Double Slide Controller

Tomás Henriques

Buffalo State College - Music Department - 1300 Elmwood Ave. Buffalo NY 14222, USA

716 878 6401

henriqjt@buffalostate.edu

Abstract

The Double Slide Controller is a new electronic music instrument that departs from the slide trombone as a model for its design. Going much beyond a mere simulation of its acoustic counterpart it introduces truly innovative features: two powerful and versatile sets of gesture driven interfaces actuated by the hands of the performer, as well as featuring two independent slides, one for each hand/arm of the musician. The combination of these features make this instrument a great tool to explore new venues in musical expression, given the many degrees of technical and musical complexity that can be achieved during its performance.

Keywords: Musical Instrument, Sensor technologies, Computer Music, Hardware and Software Design.

1. Towards an electronic slide trombone

The acoustic slide trombone has been used as a framework for different experiments in electronic music performance. Collins' "trombone-propelled electronics" [1] used an old trombone to house a digital signal processor allowing live sampling and various sound modifications. The work of Farwell [2], Lemouton and Sluchin [3] used the trombone's slide to mount distance sensors capturing its position and mapping the data into different music synthesis and control parameters. On a different front, Cook's Tbone [4], a software model of the instrument was a pioneering application to simulate the trombone's sound but was not geared at being a performance tool. Building an electronic controller to mimic the slide trombone has proven to be a challenge. The simplicity of tone production in the acoustic instrument contrasts with the complexity needed for its emulation using current sensor technologies. The DS-C attempts to create such emulation while providing novel interface components that fully expand the gesture rich features of trombone playing.

2. DS-C Overview

This new interface comprises four distinctive parts, grouped by their functionalities and the scope of the sensors used in their making. These are as follows:

a) a double slide mechanism, consisting of a set of two long sensor (50cm) position strips

b) two hand controllers capable of freely moving in three spatial dimensions

c) a mouthpiece that senses breath and lip pressure and that gets kinesthetic information from a vibration motor

d) and the sensor interface component that receives the information coming from 18 analog sensors and 26 digital switches contained within the instrument.

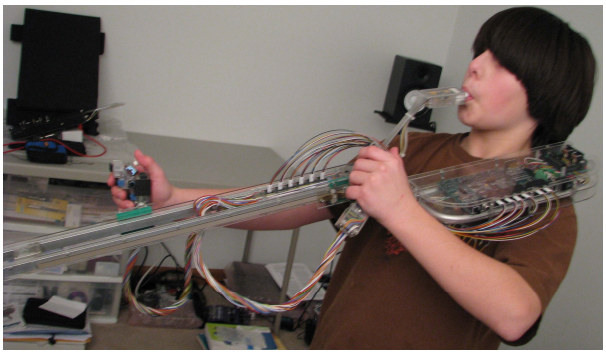

Figure 1. Playing the Double Slide Controller

3. Design of the DS-Controller

The two non-moving **virtual slides** sit on a dual parallel aluminum frame. They are played *independently,* each using a small roller mechanism that sits on its respective position sensor and made to slide up and down within its total length. The rollers are physically linked to the hand controllers that are moved by the performer's hand/arm motions making the integration of both the slide and hand controller components seamless.

Each of the two **hand controllers** has a two-axis accelerometer, a gyroscope, a force sensor resistor, a joystick and thirteen on-off buttons. These hand controllers can freely move in three spatial dimensions and use the accelerometer and gyroscope to capture complex hand motions. The force sensor resistor allows the performer to squeeze the controller with his thumb giving him/her an extra type of control. The joy stick is also accessed by the thumb very much like in a regular game controller. Eight out of the thirteen buttons are placed parallel to each other in rows of two buttons each, but at different heights. These buttons are easily accessed by implementing an ergonomic approach that

allows both the finger tips and middle phalanges to trigger them. This new method optimizes the usability

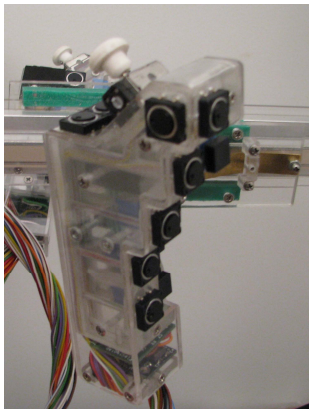

Figure 2. The right hand controller

of the fingers as control sources by going a step beyond what is currently offered in most music interfaces or even game controllers.

The mouthpiece has three sensors built in. An air pressure sensor set by default to control the amplitude and the brightness of the sound being produced; a force sensor resistor placed at the tip of the mouthpiece allowing the performer's lips to exert pressure on it, generally to produce vibrato, and a small vibration motor of variable speed that can be programmed to respond in many different ways such as detecting notes played out of tune, etc.

The Double Slide Controller uses two separate **sensor interfaces** working in tandem at full capacity: a hacked Electrotap's Teabox [5] and a MIDItron [6]. The former captures eight analog sensors and sixteen digital switches at a resolution of twelve bits, sending that information as a S/PDIF signal to a computer running MaxMSP. The latter gathers analog voltages from ten sensors and ten on-off switches with a resolution of seven bits, sending the information as MIDI messages to the same machine running MaxMSP. Teabox's higher resolution was needed to fully capture the quick motions exerted on the position sensors.

4. Playing the Double Slide Controller

The DS-Controller generates sound by blowing into its mouthpiece and moving the roller mechanism that sits on the right hand sensor strip. Pitches are selected using a group of switches in the left hand controller which choose a reference overtone. The motion of the virtual slide can alter the reference overtone by as much as a diminished fifth just like in the acoustic slide trombone. The double slide controller can play its sound via MIDI by sending key, breath and pitch bend messages to a hardware music synthesizers/sample playback module etc, enabling the simulation of the traditional glissandi tone production of a trombone. It can also be programmed to use software synthesis applications to generate audio in real time directly from a computer.

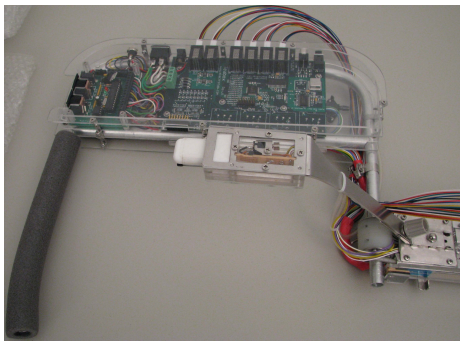

Figure 3. The mouthpiece and the two sensor interfaces

5. Advanced Performance with the DS-C

Besides using the Double Slide Controller as a simple monophonic electronic instrument, it can be also used as a complex performance tool. The DS-C has been programmed to play in different performance modes that were previously developed by the author for the META-EVI wind controller [7].

The performance modes include a Harmony Mode allowing the instrument to play harmonies in real time while simultaneously playing a lead melody; a Counterpoint Mode, now made easier by using the two slides of the instrument and a Sample Trigger Mode that turns the instrument into a complex sample play back unit.

6. Acknowledgments

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