Toolkit for building your own instrument with Pd

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Background

- computers provide incredible, real-time control over sound
- live computer music has become common
- sound synthesis frees the interface from generating sound
- the human body is capable of a massive range of gestures
- keyboard/mouse/monitor interaction leaves a lot to be desired

Intense musical collaboration or tech support?

New model of instrument design

- old model
  - designed for general purpose
  - intended to be used by numerous people
  - few catch on, but when they do, they remain for a long time
- new model
  - designed for specific purposes
  - intended for one person, or a specific set of people
  - often designed for a particular piece

Two examples of new interfaces for musical expression from the mid 80's

Michel Waisvisz playing The Hands

Max Mathews playing the Radio Drum

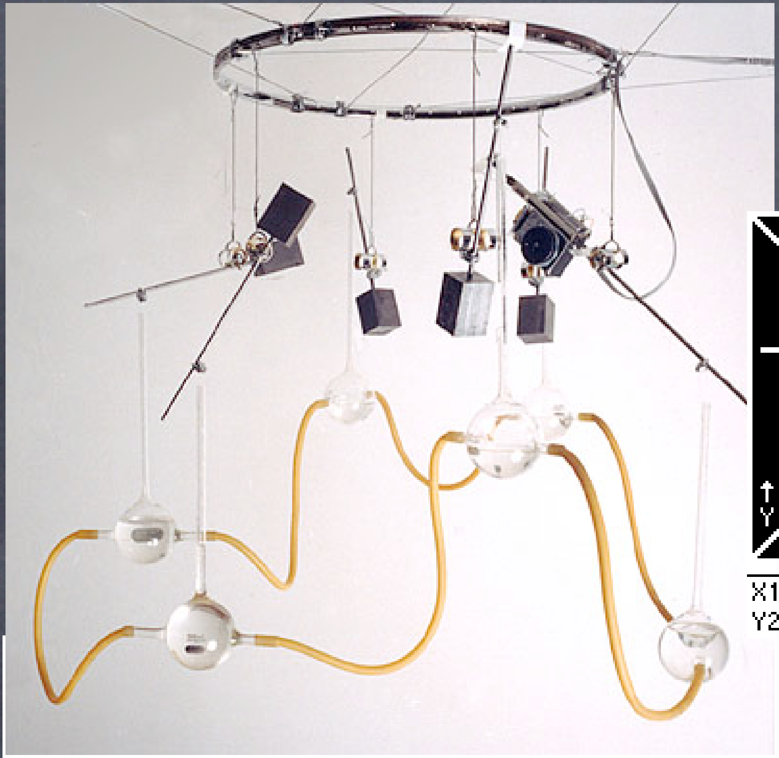
StickMusic

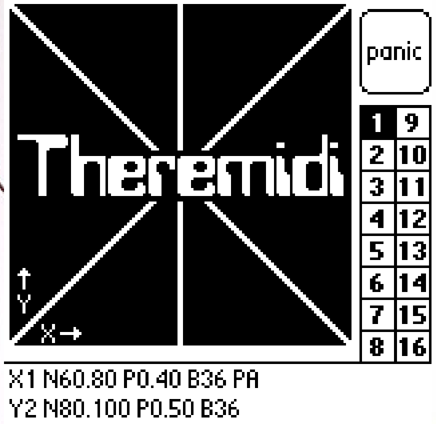
- mouse mimics violin bow
- joystick controls timbre
- vibration in mouse
- force feedback in joystick

The Fundamental Breakdown

- Input
  - Getting data from the user which is used for control. “Human Interface Devices” aka HIDs.
- Mapping
  - Mapping how the input data is mapped to the parts of the program that create the output.
- Output
  - What the user wants to control and create. Traditionally, this has been sound, but it need not be limited to that.

Human Interface Devices (HIDs)





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X1 N60.80 P0.40 B36 PA
Y2 N80.100 P0.50 B36
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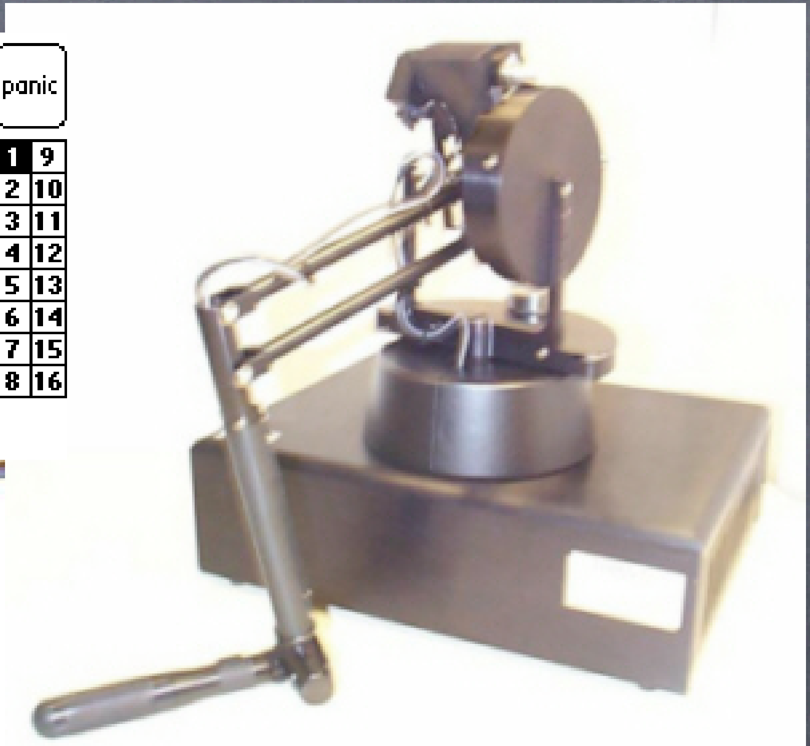

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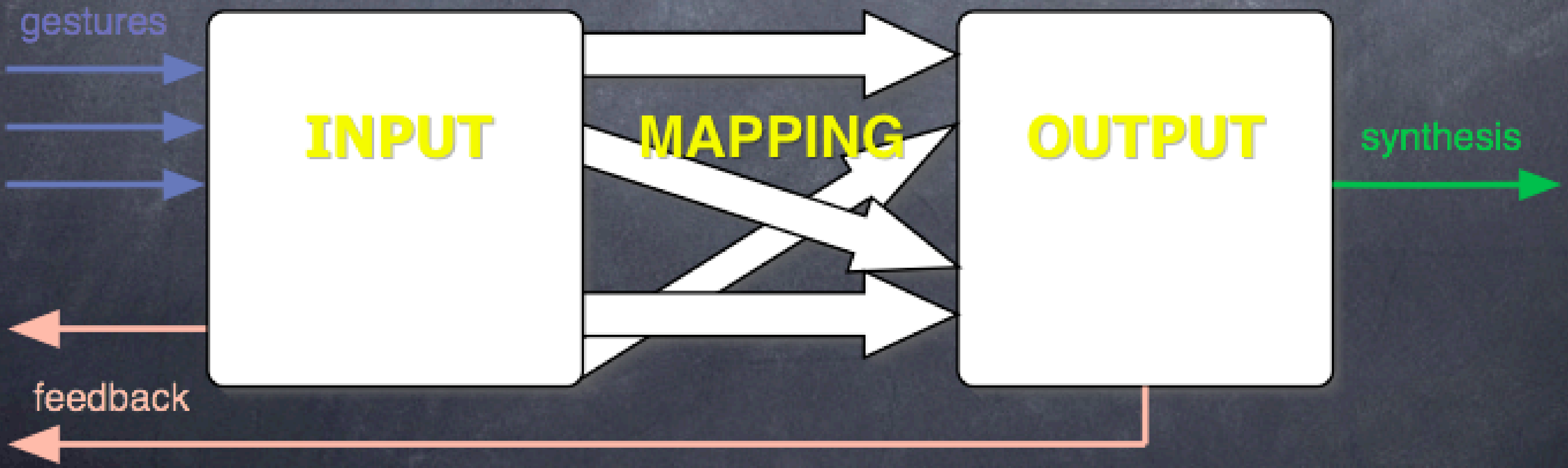
Human Interface Devices (HIDs)

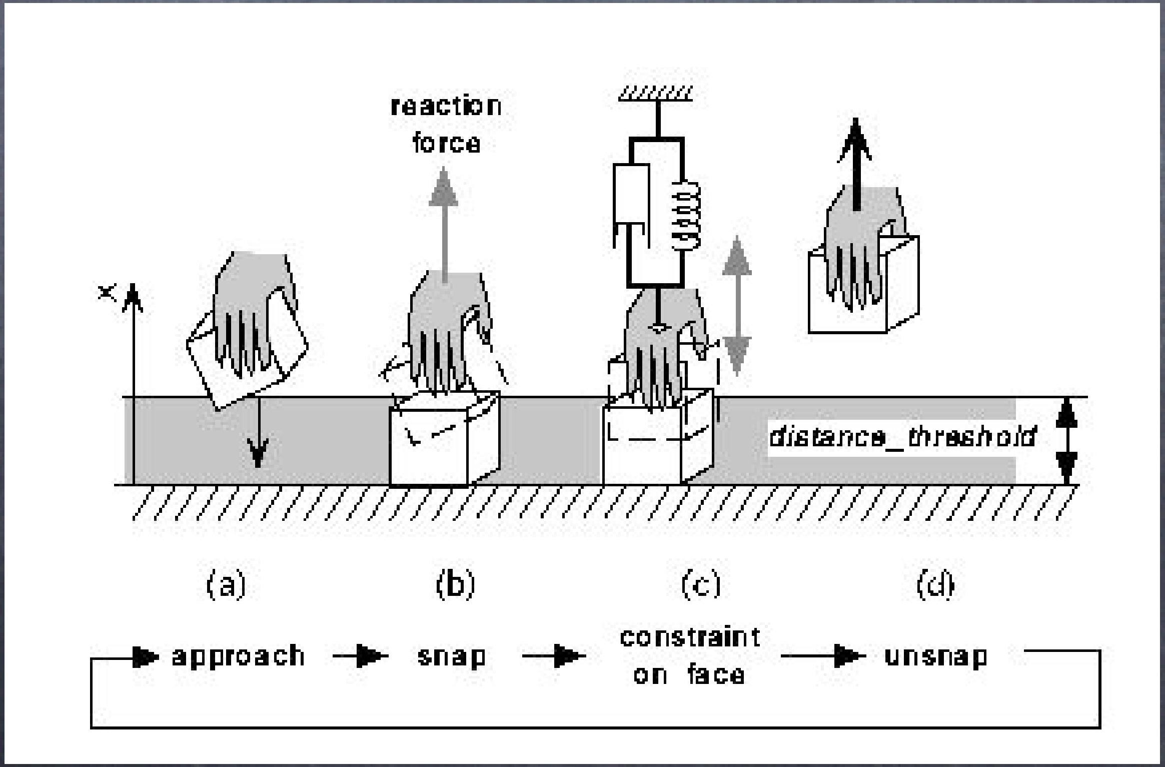
Mapping

- HIDs almost always produce linear data
- mappings in expressive instruments are rarely linear
- complex mappings tend to create more engaging instruments
- one-to-one, one-to-many, many-to-one
- haptic and visual feedback



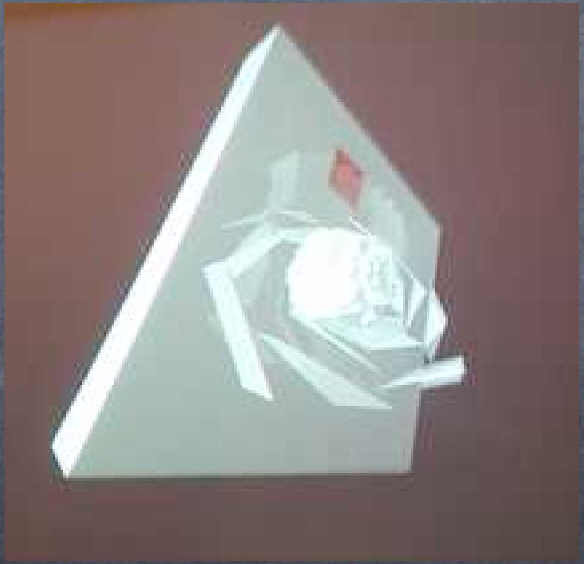
Haptic Feedback

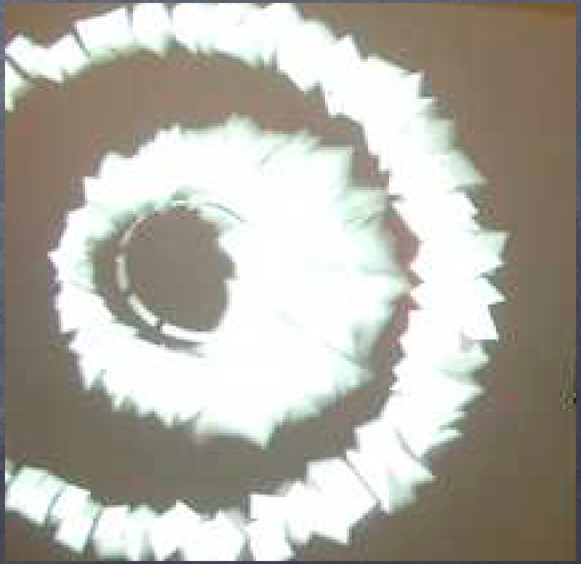
- sense of touch at the skin level and forces to the muscles and joints
- vibration and forces to provide another channel of information
- joysticks, gamepads, steering wheels, mice, high-end and custom equipment



Visual Feedback

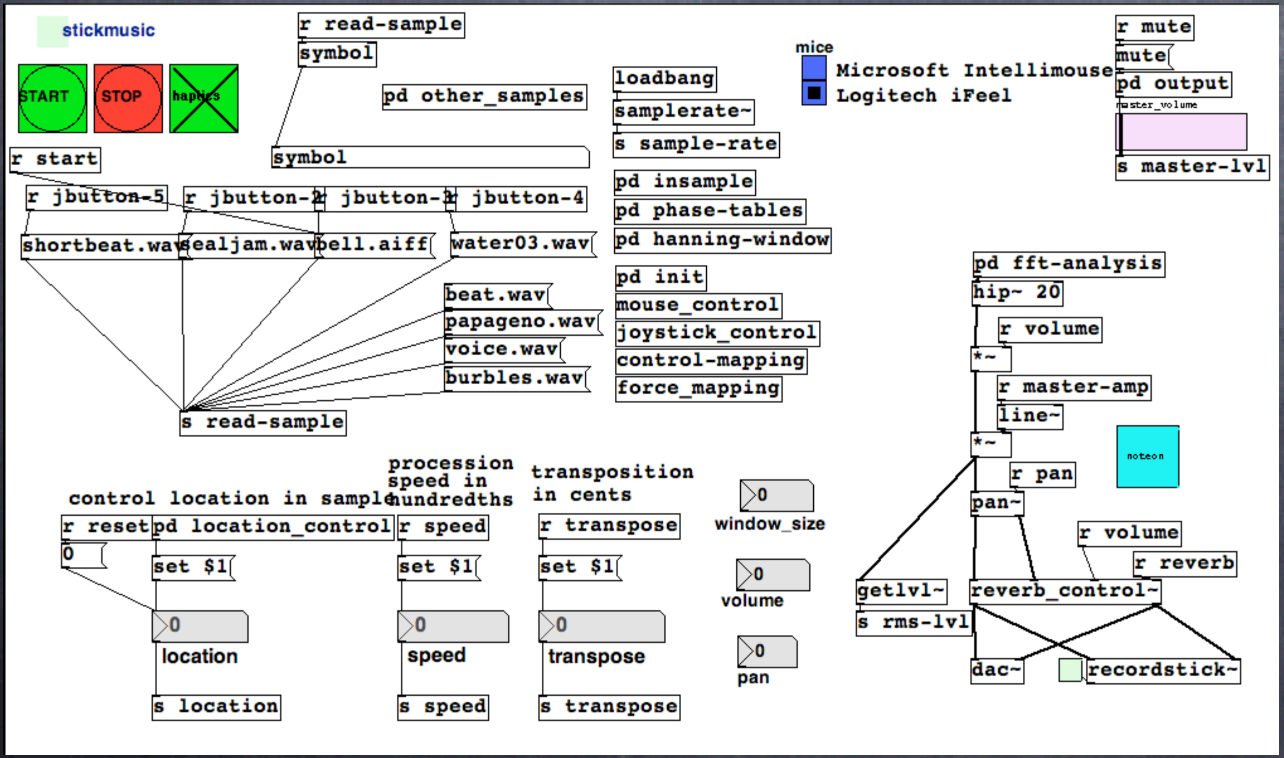
- modern graphic generation creates vast possibilities
- computer instruments can provide greater visual feedback than traditional instruments

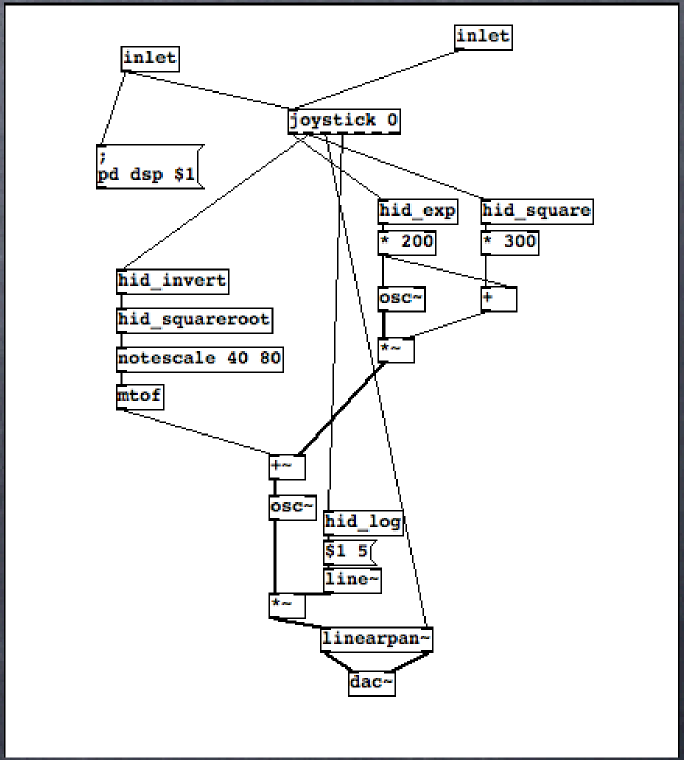




Pd provides a fertile environment

- rapid programming environment
- high level programming
- unified platform for audio, video, physical modelling, input devices, haptics, etc.
- free software running on multiple platforms



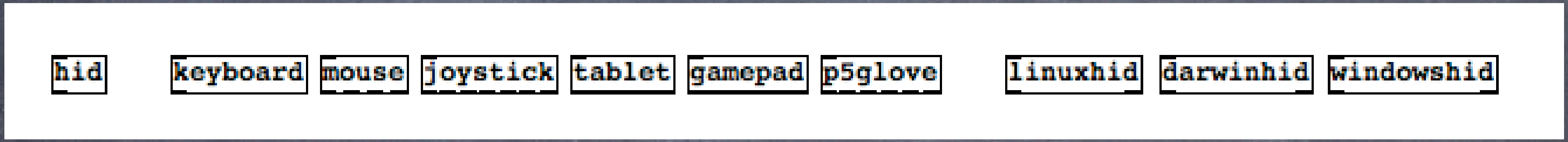


Human Interface Toolkit

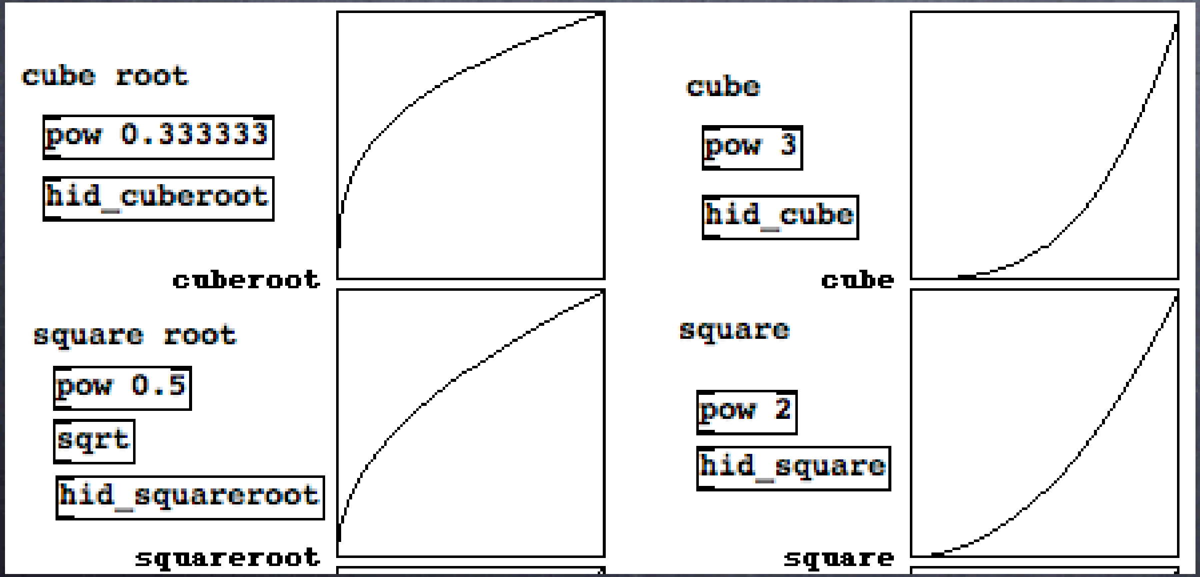
- cross-platform objects with a consistent representation of events
- many different HID approaches unified into one framework
- beginners can build a working instrument
- rapid prototyping for advanced users

Parts of the Toolkit

- low level [hid] object provides common method to access most HIDs
- [mouse], [tablet], etc. objects provide easy access to common HIDs
- a collection basic mapping objects
- high level objects to control haptic feedback effects



hid keyboard mouse joystick tablet gamepad p5glove linuxhid darwinhid windowshid



cube root

pow 0.333333

hid_cuberoot

cuberoot

square root

pow 0.5

sqrt

hid_squareroot

squareroot

cube

pow 3

hid_cube

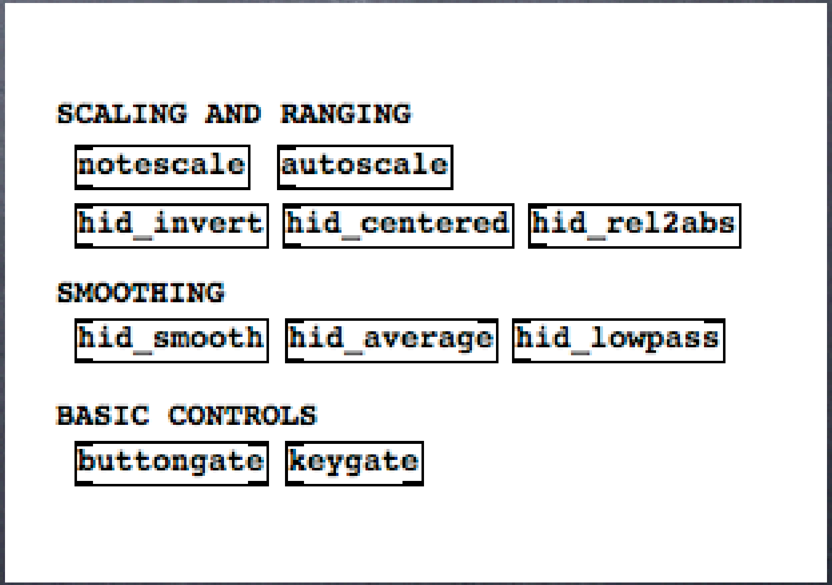
cube

square

pow 2

hid_square

square



SCALING AND RANGING

notescale autoscale

hid_invert hid_centered hid_rel2abs

SMOOTHING

hid_smooth hid_average hid_lowpass

BASIC CONTROLS

buttongate keygate

Prototype

- [hid] implemented fully on GNU/Linux
- [hid] partially implemented on MacOS X
- [mouse], [joystick], [tablet]
- smoothing objects
- objects for making basic curves
- framework for adding more objects

Future Work

- port [hid] to Windows, finish on MacOS X
- add device objects ([knob], [gamepad], etc.)
- create visual feedback objects
- further, more detailed user testing