Multiple-Touch-Sensitive Keyboard

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ABSTRACT
In this presentation, we discuss and demonstrate a multiple touch sensitive (MTS) keyboard developed by Robert Moog for John Eaton. Each key of the keyboard is equipped with sensors that detect the three-dimensional position of the performer's finger. The presentation includes some of Eaton's performances for certain earlier prototypes as well as this keyboard.

Keywords
Multiple touch sensitive, MTS, keyboard, key sensor design, upgrading to present-day computers

1. INTRODUCTION
At the beginning of the presentation, we present an audition of an early (1960's) synthesizer piece, Blind Man's Cry, by Eaton demonstrating the sensitivities of keyboard synthesizers of that time.

2. MOTIVATIONS
Unquestionably, an element missing in much electronic music is human nuance.

The multiple-touch-sensitive (MTS) keyboard restores that by taking full advantage of the human body's capacities for expression that have produced human nuance in traditional music making by developed performance artists.

It is a firm belief of both presenters that the most sensitive and meaningful music will be produced by overcoming resistance by diligent practice on the instruments – i.e., the best instruments will be difficult to play well. Furthermore, they must be played by the parts of the human body that can develop the most sensitive control, such as the tips of the fingers.

3. KEYBOARD DESIGN
The sensitivities of the MTS keyboard address some highly developed techniques for keyboard and string instruments, as well as new abilities that must be developed.

The keyboard consists of 49 keys, plus one larger multiple-touch- sensitive control surface to the left of the keys, which is intended for global parameter control. In addition, a multiplicity of input jacks can accommodate auxiliary global controllers such as expression pedals and footswitches.

Each key, independently of all the others, sends out five independent eight-bit data streams that tell the current values of a) the left-to-right position of the player's finger, b) the front-to-back position of the player's finger, c) the area of the surface of the player's finger that is touching the key surface, d) the depth to which the key is depressed, and e) the force with which the key is depressed after it reaches the lower limit of its travel.

The keyboard's circuitry scans the signals from the keys and global controllers, and delivers them to an external dedicated computer through a single eight-bit parallel interface. The dedicated computer maps the key data and then formats it into a MIDI data stream, each key being assigned to a different MIDI channel within a predetermined range. Each of the key outputs may, of course, be assigned to any MIDI control change or other continuously variable destination. Thus, any key parameter can be applied to whatever facet of the music is susceptible to control in the synthesizer or computer program used. Any number of these may be used in a preset mapping, and the mappings may be changed in the course of a piece. (In Eaton's "Genesis", e.g., seven different mappings are used, three of which employ all five sensitivities in some of the slower sections, whereas only two are used in one brilliant, faster section.)

Moog will present a brief technical description of the sensors themselves. Eaton will then present a DVD of a piece written and performed by him.

4. *RAISON D'ETRE* FOR THIS PRESENTATION
At the moment, the keyboard is controlled by a large, cumbersome, circa late 80's computer. After "Genesis", which used "black box" MIDI-controlled digital synthesizers, Eaton felt constrained by the lack of variety and relative banality of inputs provided by the then current synthesizers for the incredible controls that the keyboards were sending out - it was like threshing wheat with a surgeon's scalpel! It is also very difficult to cart that much equipment around as an electronic troubadour. Fortunately, one powerbook today has the memory and computational power to do the job of several of those late 1980's computers and synthesizers.

We are doing this presentation today with the hope that we will initiate a dialogue with any or all of you on how we could connect one or more the keyboards to an up-to-date, portable computer, and what would be the best software to use on it. In particular, the current software for the old computer, which is

written in C and assembly language, presently needs to be ported over to, say, a Powerbook G4.

We would like to get your ideas for synthesis programs, and to increase the general awareness of this powerful keyboard,