The T-Stick: Design, Construction, Performance and Pedagogy

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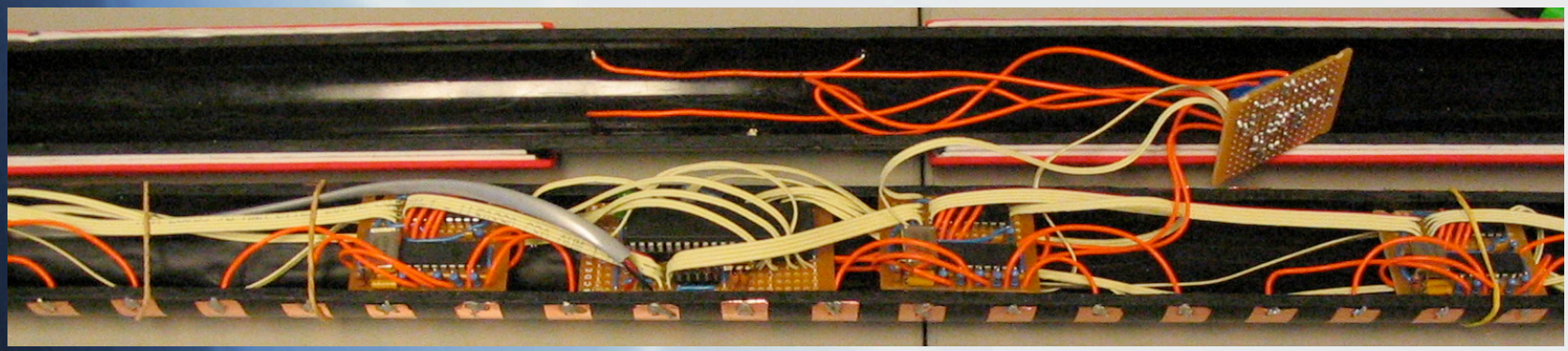

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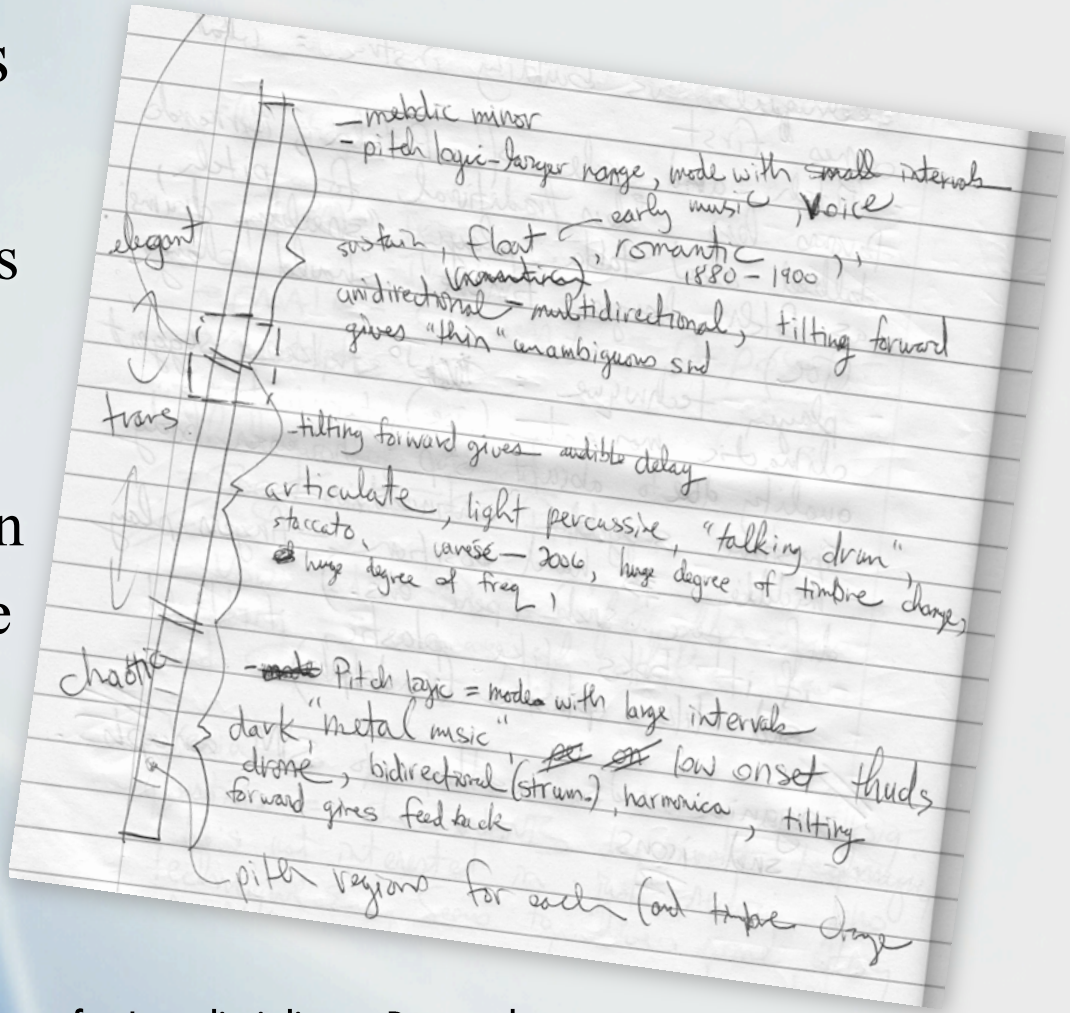
Goals of the T-Stick project

- To create an “expert” musical interface: engaging to new users, allows virtuosic playing, and is “worth practicing.”
- To use the familiarity of the physical world in the same way that “instrument-like” and “instrument-inspired” controllers are said to leverage pre-existing performer skill
  - The T-Stick is a “alternative” controller - it does not (deliberately) mimic an existing instrument
  - It does, however, have a “feel” (weight, shape, texture). Can we augment this with audible feedback?
  - Implement mapping such that the controller is suggestive of the interaction possibilities and sound output

Hardware / Controller

- Started with sketches
- Discussion
  - Interaction metaphors
  - Virtuosity
  - Effort
  - Trends in DMI design
  - Possible performance practice



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Hardware: Motivation

- To create a multi-touch surface, able to tell the difference between the touch of a finger and that of a hand.
- To explore the possibilities of emulating a physical acoustically-vibrating object
  - Excitation
  - Modification
  - Damping

Hardware: Sensor choice & placement

- 48 capacitive touch sensors covering half of the pipe
  - Sense touch, holding, brushing, tapping
- 2 three-axis accelerometers, one in each end of the pipe
  - Sense tilt, roll, shaking, swinging
- 2 pressure sensors on the “back” of the pipe
  - Sense continuous pressure
- 1 piezo-electric contact microphone bonded to the inside of the pipe
  - Sense tapping, twisting of the pipe

Hardware: input from performers

- Length of pipe
- Spacing of capacitive sensors
- Foam thickness over pressure sensors
- Fret height
- Fret markers
- Space between pressure sensors and at ends
- Adjustable spike

Mapping

- “Many to many” mapping approach
- Implementation of mapping (in Max/MSP) is multi-layered
  - Controller-side mapping layer calculates higher-level features from the raw sensor data, and exposes control signals for mapping to synthesis parameters
  - Synthesis-side mapping layer creates inter-relationships in synthesis parameter-space

Mapping - continued

- Used verbal feedback from performers to optimize mapping
  - Very important to have feeling of being “in control” of the sound output!
  - Reproducibility
  - Ability to stop the sound

Synthesis

- Current synthesis uses *Sculpture*, a software instrument for physical modeling included with Logic
- Benefits:
  - Much of the synthesis-side mapping is built-in
  - Simple interface for controlling multiple parameters simultaneously

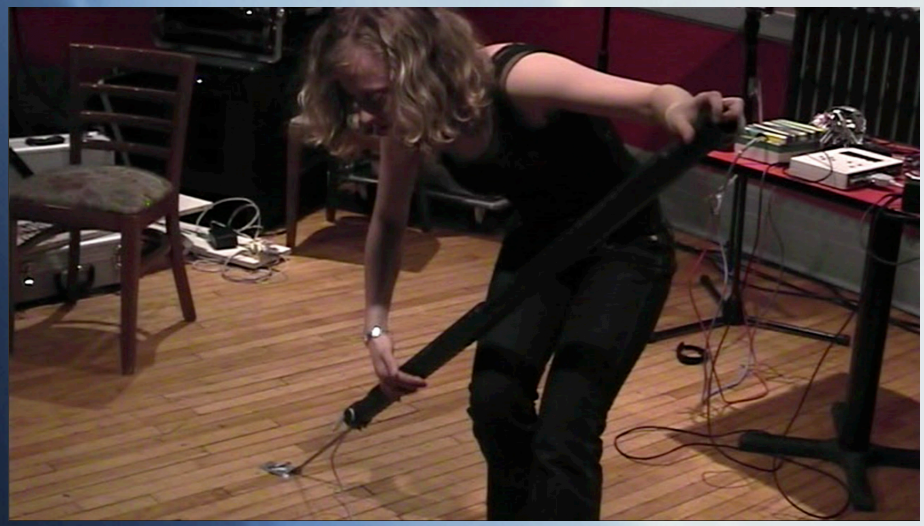
Notation for gestural controllers

- The dilemma:
  - Do we notate the intended sound output, instructions for producing this output, or the desired gesture?
  - Example: to change delay time, in the score do we
    a) indicate delayed copies of the performed sound
    b) indicate that the "delay time" parameter is changing
    c) indicate that breath-pressure should be increased (for example)
  - How do we leverage a performer's existing score-reading skills when controlling atypical parameters?

Performance Practice / Pedagogy

- We have had the chance to work with some excellent performing musicians as collaborators in this project, in the context of
  - A graduate seminar on gestural controllers
  - The *McGill Digital Orchestra* project
- To date, the T-Stick has been performed publicly 4 times
  - Twice in the MUGS695 seminar concert
  - Once during a McGill "Mini Music" lecture
  - Once in Fernando Rocha's lecture recital

Performance Practice



Two contrasting methods for playing the T-Stick

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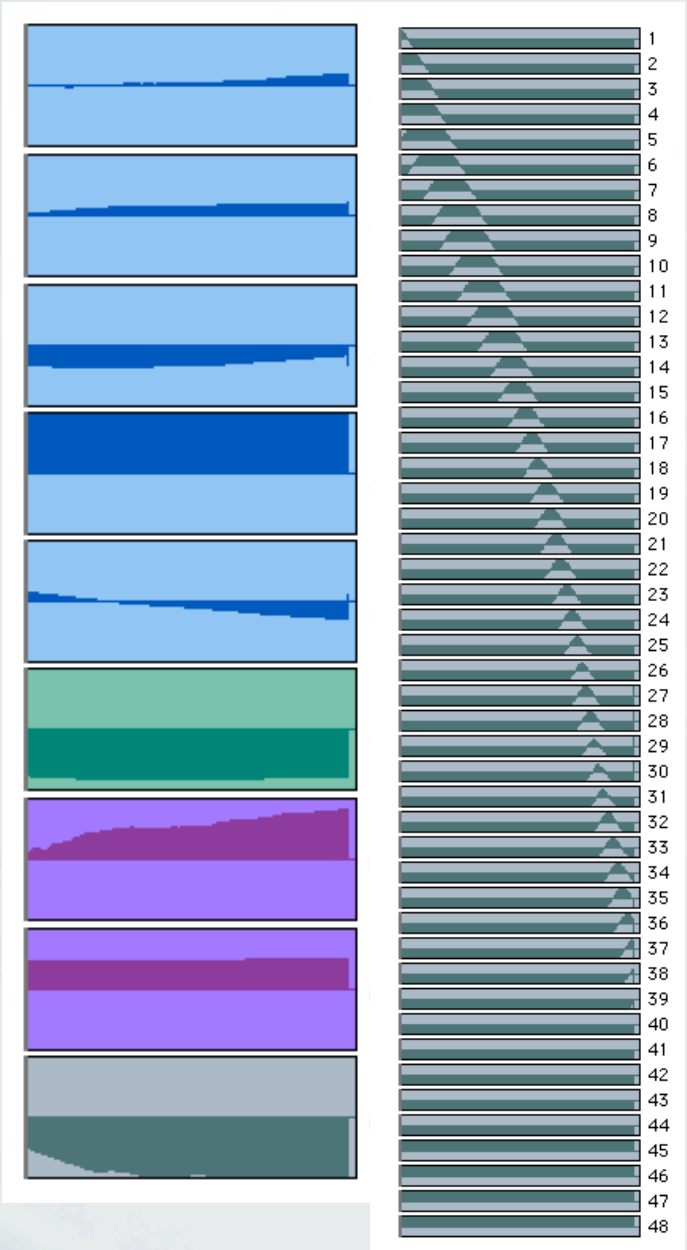
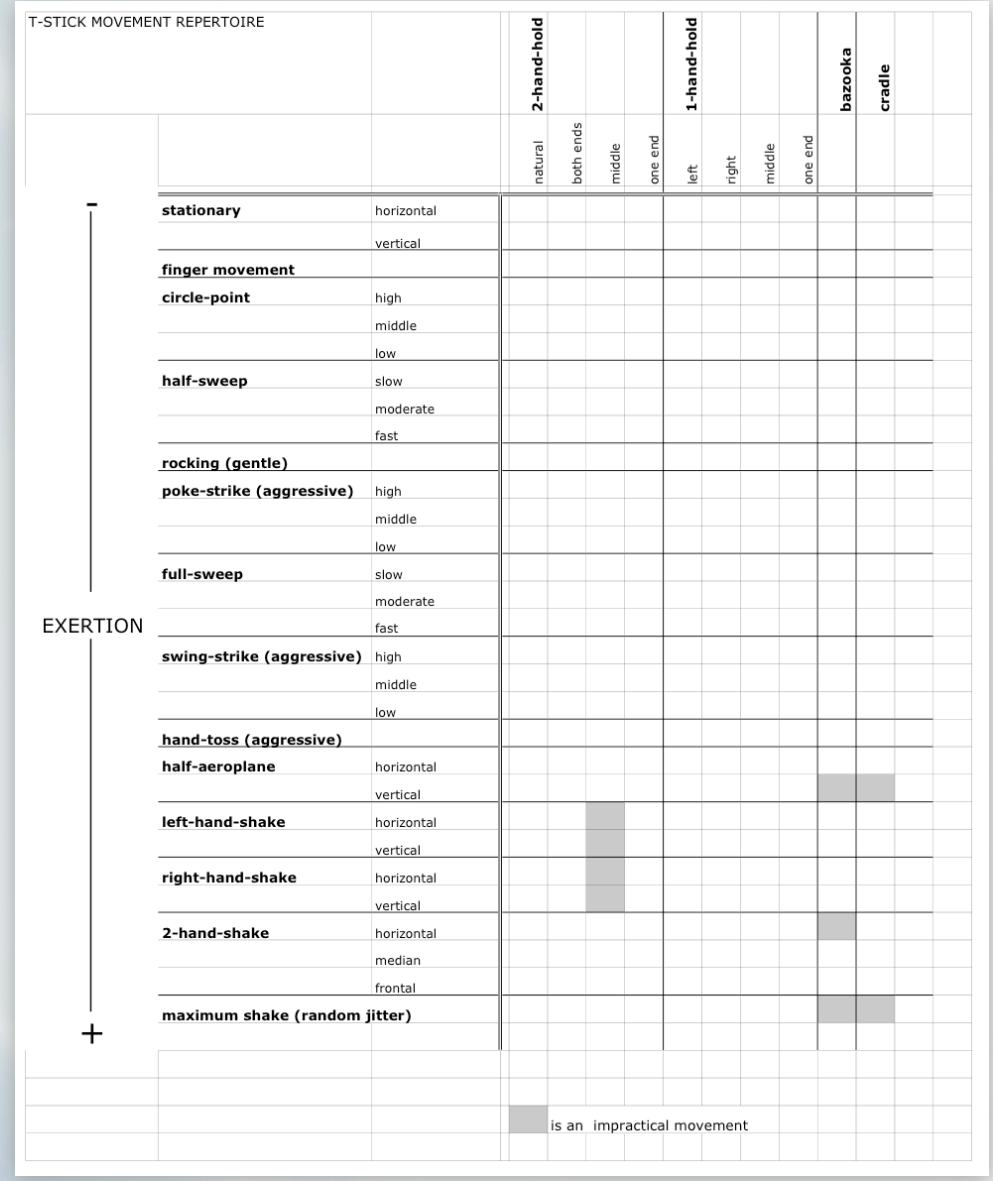
Performance Practice

We have been working with performers to refine the mapping of the T-Stick. Sensor output is recorded for various gestures in order to allow “off-line” editing of the mapping.



Performance Practice:

classifying possible gestures



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Future direction: 2006-2007

- Explore additional sensing modalities
  - Ultrasound ranging
  - Breath pressure
  - Digital compass
  - Air microphone
- Increase controller sampling rate
- Increase resolution of capacitive position sensing
- Develop a wireless version
- Refine mapping and synthesis

Future direction: 2006-2007

- Complete a quartet of T-Sticks
  - Various sizes
  - Sensing may differ slightly between members, but overall sensing approach will remain constant
  - Look at differences in performance practice, “portability” of skills between instruments
  - Implications of composing for ensembles of gestural controllers
    - Voicing, ranges, articulation, blending and contrast
    - Can we successfully create a family of complimentary controllers?