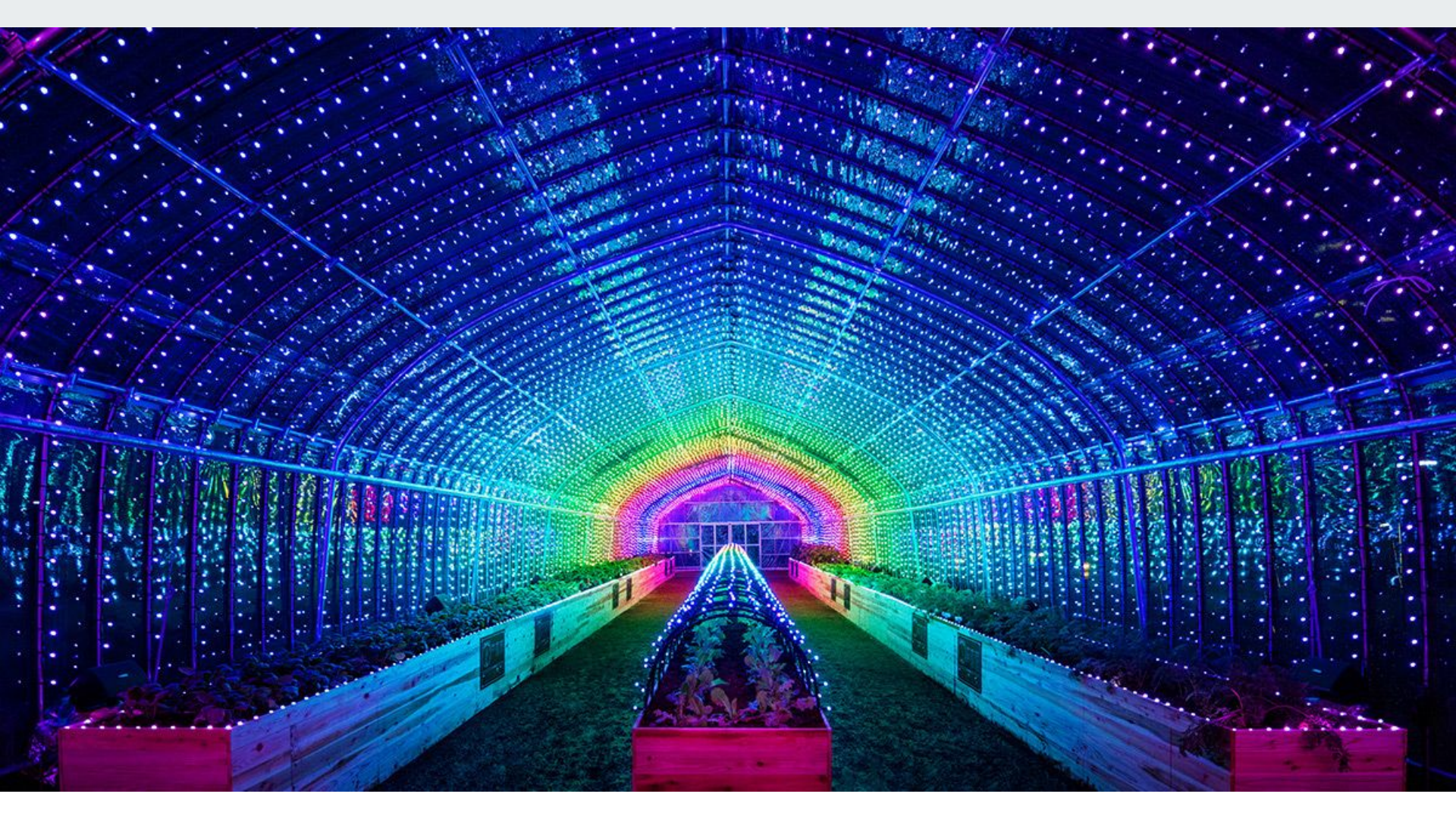
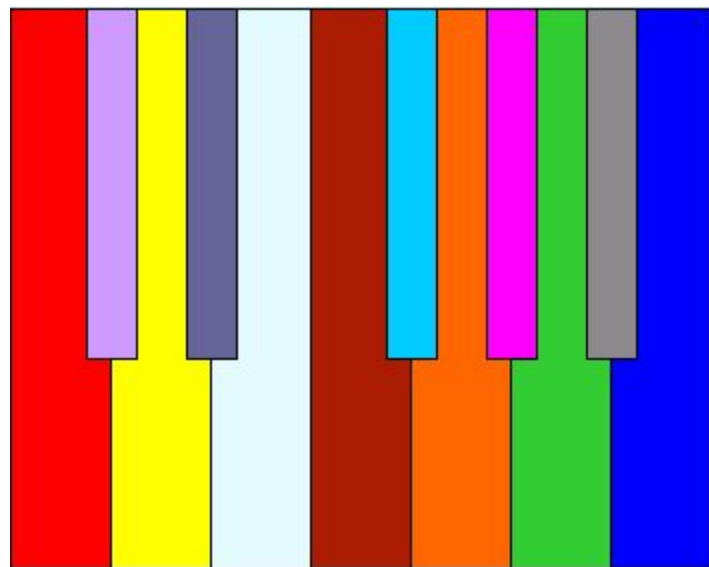




Chromesthesia and IoT

David Wu



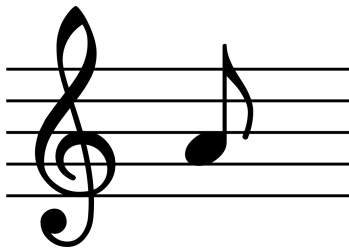




Demo

Satie: *Gymnopedie no. 3*

MIDI



```
{  
  "event": "noteon",  
  "note": "67",  
  "rawVelocity": "46"  
}
```

- **MIDI**: digital instrument input/output language
 - Notes
 - Volume
 - Duration
 - Start, stop, pitchbend events
- **Web-MIDI**: Cross-platform MIDI support in web browsers

Philips Hue





Hue API

All API calls are sent to the “Bridge,” which then broadcasts them to light bulbs.

Get Bridge IP address: GET `https://www.meethue.com/api/nupnp`

Get light information: GET `/api/{user}/lights`

Alter light: PUT `/api/{user}/lights/{light}/state { “on”: [true/false], “transitiontime”: [0-100], “xy”: [0-1, 0-1], “bri”: [0-1] }`



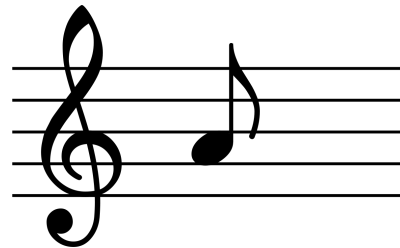
MIDI + IOT (Piano + Hue) in JS

Web client: Read MIDI input, analyze chords, send commands to Hue bridge

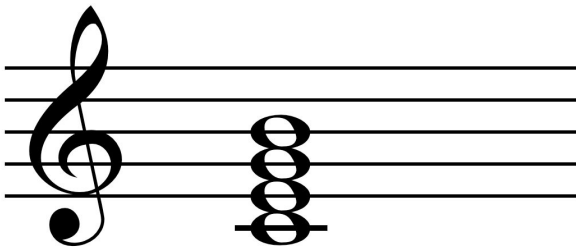
Web server: Registers Hue users, stores local Hue state (user information), serves web assets (html, js, etc)



Theory detour



- A *scale* is a series of individual notes starting at a single note
- A *chord* is a set of individual notes
- Notes can be denoted as numbers representing offsets from the starting note of a scale
- Different combinations create different named chords





Chord initialization

- A set of basic chords is associated to a distinct, specific set of colors at startup.
 - A major -> “blue”, “pink”
 - D# major seventh -> “green”, “orange”
- Basic chords (repeats for each starting note)
 - 0 4 7 - major
 - 0 4 7 11 - major seventh
 - 0 3 7 - minor
 - 0 3 7 10 - minor seventh
 - 0 3 6 - diminished
 - 0 3 6 (9) - diminished 9
 - 0 4 8 - augmented
 - 0 4 7 10 - dominant seventh
 - 0 4 7 9 - major sixth
 - 0 3 7 9 - minor sixth

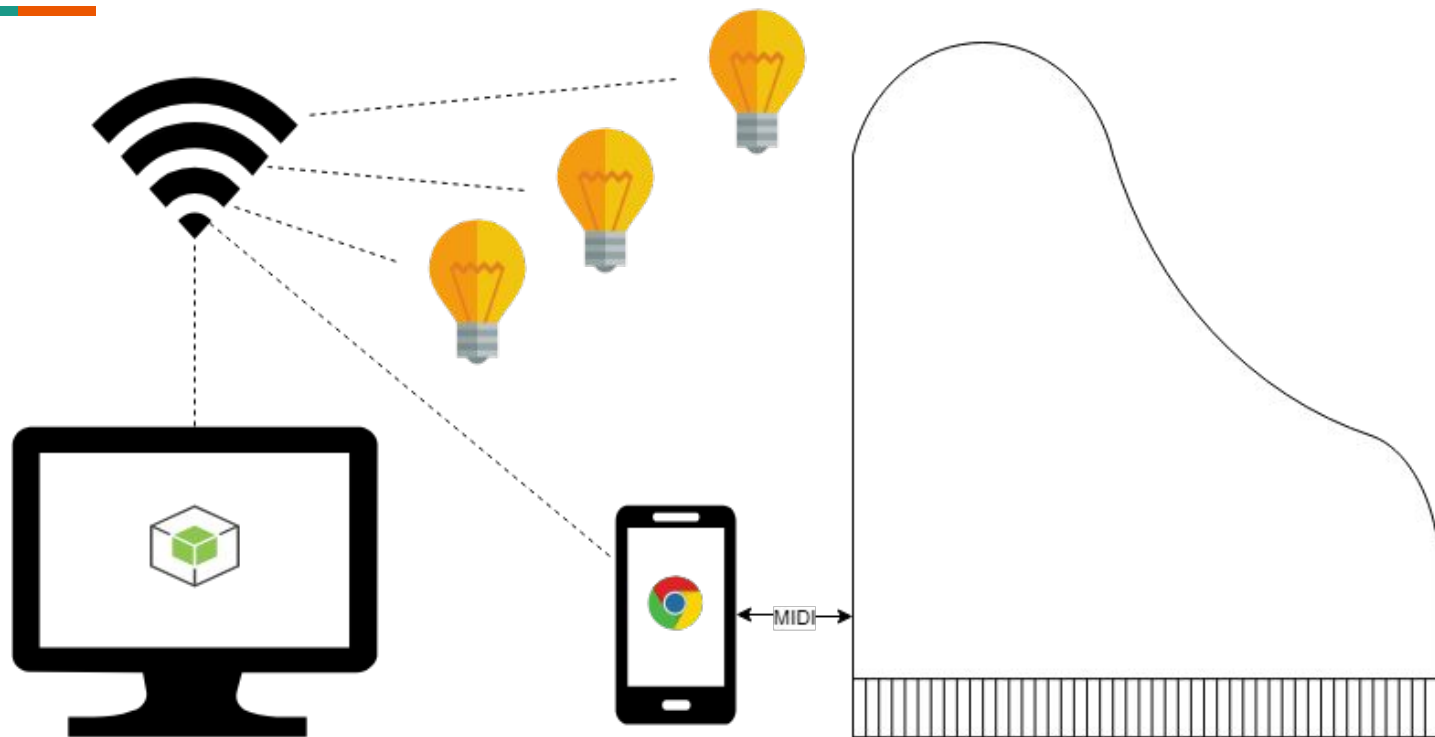


Chord analysis

1. MIDI note inputs are processed
 - a. 88 keys are normalized into the 0-12 range
 - b. Duplicates removed
 - c. Sorted in ascending order
2. Groups of 3+ notes are compared to existing {chord > color} mappings
3. New groups are associated to new colors at runtime
4. Input velocity (volume) is translated as light brightness

{ notes: 4, 32, 12, 20, velocity: 74 } > { 0, 4, 8 } > “C augmented”

> colors: “teal”, “flamingo”, brightness: 74





Demo

Satie: *Gymnopedie no. 1*



Takeaways

- Working with Hue is easy (takes about 10 minutes to build app that turn lights on/off)
 - <https://developers.meethue.com/develop/get-started-2/>
- Working with MIDI is easy in the browser
- IOT does not necessary mean Raspberry PI and soldering circuits
- Improvements: Hue latency (70ms for V2 bridge); darker setting



Try it yourself

At home: <https://github.com/dxwu/Synesthesia>

At the [View!](#)



Questions?