

MAX/MSP:

A Software Tool for Percussionists

By J.B. Smith

MAX/MSP is a popular software package used by a variety of artists and technologists including composers and performers. It allows users to create, control, and interact with practically anything that can be represented as a digital signal. Max is a true cross-platform system compatible with both Mac OS-X and Windows XP/Vista. Examples of simple uses include:

- Sound file and sample playback
- MIDI instrument control
- Audio signal processing
- Basic interaction with digital media

More complex functions are also possible, such as:

- Core system control of a multi-media production (MAX/MSP can control audio, video, lighting, pyrotechnics, etc.)
- Complex computation and processing of any type of analog or digital signal
- Real-time composition or improvisation
- Multi-camera movement sensing

For those new to the software, screen shots will appear imposing. Initially, the best way to understand the program is to relate it to analog synthesizer operations. With a modular synthesizer, one module connects to another using a cable. In MAX, virtual cables connect objects on the screen, each object with its own

function. An object representing the internal microphone, for instance, could be connected to another object representing a recorder.

I've been using the software package MAX and MAX/MSP for over 10 years in numerous performance situations. Most of my applications that use MAX are simple, though some tax even the fastest processors and hard drives available in today's computers. My motives are simple: MAX offers a high degree of performance control and high level of audio quality.

Following are selected MAX functions and example works in which MAX performs a central role.

SOUND FILE PLAYBACK

A basic, yet powerful, use of MAX is as a sound file player. A user may create a patch that allows one to start audio playback at the push of a button or pedal. The simplest situation would be for the performer to start an electronic accompaniment from an on-stage position. Additionally, the performer can trigger multiple files that are used in a piece. I used MAX in this way for the following pieces:

Glenn Hackbarth's "Points in the Sky" for clarinet, percussion, and computer was originally written for a set of triggers mounted onto several percussion instruments. MAX would "track" the percussionist's performance and

trigger a series of MIDI sequences at appropriate points in the score. In place of the MIDI files, synthesizer, and triggers I programmed a MAX/MSP version that allows the percussionist to "conduct" the electronic part using a foot pedal. Subsequently, I used a similar system to perform a number of other works:

- Gary Kulesha: "Angels" for marimba and electronics;
- Phil Winsor: "Dulcimer Dream" for marimba, vibraphone, and tape;
- Ed Miller: "Going Home" for clarinet, vibraphone, and computer;
- J.B. Smith: "In Light of Three" for clarinet and percussion;
- Akira Ifukube: "Lauda Concertante" for marimba and orchestra;
- Geoff Holbrook: "Wooden Stars" for multiple percussion and computer.

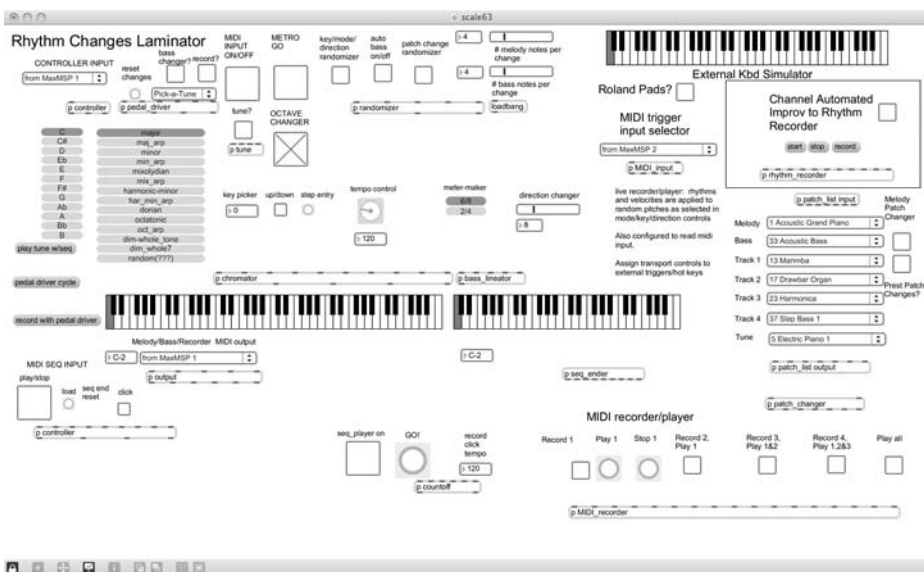
A similar approach is used in Tristan Murail's "Lesprit des dunes" for chamber ensemble. A keyboardist conducts the electronic part using a MIDI keyboard. Each key on the instrument is assigned to a sound file. Pressing C-sharp starts one file, D another, etc.

Many works require the use of a click track. There are many pieces that take advantage of the two tracks that are available on an audio CD. One track contains the accompanying audio file; the other has a synchronized click/cue track run only to the performer's headphones. Unfortunately, the audio quality of the accompaniment is limited since it is a mono signal instead of the fuller-sounding stereo signal. MAX/MSP, with an audio interface, can generate a stereo signal through two of the interface's outputs and direct a click/cue track to a third output for the headphones. If no interactivity is required, any multi-track audio software could be used as well. I use simple three-track player patches for pieces such as Ed Campion's "Losing Touch" for vibraphone and computer-generated tape, Daniel Lentz's "Apparitions of JB," and my piece for tuba and computer, "Die Tubageister."

VISUAL DISPLAY

Another simple use of MAX is to display a counter while a sound file is playing so that sync points are accurately executed. Two different approaches are used in the following pieces.

Scott Wyatt's "Time Mark" is written for



MAX/MSP computer-assisted improvisation patch.

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multiple percussion and tape. In two spots, sync points do not have preparatory cues. For both, I have a display that counts down five to zero. Instead of guessing (praying) where the entrance will be, the display allows for easy synchronization. In Eric Richard's "finalbells" for tuned cowbells and prerecorded audio, MAX was programmed to display a large digital clock on the computer screen. In addition, the computer displays the score to the music and "turns" pages as the piece progresses with scans of each page of music opened automatically by the software. In total, MAX plays the accompanying audio file, displays the music for the performer, and provides a clock image to keep everything synchronized.

MAX can also help with performance execution issues. In Daniel Lentz's "The Apparitions of JB" for MalletKAT and electronics, MAX is used to step through multiple synthesizer patch changes with the use of a foot pedal. In his "Temple of Lament" for soprano, MIDI keyboard, and electronic percussion, I shamelessly used MAX to step through the pitches in an interlude that I was having difficulty performing. Using a single pad, I played the rhythm while MAX added the pitch number to the MIDI signal.

AUDIO PROCESSING

Compositions written for performer(s) and live electronics are necessarily complicated by the need for specialized equipment to realize the piece. More so now than ever, however, the necessary gear is often sitting in a typical musician's studio. Several works require only a laptop with the audio output run through a sound system. Kaija Saariaho's "Six Japanese Gardens" for solo percussion and electronics and Marita Bolle's "What Exit?" for chamber

ensemble could be performed in such a way. A free player version (MAX/MSP Runtime) is available from the manufacturer's Website (Cycling74.com). With the player and the composer's patch on disk, nothing else is required but a computer and audio cable.

If, on the other hand, processing of acoustic audio signals is required, a critical piece of equipment is needed: an audio interface. Numerous models are available that utilize Firewire technology to easily and efficiently transfer audio signals to and from the computer. Models such as MOTU's 828 and 896 and Digidesign's DIGI01 and DIGI02 are popular, but numerous companies are making comparable products at various price levels. With the unit's software driver program loaded onto your machine, a double-click and single selection is usually all that is required to make your system compatible with a MAX patch. With the ability to input a high-quality audio signal into your computer system, a number of possibilities arise.

For the improvised fourth movement of Michael Daugherty's "UFO" for solo percussionist and wind band I used a MAX/MSP patch to process the amplified sounds of a rack construction consisting of numerous metal and skin instruments. Pickups were attached to many of the instruments that allowed even the smallest sounds to be fed into the system. With the click of a pedal my performance was sampled and modified using a series of grain synthesizers that were integrated into the program.

I've also written a patch to replace the digital delay unit required in Nigel Westlake's "Fabian Theory" for marimba, toms, and delay. MAX/MSP creates the echo effect that runs throughout and plays back a pre-recorded marimba

First page of Eric Richard's "finalbells" for tuned cowbells and pre-recorded sounds.

loop in the middle of the piece. Originally the performer would have pressed a pedal to start the loop record and released it to start the loop playback. To ensure an accurate sample length and to avoid any problems on the loop repeats (clicks and pops are common), I recorded the part in advance and edited the wavetable to ensure that the repeat was smooth.

AUDIO RECORDING AND PLAYBACK

I've performed a number of works by composer Daniel Lentz. He's an ingenious writer who made the multi-track tape recorder a central component in a number of his early works. In "b.e. comings," for instance, a chamber ensemble performs each pass of an eight-channel piece live. The accumulative layering effect matches the dramatic nature of the work's text. The same approach is used in his "Can't See the Forest...music" for speaker, wine glass, and

multi-track recorder from 1971 and "Bacchus Codices No. 3" from 2007. For a recent performance, I offered to write a MAX program that would duplicate the process without the need for an assistant or for the requisite delay while a tape rewind or an operator reconfigured the recorder. With the use of an interface, the acoustic signal of the performer can be fed into the MAX system. In the end, MAX provides a click track, records and plays back each pass and, in my version, has automated panning that spreads the voice and wine glass pitches around the space.

THE IMPROVISING COMPUTER

With MAX, the performer can utilize more involved processing, as well. In Todd Winkler's "Stomping the Ground" for MIDI percussion and synthesizer, the computer actually improvises along with the performer in

the second movement. The computer "listens" to the performer and then, when triggered, uses the performer's rhythm to construct its own melodies.

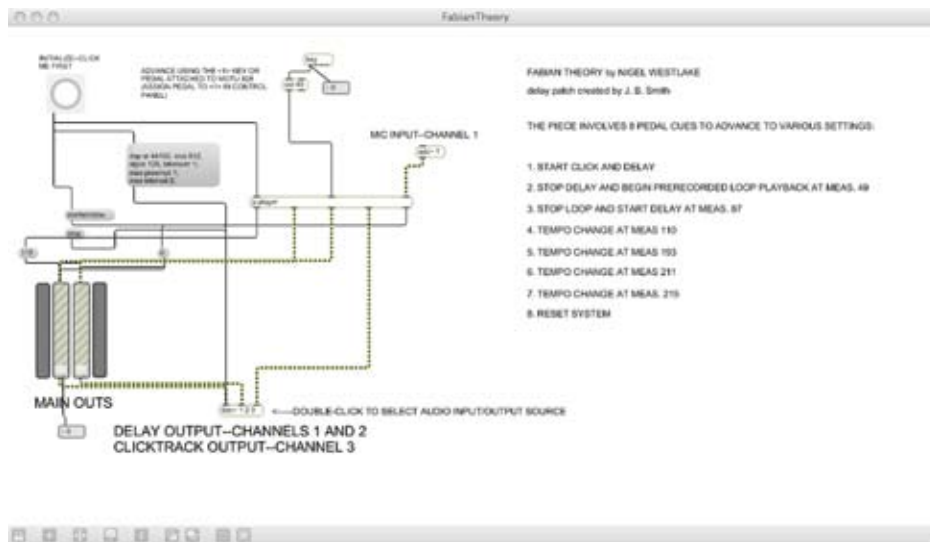
In an installation piece I developed named "Convolution Canopy," the MAX patch randomly chooses from a library of sound files and combines them into merged audio signals. Ambient audio recorded on a city bus, for instance, was combined with the cacophony of a working metal shop.

In a new piece being developed with jazz pianist Michael Kocour, a player on an electronic drumset will dictate the rhythmic material while the software generates pitches. The program has been designed to choose notes from appropriate modes and chord sets that will be configured in advance. The drummer will play idiomatic rhythmic figures while the computer designs the melodic contour. The net result could be described as computer-assisted improvisation.

PEDAGOGY

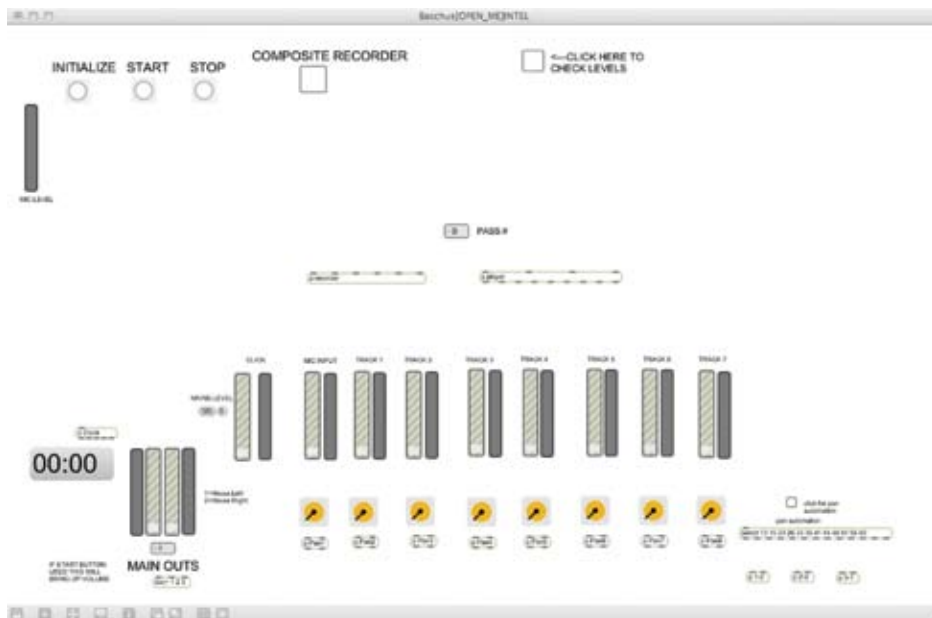
Pitch Tracker is a computer program and hardware package I designed to assist music students with pitch and rhythm skill development. To evaluate a student's pitch abilities, the program "listens" to a performance of one of many available exercises and offers quantitative feedback. Designed for use by percussion students, the original system consisted of a set of electronic drum pads, a MIDI-equipped vibraphone, a MIDI interface, and a Macintosh computer. Subsequently, as the software evolved, I've been able to create a version of the patch that can listen to acoustic instruments.

Every musician strives to eliminate wrong notes, poor rhythm and dynamic inaccuracy from his/her performances. *Pitch Tracker* offers a means to focus on those issues. Pitch skills are tested using a keyboard percussion instru-



Delay and loop playback for Nigel Westlake's "Fabian Theory" for marimba, toms, and digital delay.

The advertisement features the vanderPlas logo and website address (www.vanderPlas-perc.nl) in the top left. In the center, a quote reads "I've made my choice." attributed to JOE LOCKE. The background shows a marimba with mallets resting on it. On the right side, there is a portrait of Joe Locke, a man in a dark suit and white shirt, looking towards the camera.



Live multi-tracking patch for Daniel Lentz's "Bacchus Codices #3" for speaker, wine glass, and multi-track recorder.

ment that is fed into a computer. The program tracks pitch accuracy. Similarly, a student's rhythm skills can be tested using an electronic drum pad. Evaluated in milliseconds, rhythmic placement is charted by use of a graphic interface. Students who play ahead or behind the beat can see precisely where their rhythmic tendencies lie. Velocity execution is tracked and displayed using a graphing feature.

Upon opening the program, musical examples are displayed. When the user clicks on a "Record" button a metronome click is heard and the recording process begins. Upon completion a screen is displayed that shows three graphs, individually indicating pitch accuracy, rhythm accuracy, and volume performance. The results can then be stored in a data file.

A simpler version, *Flashworks*, doesn't have the evaluative functions but provides the music-display features described above without the need for specialized equipment.

CONCLUSION

MAX/MSP made available to me a world of audio processes and performance controls. Learning to use the software was a long-term process, but in doing so I discovered numerous ways to apply the program to my performance, composition, and teaching.

For those interested in seeing/hearing representative works written with MAX/MSP, samples can be accessed on the manufacturer's Website: Cycling74.com

Dr. J.B. Smith is Professor of Music and the Coordinator of Percussion Studies in the School of Music at Arizona State University. He is internationally recognized as a performer, composer, educator, and conductor. He is

director of the ASU Contemporary Percussion Ensemble that was featured at PASICs 1991, 2002, and 2006. His CDs *Apparitions for Percussion*, *First Reflections*, and *At the Desert's Edge* are available from Amazon.com. He has written articles for *The Instrumentalist*, *The Canadian Band Journal*, and *Percussive Notes* and served as president of the Arizona PAS chapter. In 1995, he hosted PASIC in Phoenix. Smith is active as a composer, with numerous works published by C. Alan Publications. PN

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