Gluisax: Bent Leather Band’s Augmented Saxophone Project

Stuart Favilla  
Bent Leather Band  
SonicFrontiersCTME  
Victoria University  
+61 397301026  
sfavilla@bigpond.com

Joanne Cannon  
Bent Leather Band  
SonicFrontiersCTME  
Victoria University  
+61 397301026  
joanne_cannon@bigpond.com

Tony Hicks  
Musician/Saxophonist  
Improvisation Department  
Victorian College of the Arts  
+61 394597936  
hixt@optusnet.com.au

Dale Chant  
Musician/Saxophonist  
Software Developer  
red centre software  
+61 394597936  
dale@redcentresoftware.com

Paris Favilla  
Musician/Saxophonist  
Improvisation Department  
Victorian College of the Arts

ABSTRACT
This demonstration presents three new augmented and meta saxophone interface/instruments, built by the Bent Leather Band. The instruments are designed for virtuosic live performance and make use of Sukandar Kartadinata’s Gluion [OSC] interfaces. The project rationale and research outcomes for the first twelve months is discussed. Instruments/interfaces described include the Gluisop, Glualto and Leathersop.

Keywords
Augmented saxophone, Gluion, OSC, virtuosic performance systems

1. INTRODUCTION
The Bent Leather Band is currently undertaking its Sonic Frontiers residency at Victoria University’s Centre for Telecommunications and Microelectronics [Melbourne]. The ensemble was formed to develop new instruments and new music for the virtuosic live performance. So far, the project has developed a number of unique and versatile instruments including light-harps and electronic leather bassoons. The project has been developing over a long term [15 years] and research has been undertaken concurrently with artistic activities including; concerts, exhibitions and recordings. Research projects have investigated a number of areas including; musical languages [Free music, Indian music gamaka, micro-tonality and multi-phonics], interface design, live signal processing, performance techniques, virtuosity, feedback systems and skilled performance.

The project has sought to develop mature instruments from working prototypes, playable instruments. We define playable instruments as expressive, responsive, versatile and practicable: suitable for technical and musical development. The project has also aimed to develop instruments that are intuitive, inspiring and capable of demonstrating their own sound and personality. Additionally the project has focused on live improvisation and since the Paris NIME, has been joined by a number of new musicians in order to develop new interfaces or extend their own acoustic instruments with sensors, sound interfaces and software. The project has been working with gluion streaming interfaces [5], with the idea of forming a large ensemble of networked playable instruments. This demonstration presents work undertaken with three saxophone players, Tony Hicks, Dale Chant and Paris Favilla, to develop extended saxophones for this larger ensemble. Other musicians have contributed also, including Derek Pascoe from the University of Adelaide.

2. BACKGROUND
When embarking on this project, we were conscious that the saxophone has had quite a history of modification and use in electronics. After all, it was Daniel Kientzy’s Computersax [6] work in the late 1980’s early 1990’s, that served as an initial inspiration for us to head into signal processing. Braxton and Rosenboom’s live interactive CD was a favorite for a while and even local Melbourne musicians such as Brian Brown were experimenting with leather saxophones and effects machines. Digital controllers by Yamaha, the EWIs, and Syntaphones all belong to a MIDI generation and together, with many other experimental interfaces are well beyond the scope of this demo for critical review.

Meta, augmented and hybrid instruments, there are so many now. Strings, percussion and brass instruments are well represented here, but the saxophone perhaps not enough. Even Sukandar’s gluions have featured on at least three meta/Mehta trumpet[s] [Axel Dörner, Jonathan Impett and Rhajees Mehta] and there are a number of trombone projects such as Nic Collins, and LeMouton [7]. The work of Matthew Burtner and his Metasax would be the best-known augmented sax controller in recent times.

His approach of placing sensors over existing saxophone keys to affect expression while playing long notes, brings into sharp focus the issues of redundancy of saxophone technique
and interface. Burtner’s musical landscape takes the saxophone well outside the instrument’s traditional jazz and repertoire boundaries into a space that redefines timbre. Burtner explains his approach as a modification of the keys, siting force-sensitive resistors under the finger-tips to affect “after-touch”. He writes; “…In essence, the saxophone keys which normally execute only on/off changes of the air column, are converted to continuous control levers…”[1].

The saxophone is amongst a number of highly specialized traditional instruments bristling with key-work. Instruments that keep your fingers busy while you hold onto it as best you can. It is arguable that this co-dependency of the Meta-sax’s traditional acoustic and electronic sensor interfaces has transformed the instrument’s nature entirely. To progress this idea further, an after-touch saxophone may not even need any keys. Instead it could perhaps be better served bristling with sensors; which is how the third of our bassoons contra-monster was conceived. Sensors were placed under the first three [strong] fingers for both hands with joysticks situated for the thumbs. The instrument is capable of ten channels of simultaneous control. However, the contra-monster was constructed via a number of prototypes and also to perform a specialized signal processing based musical language.

Schiesser and Traube’s saxophone project [8] offers a more practical solution regarding this issue. Their augmented saxophone’s electronic sensors were situated for simultaneous and independent actuation alongside the traditional saxophone key work, allowing the musician to still play conventionally and yet execute independent sensor control. Their USB interface instrument was limited to only six 10-bit analogue controllers [force sensitive resistors or FSRs, inclinometers and ultrasound proximity] and some buttons. Nevertheless it demonstrates some practical features including a control panel mounted on the right hand side of the bell.

Some other points worth mentioning here are that larger acoustic instruments usually require bigger hand stretches and that there are other places for sensors to go on the saxophone if the instrument is supported well and the thumbs are free to move.

Perhaps there is a way to augment the saxophone without any redundancy of technique, interface etc? Can the acoustic and electronic interfaces be independent of each other and also be effective? What about bending notes and other techniques that are not so on/off? Finally, what about a leather saxophone i.e. a sensor only instrument? These questions formed the basic parameters for our project and we decided to make a number of playable OSC saxophones in collaboration with the musicians.

3. GLUISOP

Amongst the saxophonists involved in the project, there remained a strong interest in developing a small, portable extended saxophone. Touring and air freight issues were the main consideration here. But also smaller instruments, well supported by neck-stands, allow for the weight of the instrument to be taken off the thumbs, potentially freeing them to play sensor controls. For these reasons we chose a bent soprano as our first instrument to work with and in collaboration with the saxophonists developed a sensor interface consisting of two panels.

The first panel mounted a number of dials, switches and FSRs and was situated on the right hand side of the saxophone’s bell.

![Figure 1. Gluisop](image1.png)

The second panel, which was much smaller, mounted a joystick, two dials and one small FSR for the left hand. The instrument was completed with an extra FSR at the lower right-hand thumb-rest.

![Figure 2. Gluisop left-hand panel](image2.png)

Two microphones were used to pick up the instruments sound, one clipped on to the bell and another one over the key-work.
to pick up key clacks and other techniques. The microphone
signal was digitized by a Digidesign 002 audio interface.

The sensors were digitized using a gluion sneaker interface
with sensors cabled [soldered] onto pins, allowing them to be
connected directly into the interface housings high density
SUB-D connector. Analogue sensors are sampled at 16bit
resolution and OSC data streamed directly into MaxMSP with
up to a 1 msec refresh rates. With the instrument supported by
a neck-strap the musicians could play the saxophone’s key-
work unrestricted and still have at their disposal up to four
independent channels of simultaneous sensor control. Situating a joystick at the lower thumb rest extended this
further to five.

Dials of various sizes and types were used on the instrument
for specific purposes. For the transposition of pitch, or delay-
time [fine control] a large dial capable of small, well-
controlled movements was situated on the right-side panel.
Roller dials have been positioned for thumbs, while FSRs have
been nested for the small “pinky” finger to control feedback of
delays and comb filters. The gluion is directly connected to
the computer using a standard Ethernet network cable.

3.1 Glualto & Leathersop
Two other saxophones were also constructed for the project. The
Glualto was constructed in conjunction with Dale Chant
and was interfaced to a 16bit Gluion Slipper interface. This
interface stacked another joystick on the left hand panel and
added two extra FSRs.

Finally the Leathersop [leather soprano sax], was developed as
a new instrument for the bent leather collection but also as a
total sensor saxophone. Similar to the Contramonster, [3] this
instrument has no open tone holes and places sensors instead
onto the closed tube. This instrument has eight FSRs and two
joysticks for the hands to play allowing for up to 12
simultaneous channels of sensor control. The Leathersop also
has a number of dials and switch based controllers and can be
used with either a continuous foot-pedal or active
electromagnetic proximity sensor [expressive radius of up to
two meters]. Leathersop’s Gluion electronics make use of
Sukandar’s new smaller circuit board and are built in to the
instrument’s body.

4. MAPPING AND PERFORMANCE
TRIALS
The saxophones’ preliminary mappings have been based on
the bent leather band’s contra-monster work and developed by
Joanne Cannon. This software patch developed in Max MSP
brings together a granular pitch shifter, a smooth pitch
delay/echo, a modulation delay patch, two transposable buffer
delays [for multi-part playing and comb filtering], and finally
a reverb. Each effect is sequenced in their previous mentioned
order with one control knob reserved for a wet/dry and global
level for stage control etc.

The smooth pitch delay/echo has a nonlinear mapping
exploding the range as the delay time approaches zero [for fine
pitch control] whereas at the other end of the delay time the
range is confined discretely to control the buffer size for
rhythmic looping and re-sampling. The two transposable
buffer delays have a pitch range of over eight octaves. The
mapping was developed as an expressive, intuitive solution
for a number of joysticks, wheels and FSRs.

At this stage of the project the majority of trial performance
work has been done with the Gluisop instrument, [consisting
of regular rehearsals over a six-month period. During this time,
the instrument was secured to an adjustable stand taking all of
the weight off the hands. Another dial controller was added to
the left-hand panel just above the joystick. The FSR on this
panel was repositioned between the underside of the panel and
the left-hand upper thumb rest of the instrument so that any
downward pressure applied to the dials or joystick of this
panel could be transferred independently as another channel
for control.

These modifications and the inclusion of the stand, made the
instrument much easier to play. Although some sensor
controllers such as those situated on the lower panel, still
require the right hand to come off the instrument’s key-work.
Although, the sensors and saxophone keys remain
independent and the instrument is capable of the full gamut of
saxophone technique in performance with four simultaneous
channels of sensor control.

![Figure 3 and 4. Tony Hicks and Gluisop](image)

Furthermore, all saxophonists involved in the project found
that the instrument could be picked up and played without a
The detailed knowledge of the signal processing techniques involved. Once the mapping was set up the instrument was intuitive to the player. New sounds and techniques have been discovered in each of the following sessions also and the development of advanced techniques continues. The mapping and sonic outcomes are also compatible with the Bent Leather Band’s existing ensemble language so the Gluialto has been brought into the group.

This instrument, although not capable of as many simultaneous channels of control as the Leathersop; introduces the main ideas of signal processing expression such as, delay time [dial] and feedback [FSR or pressure] control, the use of two dimensional joystick controllers and global parameter settings and controls. Therefore it also serves as a training instrument for the more advanced Leathersop sensor interface as well as an instrument in its own right.

The project team has also presented the instrument at the University of Adelaide where experimental saxophonist Derek Pascoe and composer Luke Harrald have been working on live multi-agent performance systems for saxophone. Luke has expressed an interest in writing for the ensemble and it is anticipated that the new instrument projects will be completed in 2008. New mappings and signal processing techniques including tuning systems and spatial projection control will also be trialed.

6. REFERENCES

5. NEXT STEPS
The next stage of the project involves building the ensemble up and networking interfaces to a single computer. The Bent Leather Band project “Heretics Brew” aims to develop an ensemble of experimental instruments/interfaces for brass, saxophones, woodwinds and guitar families. The project is building momentum and in the process of staging public performances and recording with Tony Hicks, Dale Chant, Paris Favilla and Melbourne experimental improviser and guitarist Ren Walters.