Using the augmented trombone in "I will not kiss your f.ing flag"

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ABSTRACT
This paper deals with the first musical usage of an experimental system dedicated to the optical detection of the position of a trombone's slide.

Keywords
Augmented instrument, trombone, performer–computer interaction, chamber electronics.

1. MUSICAL MOTIVATION
When planning his work "I will not kiss your f.ing flag"[1], Marco Stroppa expressed his interest in realising a gestural interface adapted to the trombone for several reasons :

- to search for a more musical, intimate relationship between an acoustical instrument and a complex electronic environment than offered by conventional interfaces and techniques based on the detection of a signal sent through microphones (a MIDI trombone does not exist!)
- to trigger events and control electronic parameters also when the performer is not playing, only by moving the slide (instead of using a set of pedals)
- to use the position of the slide as a source of information for a score follower, in order to improve its reliability and allow for the detection of silent movements
- to eventually use data extracted from the gesture of the performer to control some global features of the electronics, such as the overall dynamics, or the rise time of transients

In addition, since the musician will stand in different places on the stage during the performance of the work, the system has to function wirelessly.

2. SENSOR FOR THE SLIDE
The current version of the device employed to sense the position of the trombone's slide consists of :

- a source of red laser light fixed on the moving part of the slide (figure 1)

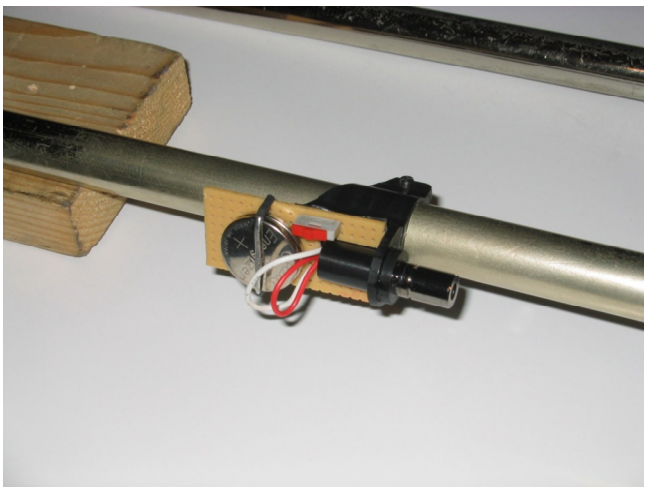

Figure 1. Laser source

- a receiver made up of two photo-electric diodes on the fixed part (figure 2)

The laser is powered by two lithium coin cell batteries and is supported by a snugly fit, hand-designed plastic ring. The diodes are fixed on an aluminium bar fastened to the trombone with a caoutchouc toric joint. They are connected to a Wise Box and send values to the computer every 5 milliseconds. The Wise Box, developed at IRCAM, is a multi-performer wireless sensor interface using WiFi and OSC [1].

The surface and intensity of the light spot received by the diodes varies as a function of the distance of the laser source (figure 3).

An accurate measurement of the position of the slide requires that the angle and focus of the laser be carefully adjusted.

[1] for augmented trombone and chamber electronics, commissioned by the Wittener Tage 2005, and premiered in Witten, Germany, on April 21st, 2005, with Benny Sluchin, trombone, Serge Lemouton, musical assistant and Jérémie Henrot, sound engineer.

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Figure 2. Diodes

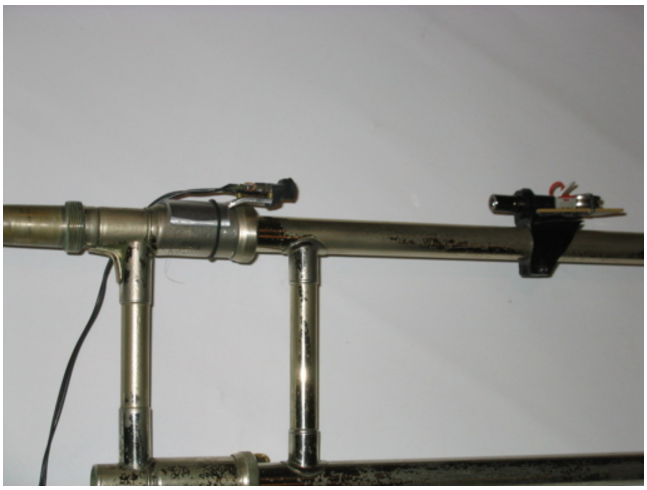

Figure 3. Slide with the position sensors

3. SYSTEM CALIBRATION

In order to map the values sent by the Wise Box to the positions of the slide, the system has to be calibrated[2]. We chose a scale of 7 values corresponding to the 7 positions of the Bb trombone[3] [3].

The calibration is done with a Max patch (figure 4) : while the performer plays a note for each position, the current value of the sensor will be tracked and a breakpoint function will be then generated for the conversion (figure 4 : on the x-axis the sensor's value, on the y-axis the scale of the positions).

This system allows for a precise, continuous detection of the positions of the slide with a reasonable spatial resolution.

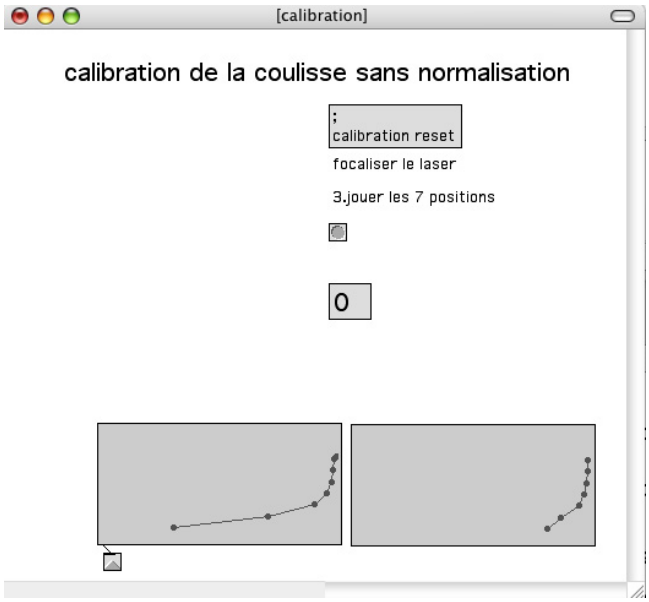

Figure 4. Calibration of the slide in Max

4. THE SLIDE AS A CONTINUOUS CONTROLLER

In several movements of "I will not kiss your f.ing flag", the position of the slide is used to continuously control some electro-acoustical parameters. For instance, in the second movement the length of the slide controls the centre frequency of two formantic filters acting on pre-recorded trombone sounds similar to those played by the performer at the same time. This is a kind of simulation of the wa-wa effect controlled by the slide (figure 5).

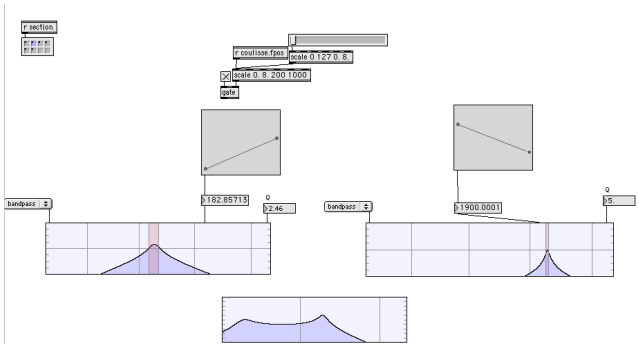

Figure 5. The slide controlling two filters

In the fifth movement, the slide is used to control the frequency of a frequency shifter, resulting into inharmonicity that corresponds to the frequency modulation

[2] at least each time it is turned on, often after some time as well, since the sensors can be sent slightly off position by the jerks of the instrument while playing

[3] cf. www.yeodoug.com/resources/faq/faq_text/slidechart.html

naturally produced by the musician singing into the instrument while playing (figure 6).

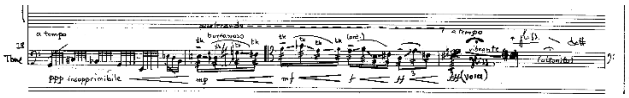

Figure 6. Excerpt of the trombone part, mov. 5

The fact that in the normal technique of the instrument the length of the slide is not necessarily correlated to pitch (longer slides can generate higher pitches than short slides, depending on which harmonics are selected) adds to the musical interest of this process, by avoiding too a stereotypical relationship between the position of the filters or the amount of modulation and the perceived result. Moreover, in the latter example, the amount of inharmonicity originating from the system depends on the relationship between the position of the slide and the pitch being played. Simple controls thus yield complex results. This is consistent with the nature of the music and the role of the electronics in this movement.

Looking for this kind of interaction between the controls of the electronics and the instrumental material has been one of the main compositional challenges the composer had to face.

5. POSITION FOLLOWING

The seven positions are approximately 10 cm away from each other. As a matter of fact, for the same musical interval, this distance is variable. A semitone in the first position is approx. 8 cm long; the size then augments progressively until the last position, where a semitone corresponds to approx. 11 cm.

We have tried to use this information when designing a score follower for the discrete positions of the slide. At first, Benny Sluchin "fingered" the score of the first movement, a very rhythmical music, with several controls triggered by a silent slide (figure 7).

A discrete position was detected as soon as the slide stopped its movement, using a simple threshold on the first derivative of the position.

Finally, after several tests, the score follower only based on the gesture of the performer proved to be not reliable enough for several reasons :

- The gesture of the trombonist's left hand is not so simple as one might imagine. The hand does not precisely stop on the position [2], but is often adjusted to that position.
- The wrist also plays an important role : supple and flexible, it acts as a spring to absorb the motion of the hand.
- Furthermore the position itself is slightly modified, in order precisely adjust the tuning of some notes of the harmonic series.
- The values given by the sensors, although very precise, are subject to too much fluctuation to generate the absolute values of the position of the slide for every circumstances.
- The high positions are especially difficult to track, since the receiver is farther away from the light source, and is too sensitive to changes of the ambient light and to small lateral displacements of the slide.

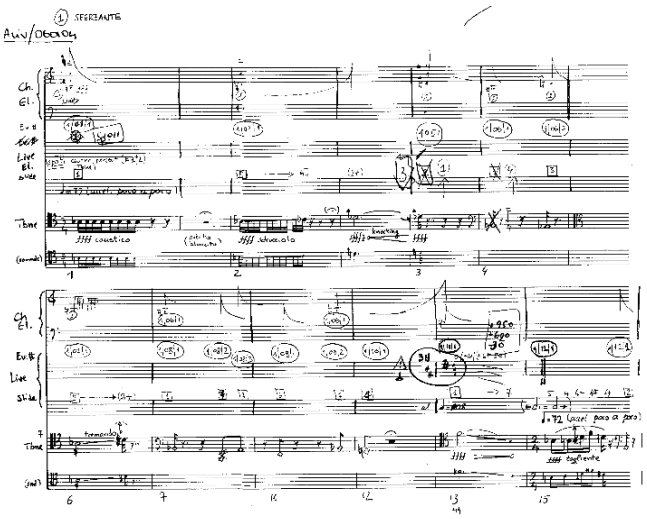

Figure 7. Beginning of the piece

Benny Sluchin suggested then to add a switch close to the mouthpiece, played with the left hand, to indicate the position changes (figure 8).

This switch makes the high rhythmic precision required in the first movement easier to perform.

Figure 8. Complete instrument with the switch

6. CONCLUSION

Given the lightness and simplicity of the prototype, the global results can be esteemed as satisfactory, both on a technical and a musical standpoint.

Several improvements to the current system could however be imagined, among them :

- The reliability of sensor itself might be improved, by either finding a better laser light, or imagining other sources.
- The algorithm to detect the positions ought to be made more precise and to use more data from research into the actual gesture of a performer's hand.
- The score follower should use as much information as possible to achieve a successful detection and not be limited only to the position of the slide.
- The whole system must function for a longer amount of time on a light battery before running out of energy.

7. ACKNOWLEDGMENTS

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8. REFERENCES

[1] The WiSe Box : a Multi-performer Wireless Sensor Interface using WiFi and OSC - Emmanuel Flety - in Proceeding of NIME 05, Vancouver, Canada, 2005

[2] Mark Kruger et al. : "Music Performance Physiology: Development of Expertise in a Natural Task: The Right Arm of Trombone Players" (http://music.utsa.edu/tdml/conf-III/III-Kruger-et.al./III-Kruger-et.al.html)

[3] Benny Sluchin, Contemporary Trombone Excerpts, A Practical Introduction to Contemporary Trombone Techniques, EME, Paris, 1995.