



Dynamic Audio

For Apps and Games

slides: is.gd/dynamic_sound_android

code: github.com/thillerson/dynamic-sound-android

[is.gd/](#)

[dynamic_sound_android](#)



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[github.com/thillerson/](#)

[dynamic-sound-android](#)

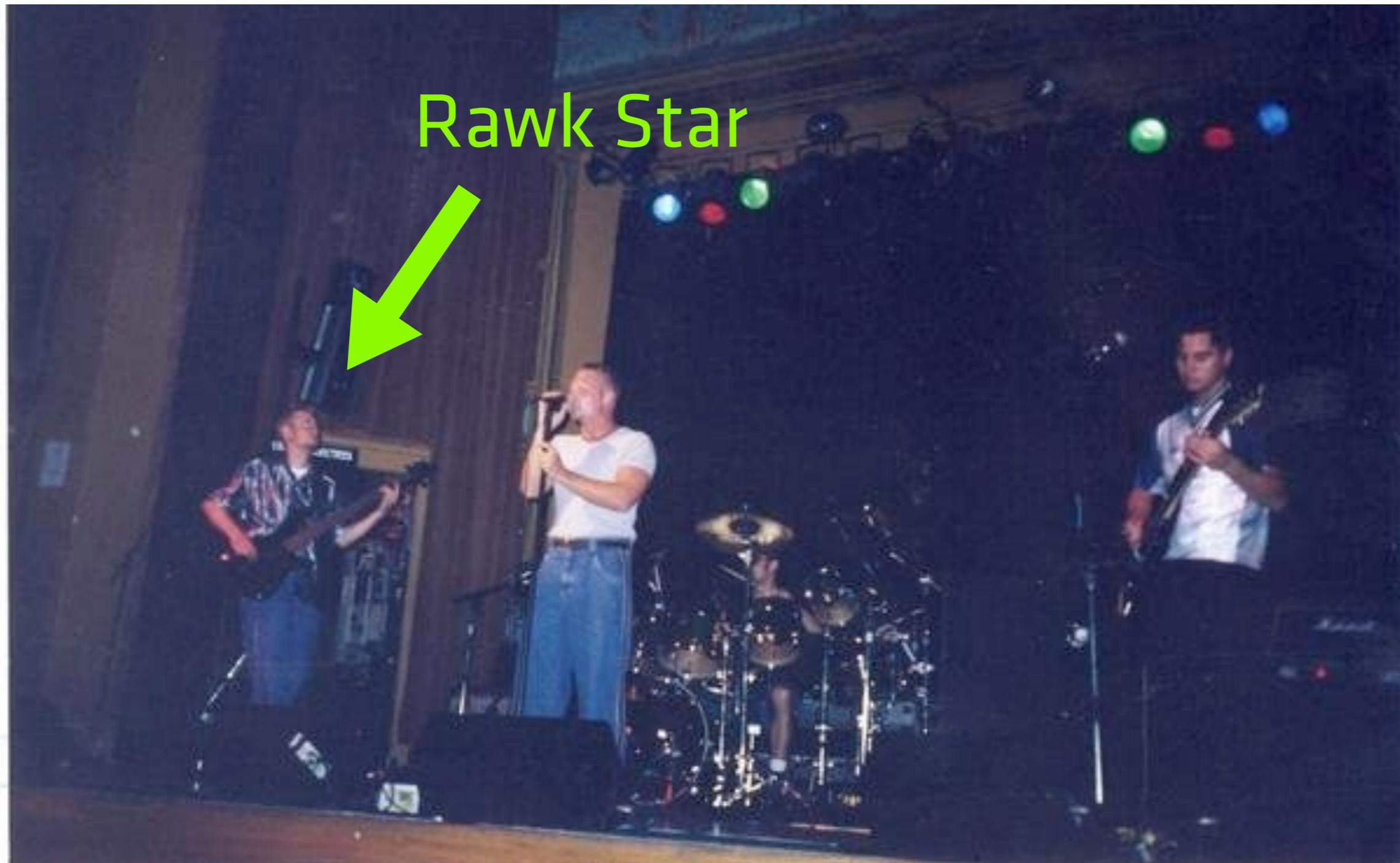


About Me

- @thillerson, +thillerson
- Developer at Tack Mobile
(tackmobile.com), @tackmobile
- Android, iOS, and Mobile Web
- Rails, Node, maybe Elixir (one day)



About Me



About Me

- Bass
- Electronic Music
- Some day I hope to play this thing



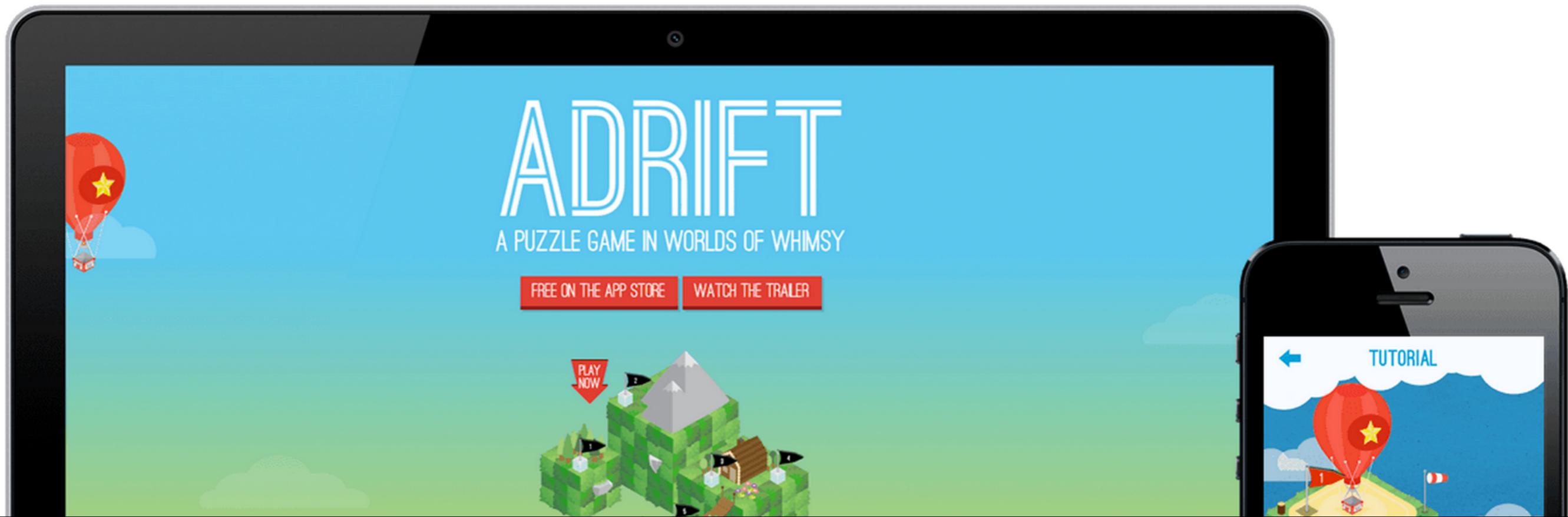
Sound Design Work: Start

- Alarm App
- Alarm Sounds
- Play Store: “tackmobile”

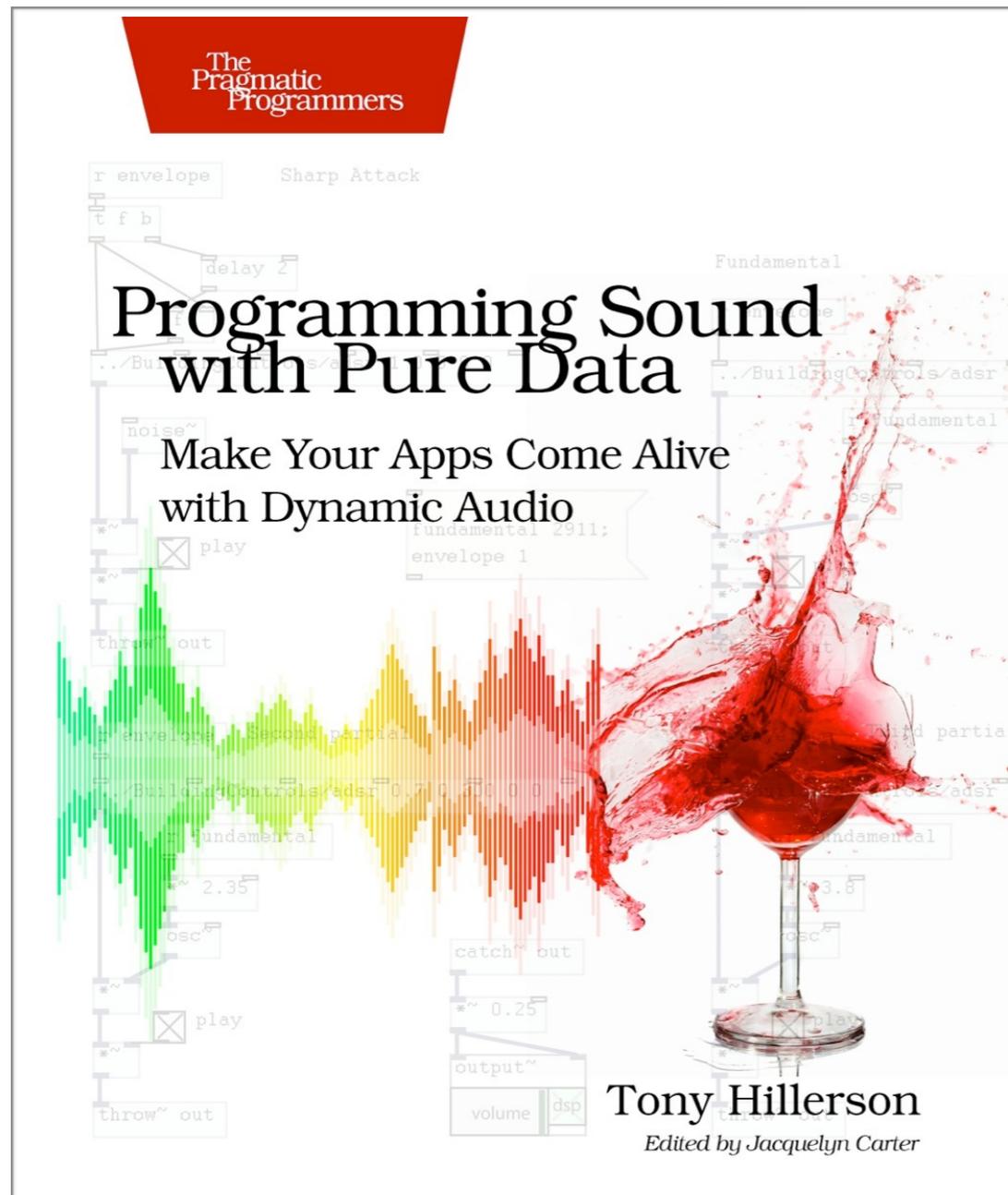


Sound Design Work: Adrift

- Puzzle Game - “Adrift” in App Store
- Background Music
soundcloud.com/tackmobile
- Sound Effects



Programming Sound



- <http://pragprog.com/>
- In Beta
- What we're talking about today...
- ... and much more

What We're Going To Do Today

- Answer: What Is Sound Design?
- Discuss UX Principles of Sound Design
- Introduce Pure Data
- Introduce libpd
- Tour Two iOS Apps Embedding Pd



When We Are Done, You Will

- Understand Sound Design
- Understand Procedural Audio
- Know what Pd is, and how libpd makes it awesome
- Be excited about Dynamic Audio in your apps and games



What is Sound Design?

A Sound Designer



Ben Burtt



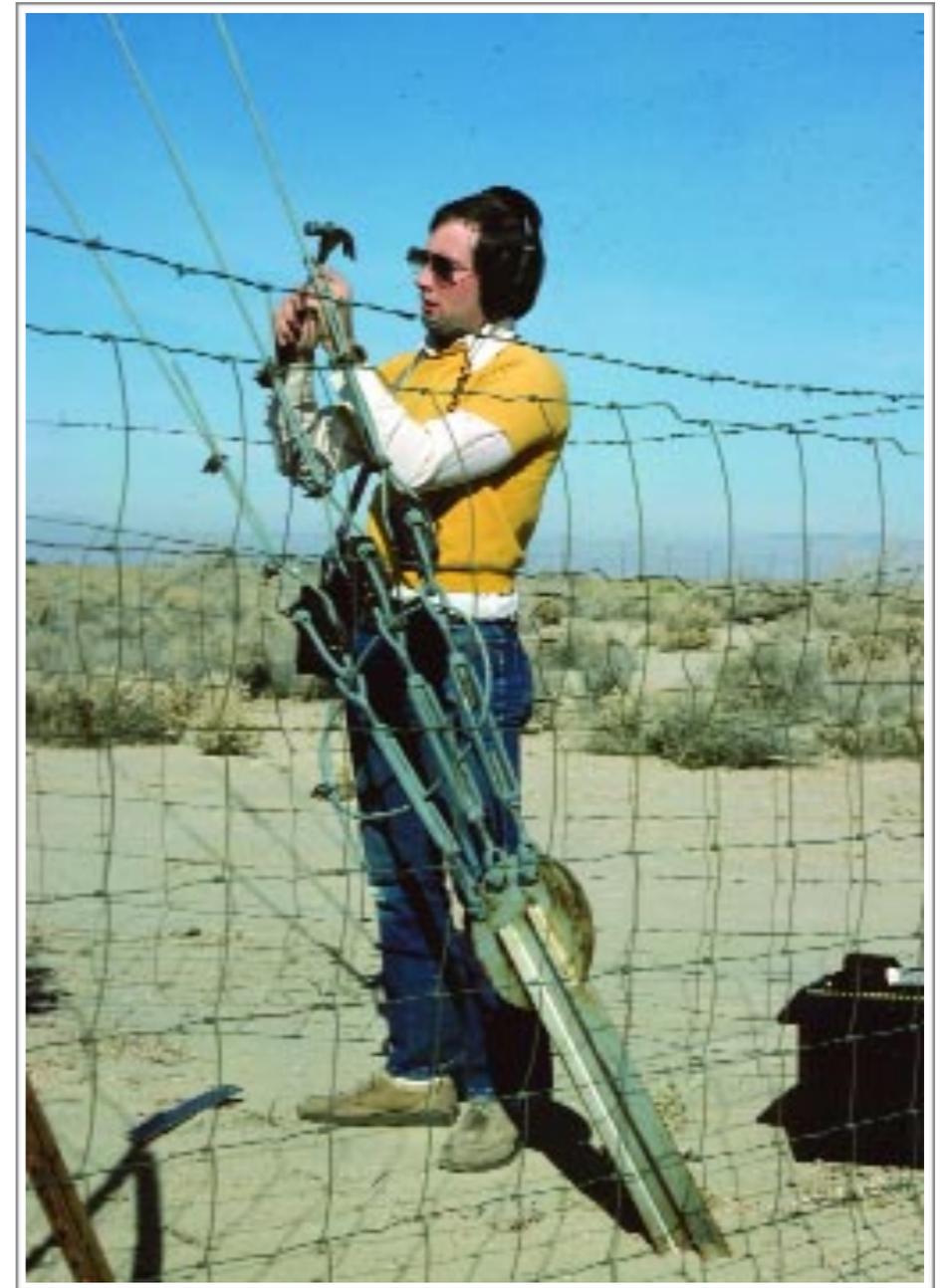
A Sound Designer...

- Conceptualizes
- Captures or Designs
- Records
- Engineers
- Produces
- ... the sound for
an experience



Sound Designer Skills

- Understand Sound
- Intuitive vs. Theoretical
- Music vs. Sound
- Audio Engineering



Sound Design in Mobile Apps

- Developers/Designers wear lots of hats
- Control
- Efficiency
- Asset size



Sound Design Principles

A Sound Designer's Goals

- Audible Feedback
- Fulfill Expectations
- Immersion
- Emotional Response



Sound Design and Good UX

- Your app doesn't need sound
- Expect to be turned off
- Don't make me listen to you
- Listen on lots of devices/environments
- Engineer for small speakers
- Make your sound mean something!



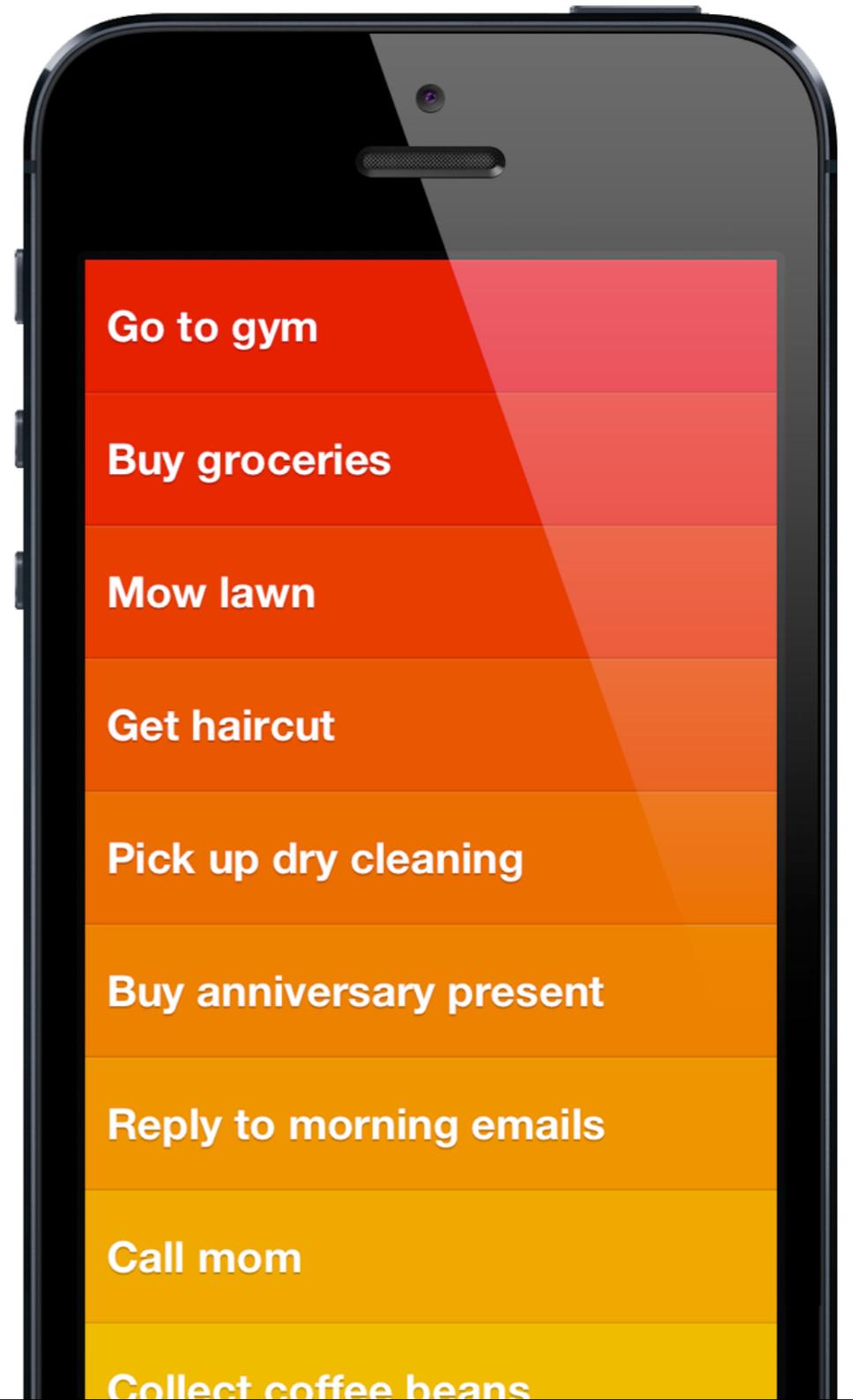
Always

- Test with phone calls
- Test while playing music
- Have fallbacks - e.g. No music, just effects
- Provide control to the user



A Good Example: Clear

- Realmac Software
- Josh Mobley
- Meaningful Sound
- demo

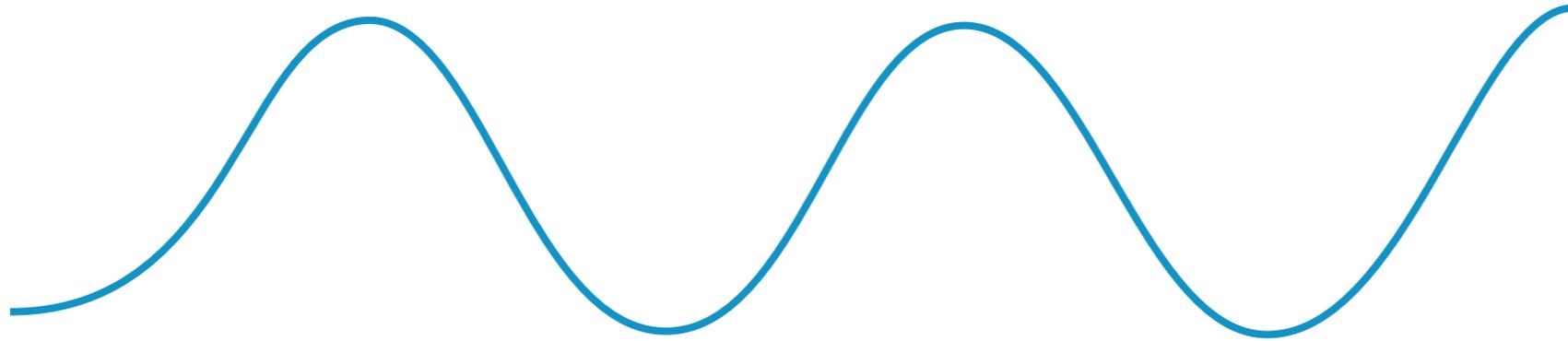


Sound

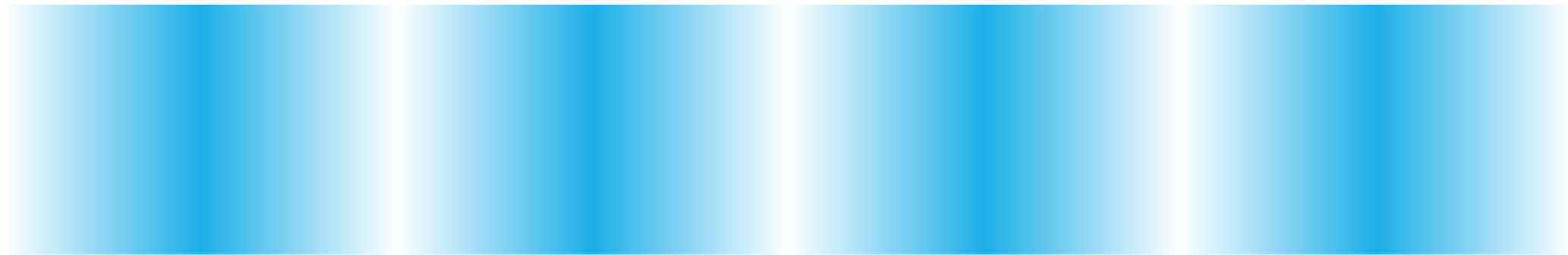
Longitudinal Waves

Of Pressure

Through A Medium



Transverse Wave



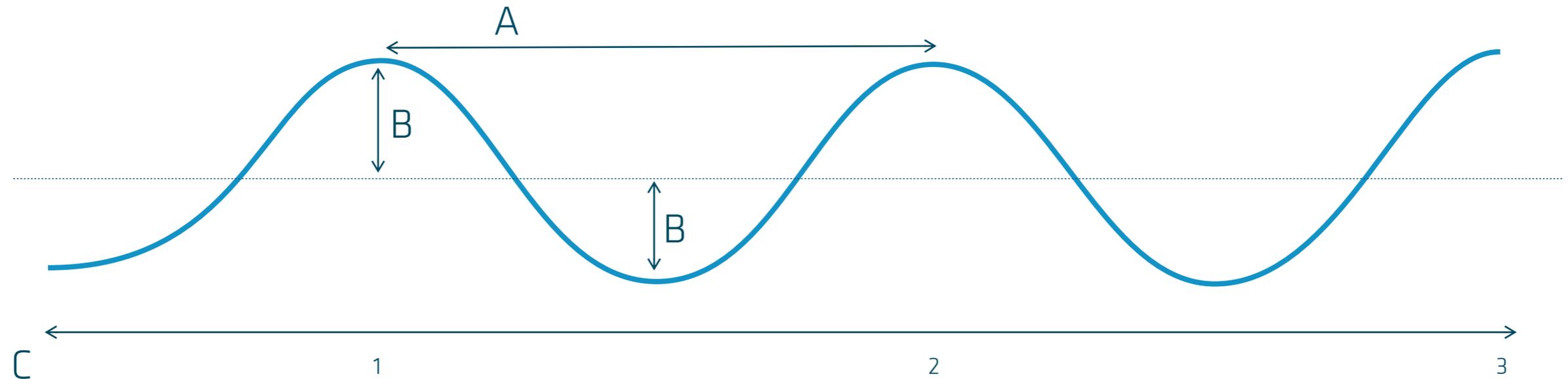
Longitudinal Wave



Sound

- Longitudinal Waves
- Of Pressure
- Through a Medium

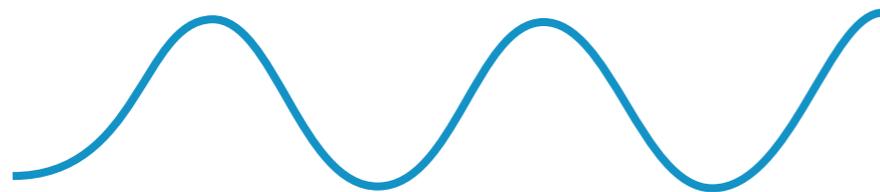
Properties of Waves



- A - Wavelength (Distance), Period (Time)
- B - Amplitude
- C - Frequency - $1/\text{Period}$ (measured in Hertz)

Fourier Series

- Based on his work ----->
- Periodic signals composed of simple oscillating functions
- Sine/Cosine waves are fundamental

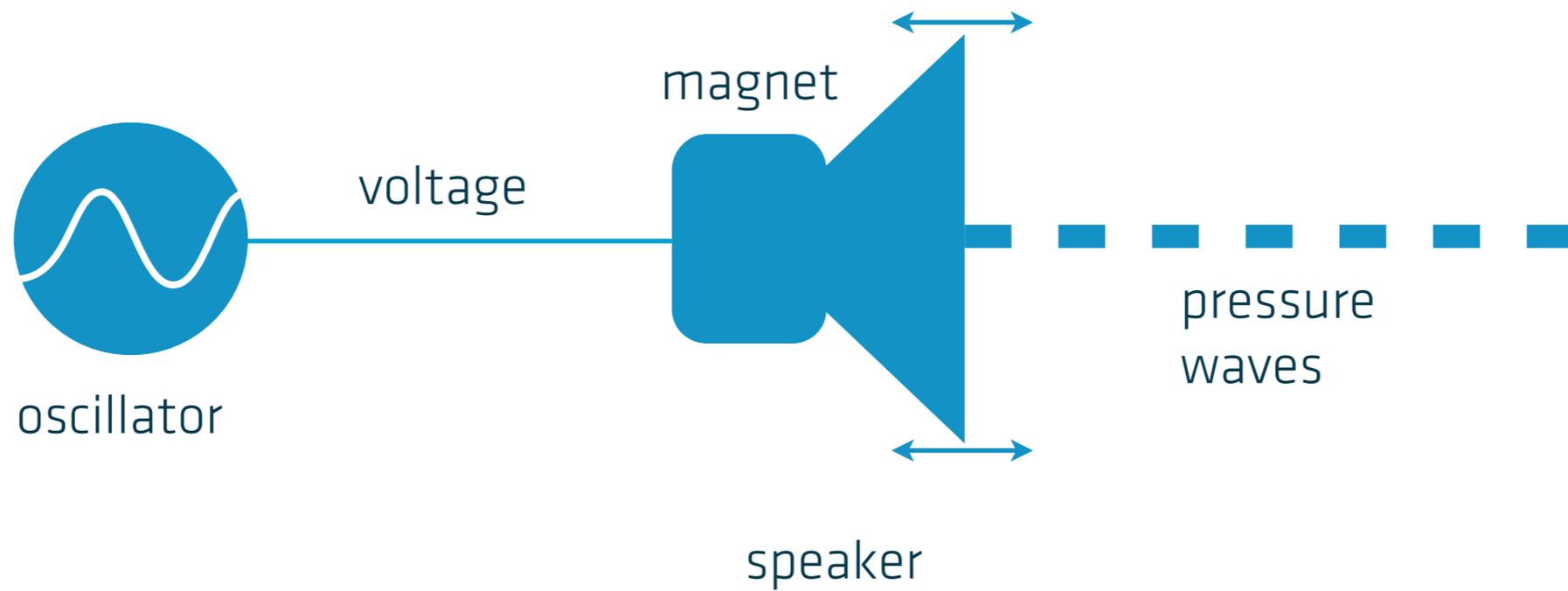


Oscillators

- Something that moves according to a periodic function
- A physical body
- An electronic device



Basic Electronic Sound



Digital Audio

- Stream of Numbers
- Signal
- Frequency and Amplitude
- DAC - Digital to Analog Converter



Dynamic Audio

Procedural Audio

- Functions
- Objects
- Controls and Components
- Produce a Signal
- “Building Sound from First Principles”



Pure Data

- Procedural Audio
- Visual Programming Environment
- Free and Open Source
- pure-data.info



Pure Data 101

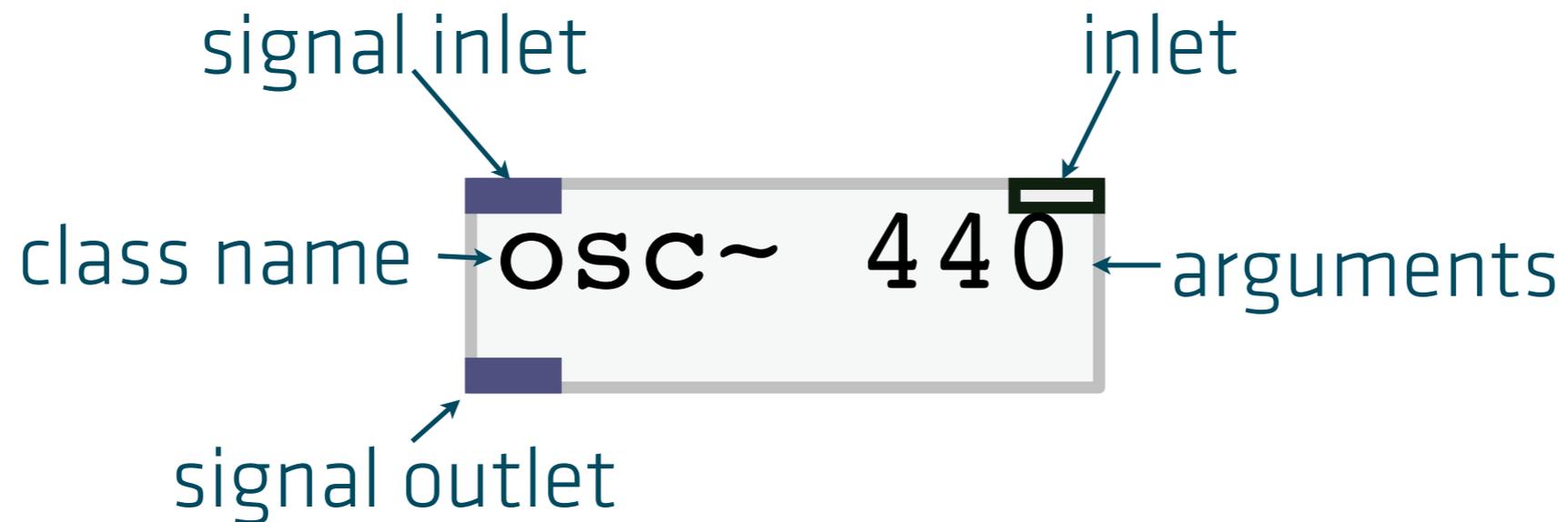
Signals and Values

- Signals are streams of numbers, usually audio data
- Values are numbers or symbols



Objects

- Pd's class
- or, kind of like a command line tool



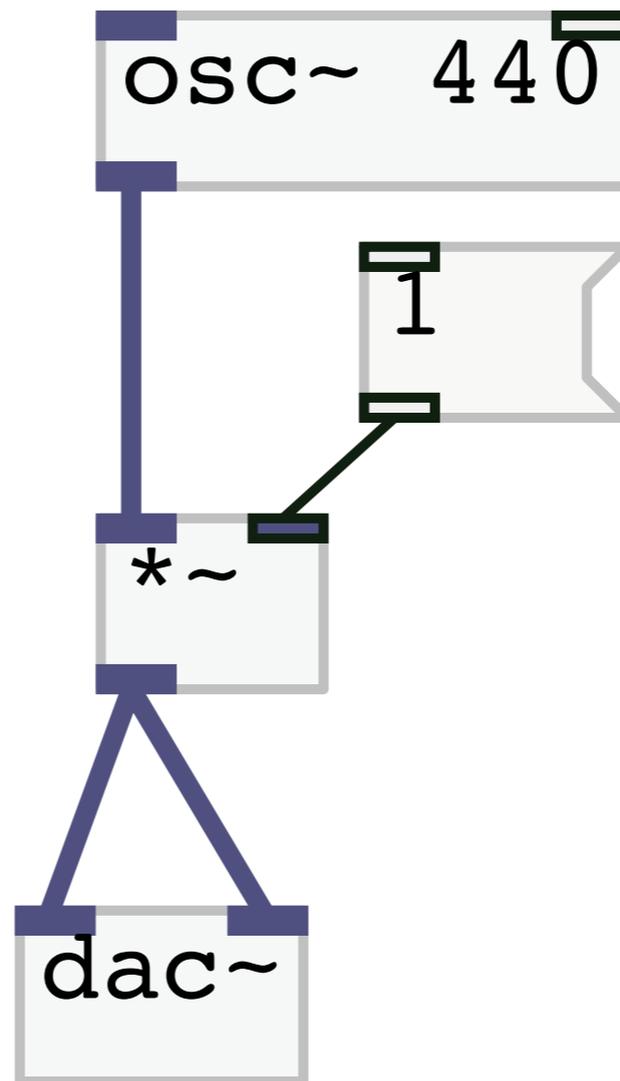
Hot vs Cold Inlets

- Hot inlets make objects immediately act
- Cold inlets usually store a value
- Execution is right to left



Connections

- Signal connections are thick
- Others are thin



Messages

- Used for sending values without a connection
- [send] and [receive] objects
- Message boxes



libpd

- <http://libpd.cc>
- Peter Brinkmann - Google Engineer
- Enables you to embed an instance of Pd in your app
- iOS and Android



libpd for Android

- Patches should be compressed raw resources
- Utilities for dealing with patches
- Provides interfaces for audio management
- PdBase bridges to Pd
- Pass messages, floats, and lists
- Provides PdService for long running audio



Examples

Source Code

- github.com/thillerson/dynamic-sound-android
- Examples of capabilities, not necessarily the best architecture
- Goal: understand capabilities, have a place to start

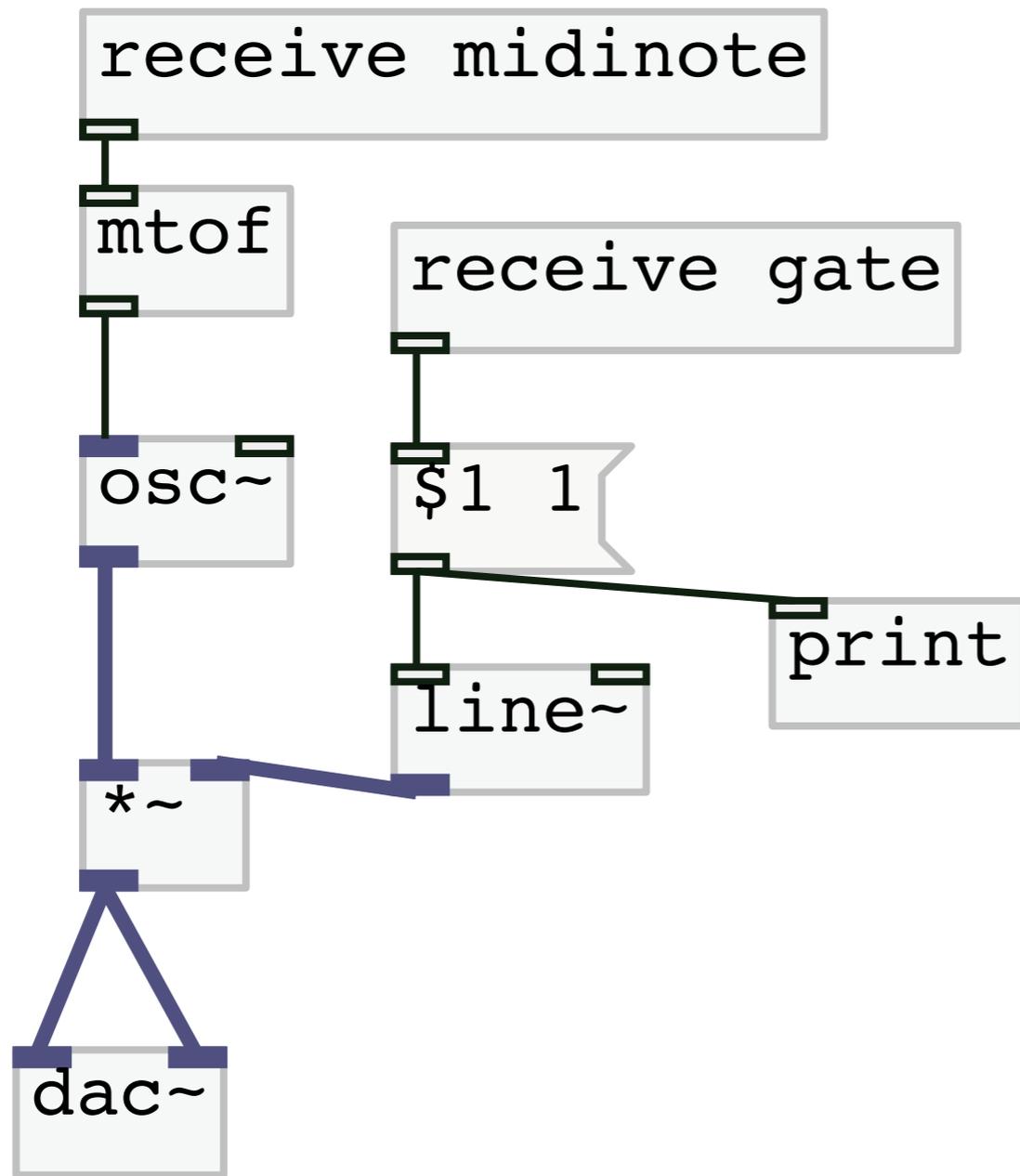


Example 1: A Simple Keyboard

- Sine wave oscillator
- Single voice
- Note on/off
- Great example of Android screen latency!



Example 1: A Simple Keyboard Patch

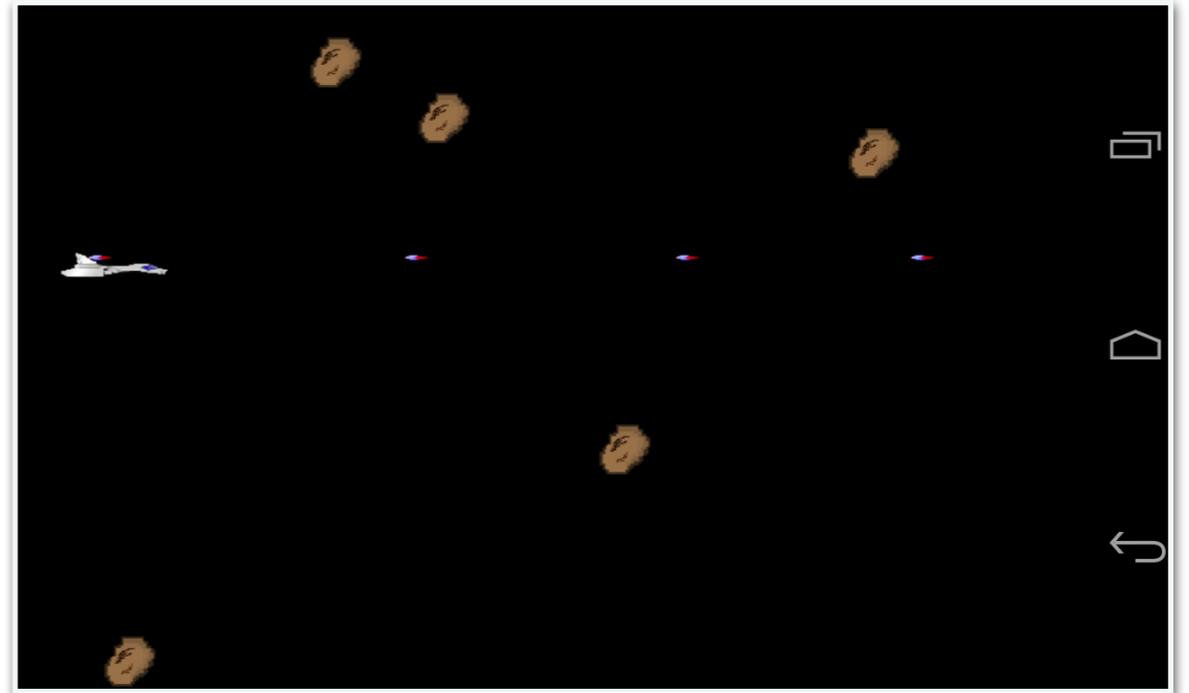


```
;
midinote 60;
gate 1;

;
gate 0
```

Example 2: Space Rocks

- Side scroller space shooter
- Very simple implementation - not production ready game code
- With dynamic sound!



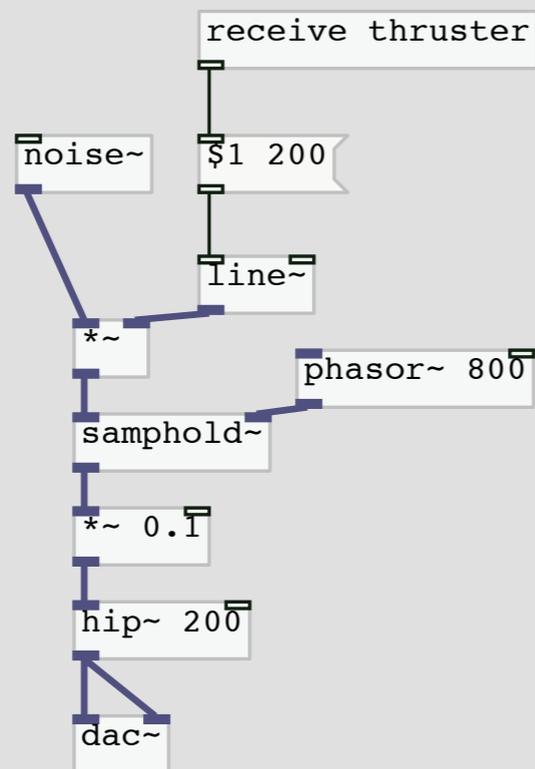
Example 2: A Game Patch

pd waveshop load a square wave at startup

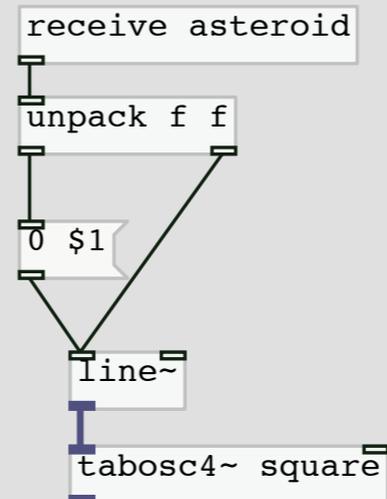
Test_Messages

```
;
bullet 25 200;
;
asteroid 200 100;
;
ship 1000 50;
;
thruster 1
;
thruster 0
```

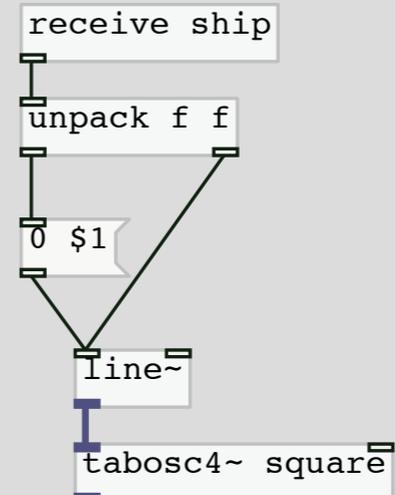
Thruster



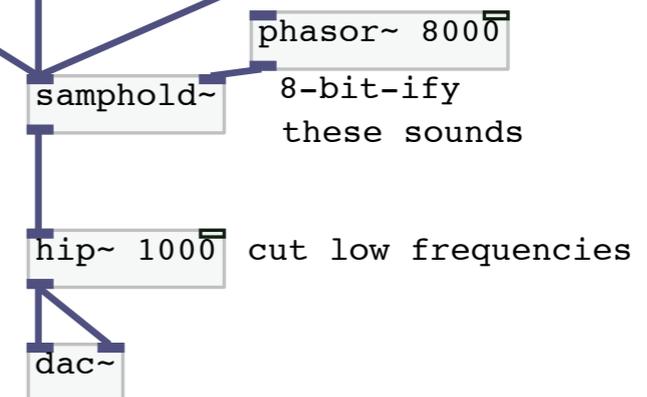
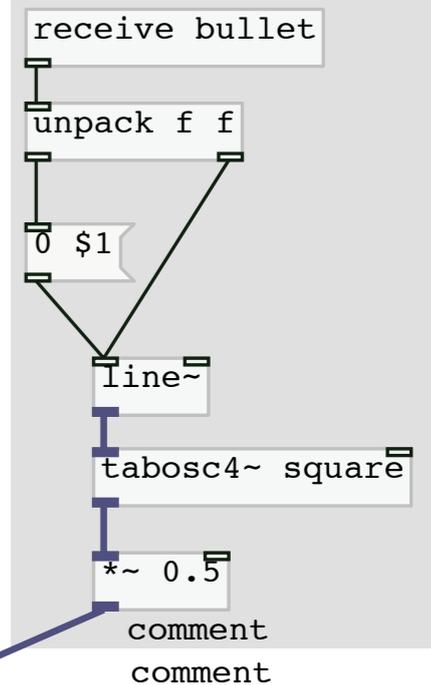
Asteroid_Hit



Ship_Hit



Bullet



The
Pragmatic
Programmers

Programming Sound with Pure Data

Make Your Apps Come Alive
with Dynamic Audio

Tony Hillerson

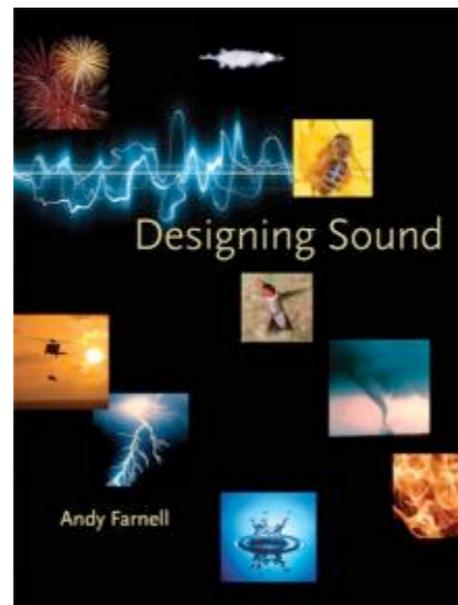
Edited by Jacquelyn Carter

- [http://pragprog.com/
book/thsound](http://pragprog.com/book/thsound)



Further Reading

- puredata.info & libpd.cc
- [youtube.com/user/cheetomoskeeto](https://www.youtube.com/user/cheetomoskeeto)
- <http://designingsound.org>
- mitpress.mit.edu/books/designing-sound



Questions

Thank you!

Dynamic Audio • Tony Hillerson

- We're Hiring!
- careers@tackmobile.com
- Excellent Team
- Awesome Projects
- Great Office