Space Palette and More

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Aesthetic, Motivation, and Interests

- Cross-functional maker – musician, software engineer, installation artist
- Fail early and often, Refine, Rework, Remix
- Deploy and document regularly
- Algorithmic composition
- Programming languages
- User interfaces (both soft and hard)
- Visual music and visual instruments

Early Work (1980-2000)

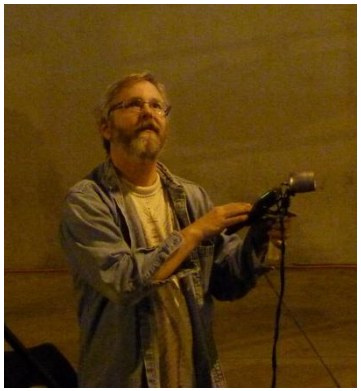
- KeyKit
  - Programming language for MIDI
  - Realtime and algorithmic use
  - User interface experimentation
    - Multi-window, multi-page
    - Object-oriented tool conventions
    - Always-recording MIDI input
    - Pull-off menus and buttons
    - Networking – MIDI syncing, tool broadcasting
- Tune Toys
  - Web-based algorithmic composition experiments

UIs for performance and installations

- Wireless QWERTY keyboard and dance pads
- Controller with 32 sliders, 96 buttons, 3 multitouch pads
- Steering wheel game controllers
- Wood-cased MIDI controller with multitouch and LCD
- Handheld camera/number-pad/LCD instrument

UIs for performance and installations











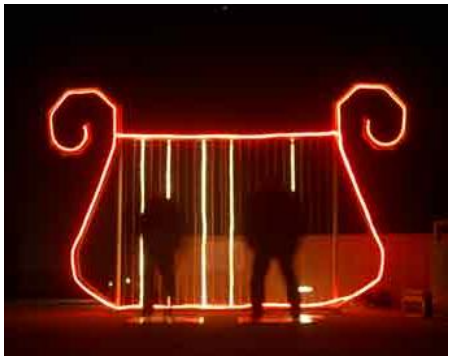
And then I went to Burning Man…

- Largest un-curated art gallery in the world
- Its culture highly values interactive art
- 50,000 active and creative people
  - To interact with whatever you bring and do
  - To inspire you by what they bring and do
- Challenging environment = learning opportunities
- Each year is a blank slate and a fresh start

Burning Man installations over 11 years

- 12-foot Lyre controlled by dance pads
- Antique radio controlled by one knob
- 11-foot Monolith – two sides, two instruments
  - Complex musical UI: 100 buttons, 32 pads, 4 multitouch pads
  - Simple visual UI: chalkboard and colored chalk
- Mobile projector screen and handheld LoopyCam
- Space Palette (7-region rectangular version)
- Space Palette (4-region oval version)

Burning Man Installations



Burning Man Challenges

Recent Focus

- 3D continuous input with hands
- Third dimension can be:
  - Pressure (Continuum, Eigenharp, Linnstrument, etc)
  - Area (Fingerworks, Magic Trackpad, iPad)
  - Vibration, Orientation (smart phones)
  - Depth (Kinect)

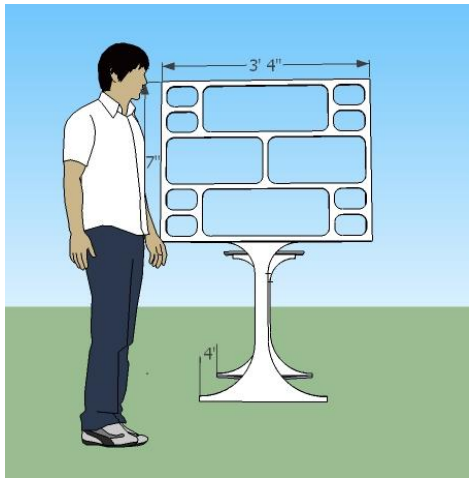
Kinect !

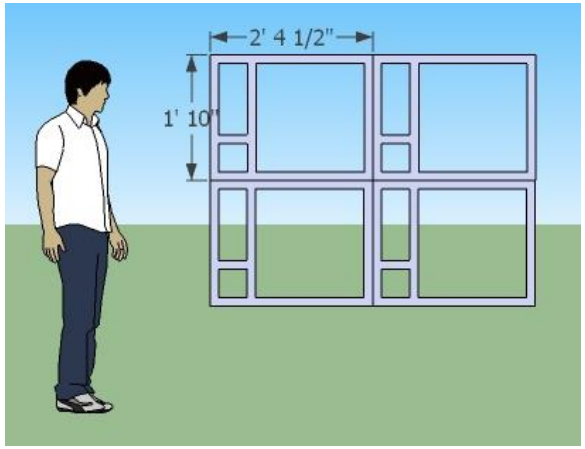
- Inexpensive and ubiquitous
- Good resolution and robustness
- Easy to use from C
- Tolerant of dust (yay!)
- Intolerant of sunlight (boo!)

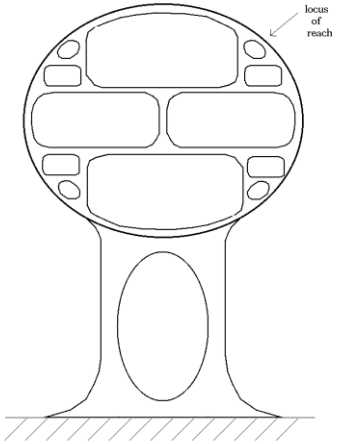
Space Palette - a 3D Instrument Interface

- Holes in a frame become 3D multitouch surfaces
- Any number of hands or objects, simultaneously
- Flexible layout allows many control possibilities
- Immediate access to different sounds/graphics
- Provides frame of reference for player and audience
- Larger visual footprint is more interesting to audience
- Immediately playable, no initial dexterity required
- Larger and less-restricted motion by player is relaxing and expressive

Space Palette - Evolution and Variations







Movies

Lightning in a Bottle 2011

Burning Man 2011

SF Decompression 2011

LoopFest 2011

Symbiosis 2012

Burning Man 2012

Controlling the Music

- Each large hole plays a different sound
- Horizontal position is pitch
  - All notes forced onto a particular scale and key
  - Typically two octaves across
- Vertical position controls timing quantization - “time frets”
  - Three bands: one beat, half-beat, quarter-beat
- Depth position:
  - Converted to MIDI aftertouch, used for vibrato, filtering, and mixing
- Small holes are buttons
  - Performance UI - change key, scale, sounds, looping
  - Casual UI – select presets

Controlling the Graphics

- Each large hole is an independent 3D drawing surface
- Each hole's drawing has independent shape/color/motion
- Depth controls the size of graphics
- Small holes are buttons
  - Performance UI - change color, shape, motion
  - Casual UI – select presets

Types of Instruments

- Casual Instruments
  - Prioritize fun and enjoyment
  - Few or no instructions
  - Immediate gratification, no learning curve
  - Path to proficiency is nice to have, but not required
- Performance Instruments
  - Prioritize proficiency and control
  - Instructions or training usually required
  - Proficiency requires practice, learning curve
  - Visualizations (real or virtual) for audience are beneficial

Where does the Space Palette fit?

- As a Casual Instrument
  - No learning curve: walk up, play, sound good
  - Natural interaction, effortless, engaging
  - Control over individual notes
  - Players recognize that they’re the ones controlling it
- As a Performance Instrument
  - Physical presence is more visible and entertaining
  - Performer’s larger movement engages the audience
  - More obvious correlation of physical actions to output
  - Frame of reference allows more and better control

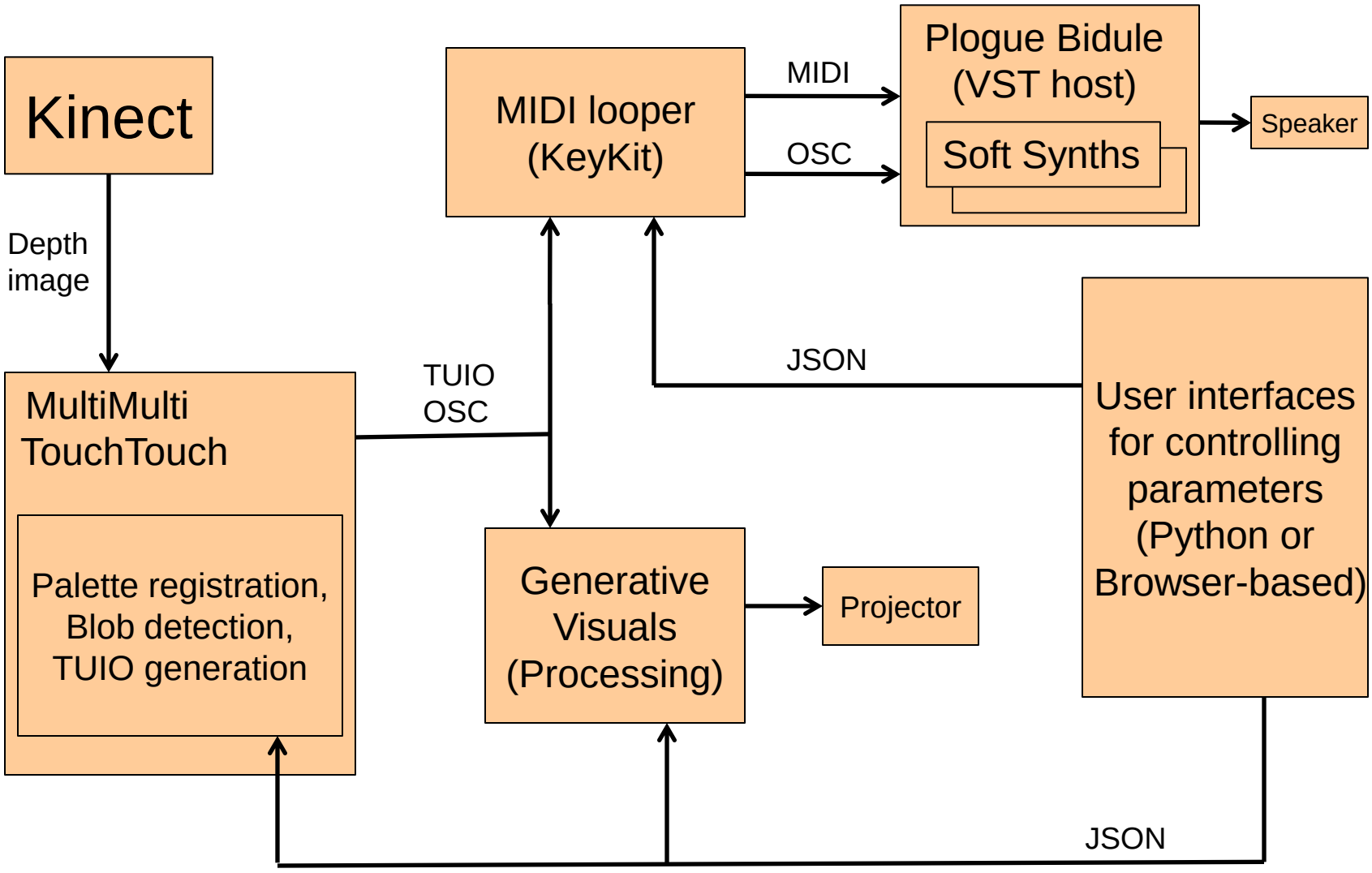
Where does the Space Palette fit?

- Both casual and performance?
  - User interface is greatly affected by the choice
  - A single physical interface can serve both
- Casual use is the current sweet spot
  - Confirmed by several years at Burning Man and other events
  - UI continues to be simplified, visual feedback added
- Performance use has been explored
  - Several solo and collaborative performances
  - Several UI style experiments (e.g. shift-select style)
  - Open source MultiMultiTouchTouch allows others to explore

Initial Evolution - 2011

- Initial prototype: 4 regions
- A little more control: 7 regions, 8 buttons
- Lightning in a Bottle
- West Coast Controller Battle
  - Tennis Ball !
- Simultaneous graphics using Processing (Java)
- Burning Man 2011
  - Multi Multi Touch Touch theme camp
- MusicTech Summit, Venice Art Crawl, Decompression, etc

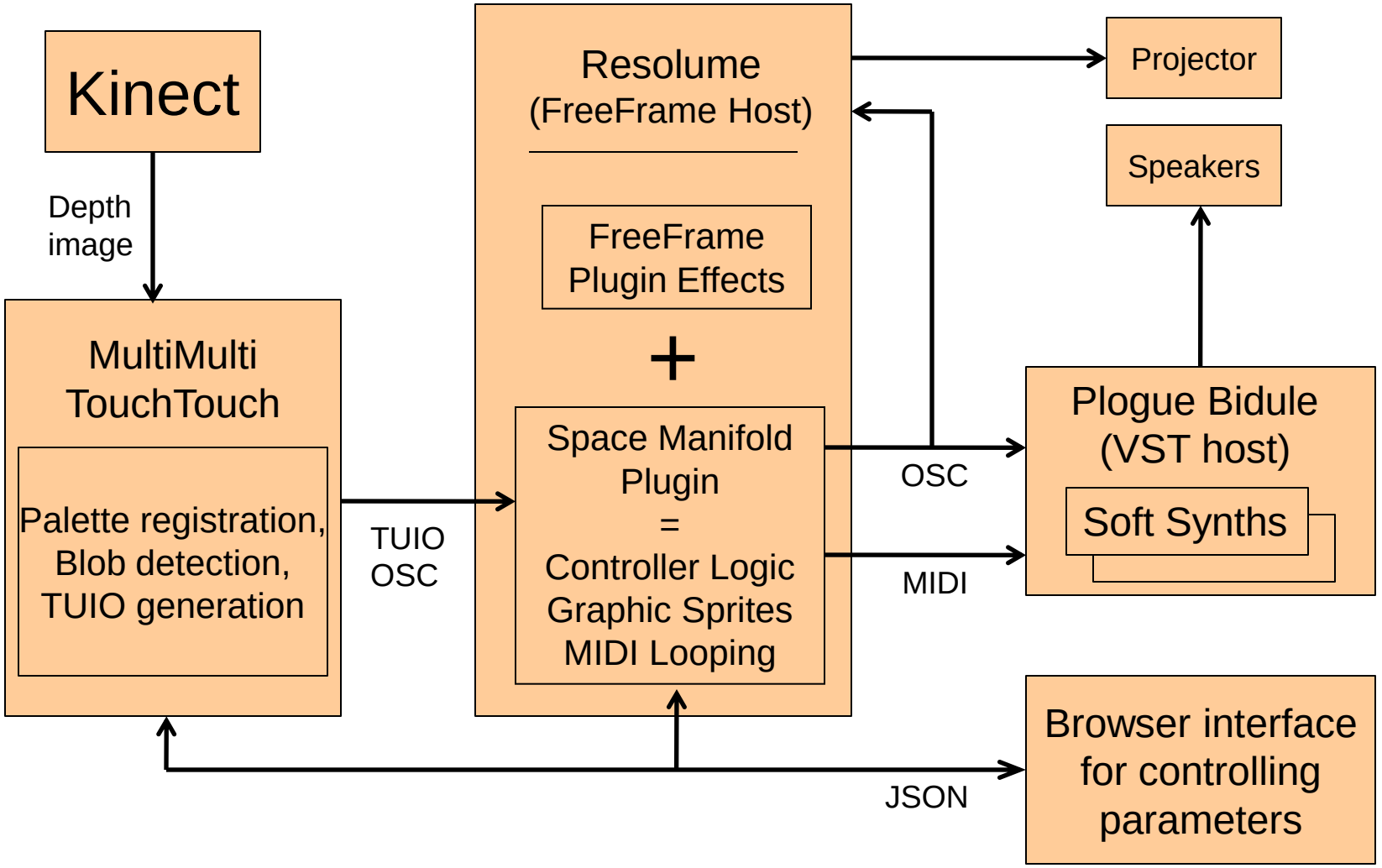
Design - 2011


Kinect
Depth image
MultiMulti TouchTouch
Palette registration, Blob detection, TUIO generation
TUIO OSC
MIDI looper (KeyKit)
MIDI
OSC
Plogue Bidule (VST host)
Soft Synths
Speaker
JSON
User interfaces for controlling parameters (Python or Browser-based)
Generative Visuals (Processing)
Projector
JSON

Recent Evolution - 2012

- Oval version – 4 regions, 12 buttons
- FreeFrame plugin inside Resolume
  - Eliminates KeyKit and Processing
  - More complex visual effects using other FreeFrame plugins
  - Resolume can be controlled with OSC
  - HTTP listener, JSON API = browser-based UI for parameter control
  - Single OSC listener and looping mechanism, better synchronization
  - Potential for interaction between graphics and music
- Python integration within FreeFrame plugin
  - Interactive development, more robust error handling
  - Live coding
  - Easier code sharing and distribution

Design - 2012


Kinect
Depth image
MultiMulti TouchTouch
Palette registration, Blob detection, TUIO generation
TUIO OSC
Resolume (FreeFrame Host)
FreeFrame Plugin Effects
+
Space Manifold Plugin = Controller Logic Graphic Sprites MIDI Looping
Projector
Speakers
OSC
MIDI
Plogue Bidule (VST host)
Soft Synths
JSON
Browser interface for controlling parameters

Things Observed and Learned

- Casual use vs. performance use influences the design a lot
- Small holes are magnetic
- Labels are rarely read
- Musicians know how to rest, listen, and be selective
  - They aren’t the only ones who can do those things
- Looping can be confusing
- Multiple users is fun, but can be confusing

More Things Observed and Learned

- Correlation of graphics to hands is often not noticed due to extreme visual effects
- People love seeing their hands (debugging display)
- Effect of depth often needs to be explained, but is immediately appreciated
- Time-frets aren’t intuitive, but provide useful variety even if you aren’t aware of how it works
- Hand motion tendencies limit the pitch range used:
  - Depth-only with no up-down or left-right motion
  - Up-down with no left-right motion

Comments about the Space Palette

- Most common:
  - I want one in my living room.
  - How much?

- Most interesting:
  - Why, it really opens up what an instrument is, right?
  - You gotta try it, you gotta try it, you gotta try it!
  - For those who can’t cross that barrier [of playing music], they’re literally crossing that barrier [hands reaching through].

Software

- MMTT (MultiMultiTouchTouch)
- Resolume (FreeFrame host)
  - Projection mapping and visual effects
- Space Manifold (FreeFrame Plugin)
  - Receives TUIO/OSC, generates graphics AND music
  - Looping mechanism
- Plogue Bidule (VST host)
- VST Soft Synthesizers
  - Battery 3, Alchemy
- Browsers (local and remote)
  - User interface (and JSON API) to control MMTT, Space Manifold

MultiMultiTouchTouch (MMTT)

- C++ program uses libfreenect to talk to Kinect
- Uses depth image only
- Blob detection using OpenCV
- Trainable interactively on new frames, holes of any shape
- Trainable without a frame, using a specially-colored image
- Browser interface to control it, using JSON over HTTP
- Output is TUIO (a standard multitouch format) over OSC (a standard UDP protocol)
- Windows-only, source code freely available:

  `http://multimultitouchtouch.com/dist`

More Info

- Source Code for MMTT (Kinect-to-TUIO)

  `http://multimultitouchtouch.com/dist`

- Search YouTube for “Space Palette”
- Email: **`me@timthompson.com`**

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