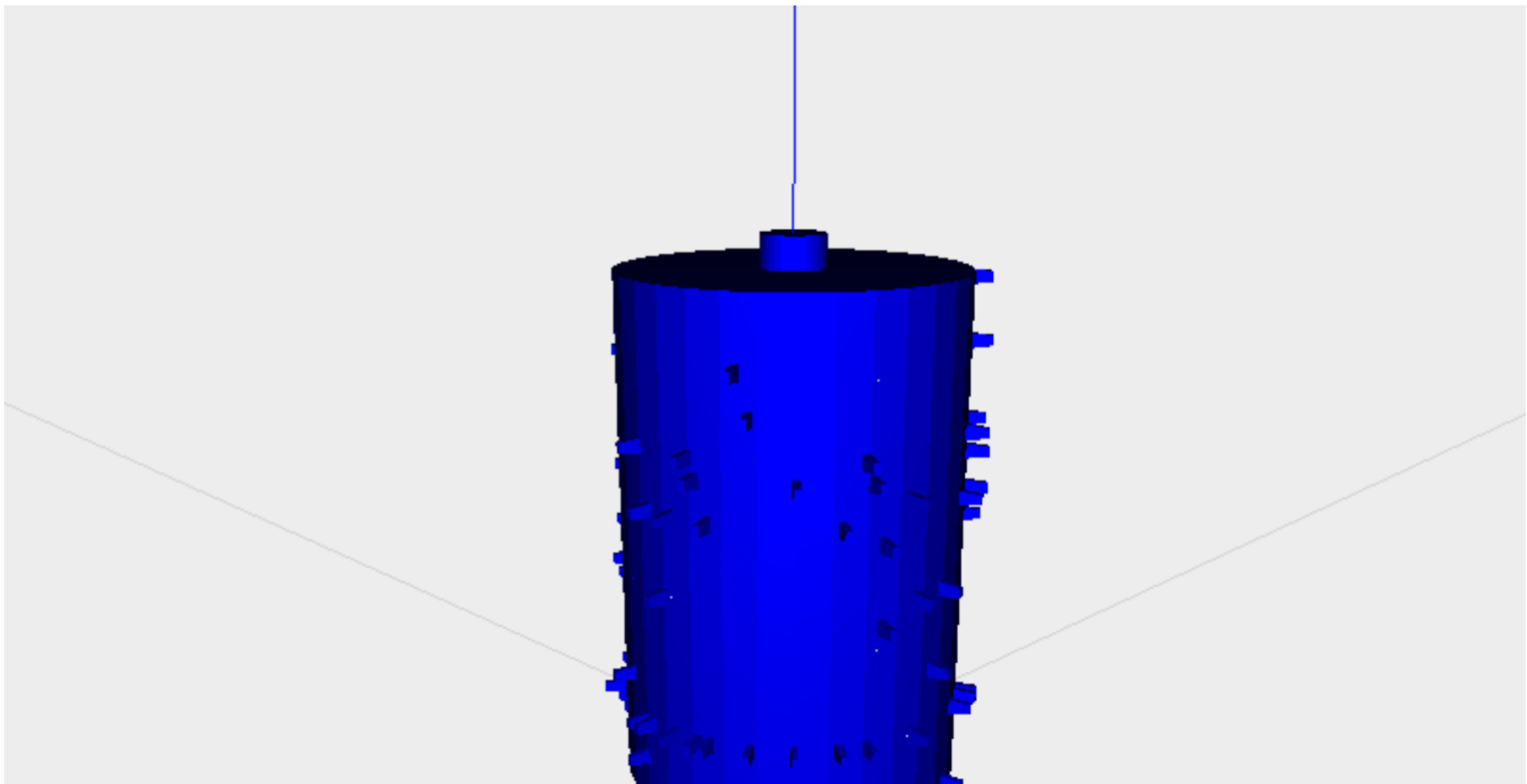
[Download Static Box Parts \(STL\)](#)

## Generate Parametric Parts - Cylinder and Comb

Upload a MIDI file up to 30 seconds long to generate the cylinder and comb for your song.

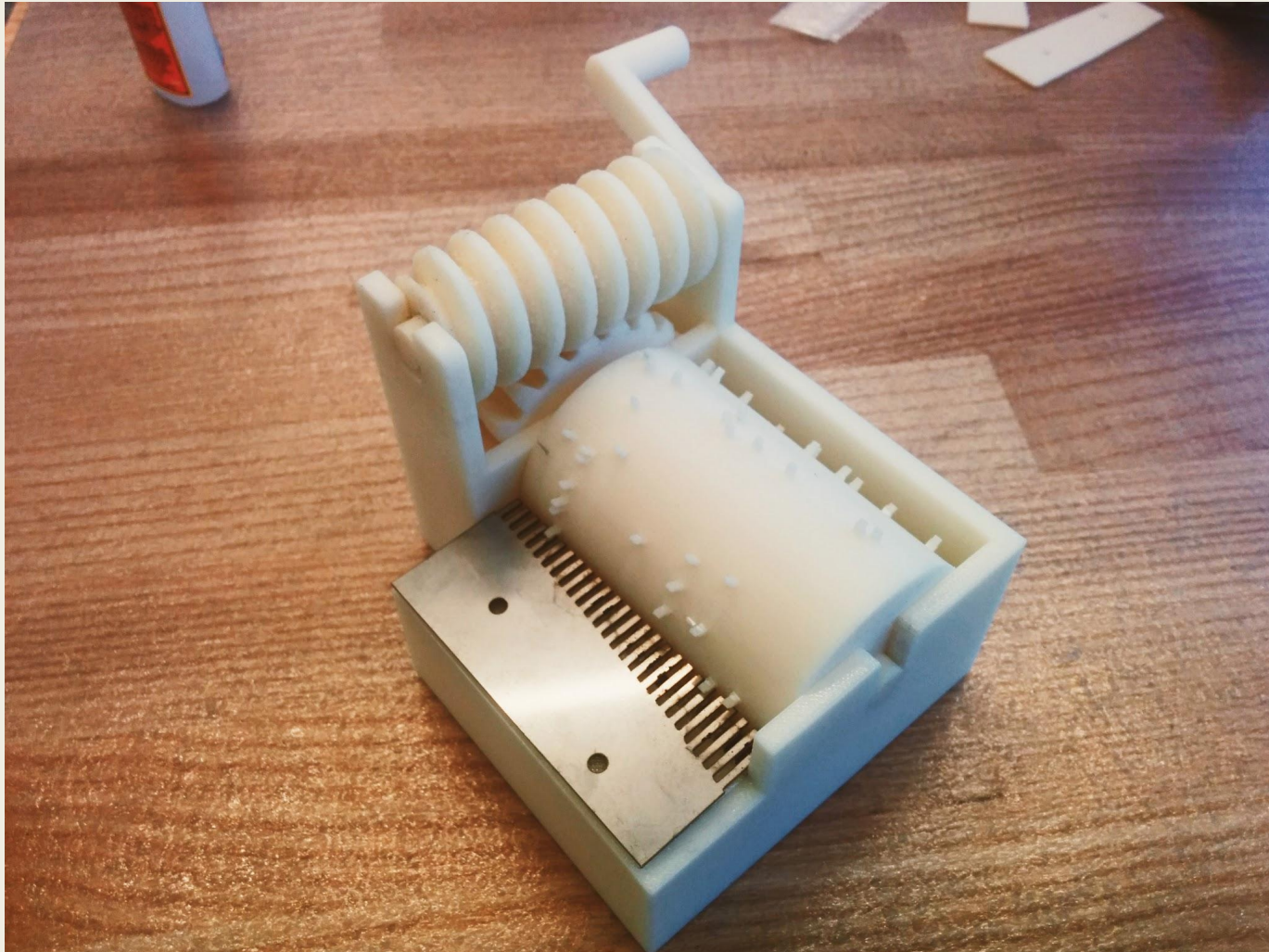
[Choose File](#) harry\_potter...t\_short.mid

### Cylinder Generator

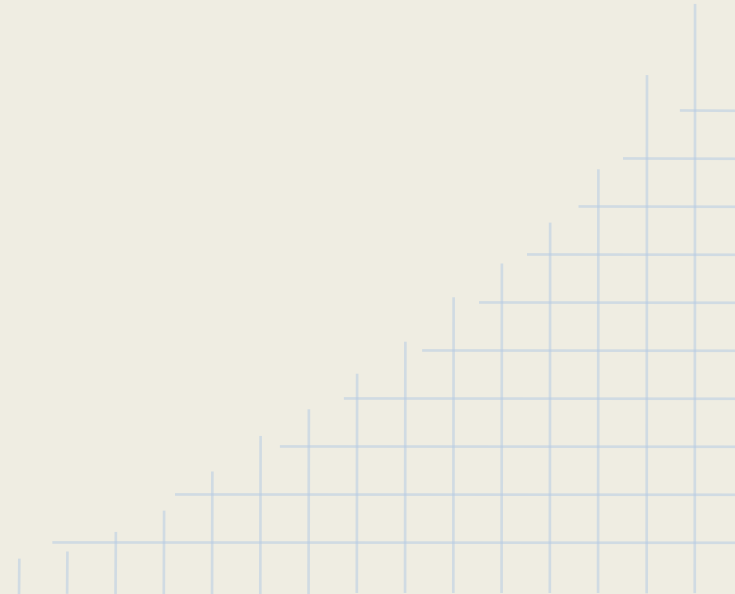
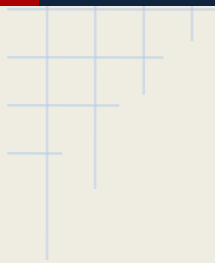


Screenshot of our UI  
(<https://tweilu.scripts.mit.edu/musicbox>)

# Results: photographic evidence

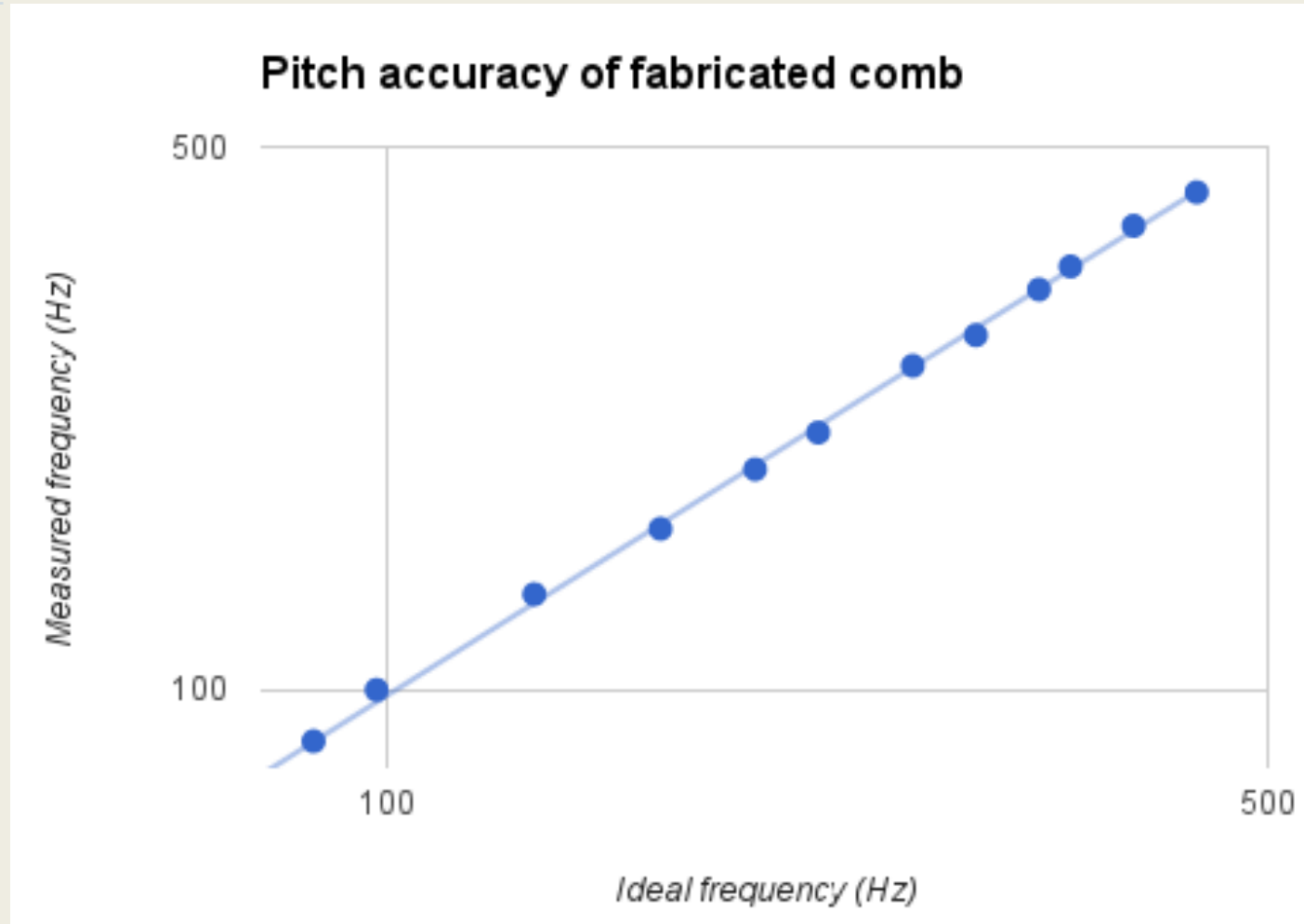


# Results: live demonstration





# Results: experimental data



# Potential extensions

- Tweak fabrication methods
  - Laser-cut flat parts of frame
  - Design flatter parts for 3D printing to reduce print time
- Material changes
  - Use thinner steel for comb
    - Current thickness is difficult to pluck without damaging ABS
- Smarter algorithms
  - Same note repeated quickly causes problems
  - Detect this and create a second track for the note

# Questions?