Percussion Instruments of the Mind

By Scott Deal

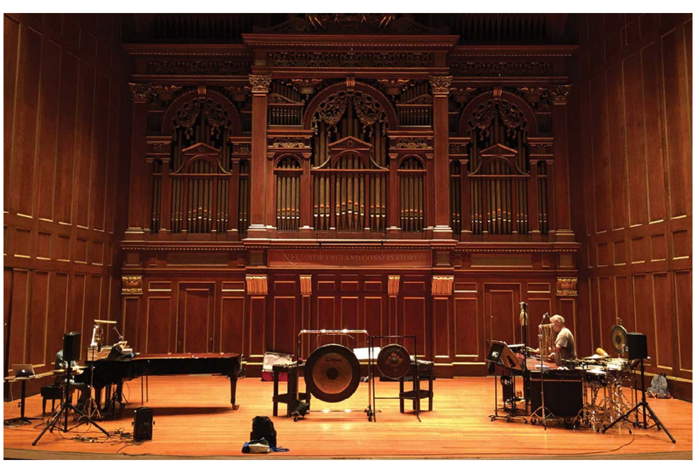
Consider what it was like to be a musician 100 or so years ago, when so many ideas grew into things that changed humanity: the lightbulb, radio, car, airplane (what an amazing thing that must have been to see in those first years). Also, the new noise of the era: cities, traffic, machinery, electricity. It makes sense that un-pitched sound became the new territory for artists. There was a spirit of adventure in the air, and people began looking for new and different ways to express themselves.

In 1916, Edgar Varèse famously dreamt "of instruments obedient to my thought" (Hansen). An interesting exercise is to think about him imagining various sounds, and then listen to his chamber work "Déserts" (1950–54) for winds, percussionists, piano, and electronic tape, or his landmark electronic tape "Poème électronique" (1958). I wonder if, could he experience performances today, he would think his fantastical instruments had been created. Impossible to know, but what's important is the idea itself: an instrument of the mind, obedient to thought, extending outward from the mind.

We also live in a time where there is a spirit of adventure in music, the scope of which is somewhat breathtaking. Electroacoustic percussive tools are different from years past, but big ideas remain. Composers have often enjoyed the chance to precisely re-create what they've borne in the studio, and so fixed media is a big idea. It has also been great fun to place a microphone on an object and then hit it, releasing a transmogrification of sounds. As a result, live electronic processing is more popular than ever as an expressive medium. Finally, people love creating music with computers, and so algorithms, sensors, and hyper-instruments have become powerful tools for the tech-oriented percussionist.

FIXED MEDIA

Some view fixed media as the old-fashioned way to create electroacoustic music, but it has great strengths as a genre. Additionally, it has been a primary vehicle for electronics and live players since the experimental music efforts of post-World War II. Tape pieces evolved because the methods and equipment used to create electronics were so bulky and expensive that their use on the stage was impractical. As a result, techniques to capture sounds on reel-to-reel tape became a prime factor in the compositional process. Some well-known works in the pioneering days of electro-acoustic percussion music include "Synchronisms No. 5" (1969) for percussion quintet by Mario Davidovsky, and "Machine Music" (1964) for piano, percussion, and tape by Lejaren Hiller, in which the tape part was created with the aid of computational processes.



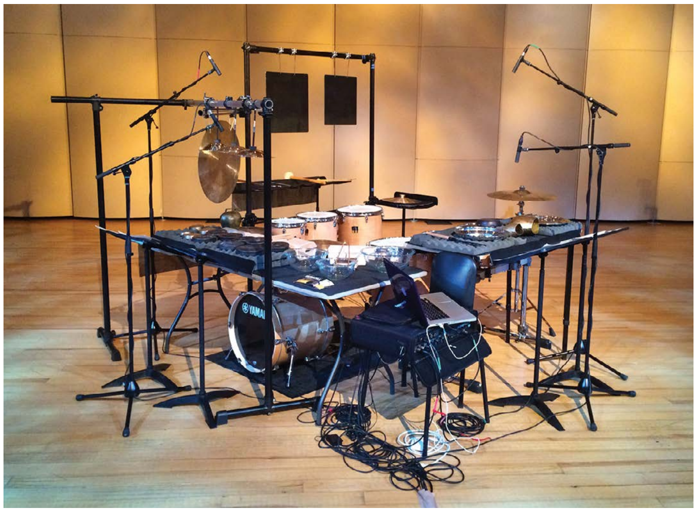
Percussionist Stuart Gerber and pianist Stephen Drury in rehearsal for Karlheinz Stockhausen's "Kontakte" (1961), for piano, percussion, and electronic sounds.

Currently, most musicians working with electronics have taken the genre higher by using Digital Audio Workstations (DAWs) and smaller, more specialized applications referred to as patches. Patches are often created specifically for just one piece of music, or to initiate a specific set of actions. They are designed and created in programming environments such as Max MSP, Pure Data (PD), and Supercollider. These formats have made using fixed media much more flexible than simply starting a tape and running it to the end. For example, in Kaija Saariaho's "Six Japanese Gardens" (1994), the percussion soloist uses a foot pedal to scroll through stages of a Max patch that triggers audio files. The solo demonstrates another aspect of newer fixed-media pieces, in that the patch also does some real-time audio processing, through the activation of reverb processing. Stockhausen's "Nasenflugeltanz" (1990), for percussion with electronics, has a degree of planned flexibility that provides the performer with a range of options, including the personal selection of samples to play to at various points in the piece (S. Gerber, personal communication, September 2017). Time marches on, sounds come and go, but fixed media works preserve the composer's original sound. Consider, for example, Stockhausen's "Kontakte" (1961), for piano, percussion, and electronic sounds, regarded by some as one of the great percussion chamber pieces of the 20th Century. The techniques Stockhausen used to realize the electronic tape have been largely computerized, and the original machines he harnessed would be difficult to obtain today. Yet each time the piece is performed, we experience the original sound of the vintage filters, oscillators, recorders, and other devices. The audio is entirely fresh and original—a perfect match to the piano and percussion array.

Martin Wesley Smith's solo "For Marimba and Tape" (1983) provides another opportunity to hear first-hand the craftsmanship of past instruments. The program note from the score reads as follows: "The tape part of this piece was produced in the Electric Music Studio of the New South Wales State Conservatorium of Music in Sydney, Australia, using a Fairlight CMI (Computer Music Instrument), a machine designed, developed, and built in Sydney. The music was typed into the computer, which then played it back in real time using both electronic and sampled sounds."

In writing these notes, Wesley Smith obviously considered the process of creating the electronic sounds to be important knowledge for the audience. The notes present the listener with a window into the past work that occurred in Sydney, and they can experience the Fairlight CMI. This is quite similar to the aesthetic of period instrument ensembles, re-creating the original sound from past eras, except in this case it is only 37 years.

Another style is that of pure electronics sounding along with acoustics, such as Tristan Perich's "Observations" (2008) for two sets of crotales and six-channel, 1-bit music, which I heard performed by Mark Cook and Kyle Maxwell-Doherty at the PASIC 2014 Technology Day. The six channels are sounded through six speaker cones suspended in proximity of the two percussionists. The electronic textures, combined with crotales, builds an impressive sonic environment. Computer-processed sounds and samples also are used as material to shape fixed



Percussion setup for "The Rush of the Brook Stills the Mind" (2013) for percussion and interactive electroacoustics, by Elainie Lillios.

media, as seen in John Luther Adams' "The Mathematics of Resonant Bodies" (2003), where the fixed part is derived from the sounds of each movement's solo instrument (drums, triangles, tam-tam, siren, and cymbals), causing one to wonder where the acoustics end and the electronics begin.

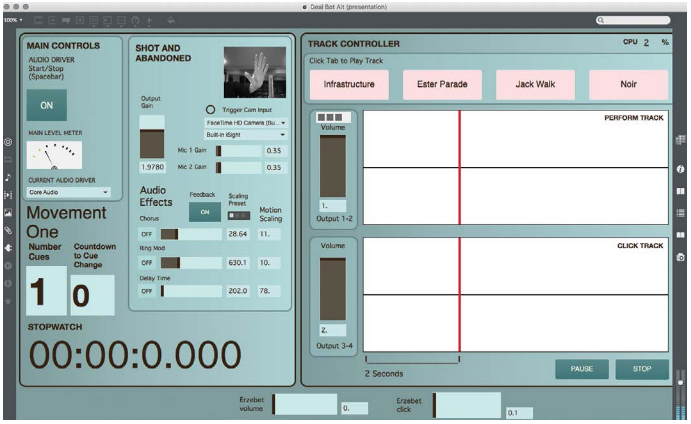
LIVE ELECTROACOUSTIC PROCESSING

Live processing exponentially increases the spectrum of aural properties, providing many paths to explore. For example, a cowbell, once processed, takes on a rainbow of characteristics that still have the original properties. Live processing necessitates the use of microphones to capture acoustic sounds, which are processed in real time and then output back into the sound space. Prior to the advent of fast computers in the 1990s, the only way to perform with live processing was to have electronic outboard gear, most of which was quite expensive. An early, classic example of live processing is Stockhausen's "Mikrophonie I" (1964), for tam-tam, two microphones, two filters, and controllers. Once CPU speed became fast enough, artists using laptops could perform the same functions, and live processing, coding, sonification, and a number of other genres proliferated throughout the experimental and improvisational community.

I suggest that improvisation is successful with live processing because of the high degree of variability that comes when a computer is played as a musical instrument. Improvisation empowers spontaneity and variability, which is essential when engaging the digital flow. While improvisation is a big part of live electroacoustics, there are also many composed works for percussion and electroacoustics.

Cort Lippe's "Music for Hi-Hat & Computer" (1998) is a good example of a piece in which a performance on a miked hi-hat is processed via a Max patch. This work was presented at PASICs 2001 and 2005. Another work that was featured at PASIC 2005 is Alvin Lucier's "Music for Snare Drum, Pure Wave Oscillator, and One or More Reflective Surfaces" (1990), from *The Noble Snare, vol. 3*, performed by percussionist Jan Williams. The performer spoke into the miked snare drum, whose sounds were then processed electronically.

Elainie Lillios' work "The Rush of the Brook Stills the Mind" (2013) for multi-percussion and live, interactive electroacoustics, is a good example of a piece that harnesses some improvisation with specific notation, and combines interactive electroacoustics with carefully placed fixed audio elements. The performer uses a USB foot pedal to scroll through various processing stages for the 14-minute work. Another work that employs multiple electronic pathways is Matthew Burtner's "Six Ecoacoustic Quintets" (2009) for percussion quintet and electronics, an epic 33-minute work. The percussion ensemble performs a strictly notated score in combination with fixed audio, live electronics, and optional media as well (M. Burtner, personal communication, September 2017).



View of the Max Patch used for Jordan Munson's "Shot and Abandoned" (2009) with embedded motion tracking.

View of the control panel for "apex altissimo" (2014), by Nathaniel Bartlett

DATA

Since the advent of computers, people have strived to make them create music. The first fully-functioning computer, the Z1, was built in 1938 in Germany (Computing). In 1950, British scientist Alan Turing proposed the Turing Test, a theoretical process to determine if a computer could think like a human (Britannica). In 1951, Australian programmers were the first to make music with a computer (Dean, 2009). David Cope's *Experiments in Musical Intelligence,* begun in 1996, harnessed machine learning algorithms to analyze a composer's works, such as Mozart or Bach, then composed original movements in the same style (ibid, 2009). George Lewis' *Voyager* software application analyzes musical performance, then generates improvisations (Lewis, 2000). Triple Point, a trio led by Pauline Oliveros, was a computer-acoustic group that used a real-time algorithmic improvising partner. Interestingly, but not surprisingly, machine processes themselves, at times without a machine, found their way into compositional techniques, as seen in the work of Iannis Xenakis, Herbert Brün, and Laurie Spiegel, as well that of spectral, stochastic, and algorithmic composers, to name a few.

Computational processes brought the rise of the algorithmic hyper-instrument, capable of sensing, categorizing, learning, and reacting to a live performer. They also bring additional musical content to a performance. Currently, there are a broad range of fascinating tools, including motion capture, score tracking, brain-wave sensing, artificial intelligence, networked music, and more. Some of these higher-order applications are broadly available at a low price. For example, Max MSP contains random generators, machine-learning algorithms, motion capture applications, and more, all designed to create spontaneous new content.

A good example in this genre is the percussion, media, and electronics piece "Shot and Abandoned" (2009) by Jordan Munson. This piece employs a motion-tracking application inside a Max patch that follows hand movements as instruments are sounded. The movement of the hands activate audio processing units such as delay, chorus, and modulation, giving the piece a very natural electronic aura that is directly connected to the movement of the performer.

Another piece in this category is one of my own compositions, "Goldstream Variations" (2012). Scored for one to seven musicians in open instrumentation, it was designed to be flexible enough to accommodate technological experiments in telematics and to employ machine-learning (ML) playback. Using software designed by Benjamin D. Smith, a vibraphonist performs a notated part that is listened to by the computer, which then compares it with pre-loaded MIDI examples of the same music that it has previously analyzed. It then improvises in tandem with the performer.

Sensing devices can be used to capture anything in the spectrum of sounds from infra-sound, through the human hearing range, and into ultra-sound. Additionally, armed with the right kind of sensors, one can capture motion, brain waves, temperature, and other physical phenomena. Percussionist-composer Nathaniel Bartlett developed an interface using multiple Microsoft Kinect devices (3D cameras) that turn the space above and below the performer's marimba into "active" zones where they can control computer processes with mallets and body. For example, in works such as "timeSpacePlace" (2013) and "apex altissimo" (2014), the system tracks all four mallets independently, resulting in a polyphonic theremin-type instrument. For these pieces, Bartlett also created a virtual "touch" surface below the marimba allowing the feet to control four two-dimensional (X, Y) computer processes. (N. Bartlett, personal communication, September 2017).

The challenge of computer-acoustic music is to obtain the specialized elements necessary for a particular work or performance. This often requires obtaining sensors, cameras, and software, to name a few items. This is an additional expense, but it also adds layers of complexity to performance systems that require attention. Another important factor is the interdisciplinary nature of groups that perform this music. A musical ensemble transforms into a working group, and the synergy takes on a different nature. A group of musicians becomes a group of musicians together with programmers, engineers, and researchers.

Striving to use these new tools with a view of artists of years past helps to contextualize the music, giving it aesthetic, meaning and a sense of place in the percussion canon. To peer harness one's imagination with the question "What if this idea could actually make a sound?" is the heritage of Varèse. To act on that inquiry is our work: blending technology, inventiveness, and elbow grease into an artistic process. This is a big part of our collective history as percussionists, and we are among the most fortunate of musicians because we have at our disposal an endless palette of sounds, combined with a growing body of tech tools with which to create. It is a great time indeed for adventurous musicians.

REFERENCES

Centre for Computing History (September 2017) Web article: http://www.computinghistory.org.uk/det/6170/Zuse-Z1-built-by-Konrad-Zuse/

Doornbusch, P. (2009). "Early Hardware and Early Ideas in Computer Music: Their Development and Their Current Forms." In Dean, R. (2009). *The Oxford Handbook of Computer Music*, p. 46. Oxford University Press

Encyclopedia Britannica Online (1998) Web article: https://www.britannica.com/biography/Alan-Turing

Keisler, D. (2009) "A Historical View of Computer Music Technology." In Dean, R. (2009). *The Oxford Handbook of Computer Music*, p. 33. Oxford University Press

Hansen, P. (1969). "An Introduction to Twentieth Century Music." New York: Allyn and Bacon, p. 316 (As cited in Holmes, T. (2015) *Electronic and Experimental Music, 5th Edition*, p. 17. New York: Routledge

Lewis, George. "Too many notes: computers, complexity and culture in voyager." *Leonardo Music Journal*, 10 (2000), 33-39.

Van Nort, D., Oliveros, P., Braasch, J. (2013) "Electro/Acoustic Improvisation and Deeply Listening Machines." *Journal of New Music Research* 42, no. 4, pp. 303–24.

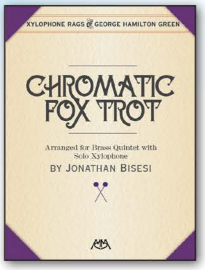
Wesley Smith, M. (1983). *For Marimba and Tape.* Program notes for original composition. Sydney: Australian Music Centre

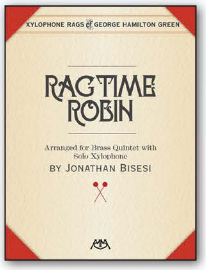
Scott Deal is a Professor and Director of the Donald Tavel Arts and Technology Research Center at Indiana University Purdue University Indianapolis (IUPUI). His most recent project is the release of *The Percussion Computer Media Collection,* a group of six electroacoustic solos and chamber works by various composers. He is a member of the electroacoustic trio Big Robot. Deal will be presenting a performance clinic at PASIC on Friday, Nov. 10 at 9:00 A.M. titled *Tools and Techniques for Percussion and Computer*. **PN**

OUTSTANDING PERCUSSION PUBLICATIONS
FROM MEREDITH MUSIC

XYLOPHONE SOLO WITH BRASS QUINTET

by George Hamilton Green • Arranged by Jonathan Bisesi





CHROMATIC FOX TROT
00231858.. $29.95

CROSS CORNERS
00237512.. $29.95

LOG CABIN BLUES
00194590.. $29.95

RAGTIME ROBIN
00231857.. $29.95

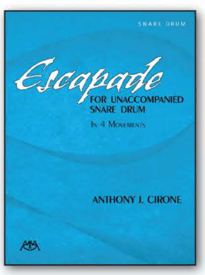
RAINBOW RIPPLES
00195786.. $29.95

TRIPLETS
00231860.. $29.95

THE WHISTLER
00231859.. $29.95

JOVIAL JASPER
00237511.. $29.95

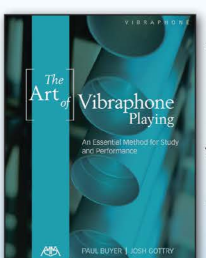
SPECIAL FEATURES



ESCAPADE
FOR UNACCOMPANIED SNARE DRUM

by Anthony J. Cirone

This advanced work in four movements is based on the Classical 4 – movement symphonic form. Each of the four movements can stand alone and are perfect for recital, auditions or semester exams.
00235299 ....$14.95



THE ART OF VIBRAPHONE PLAYING

by Paul Buyer and Josh Gottry

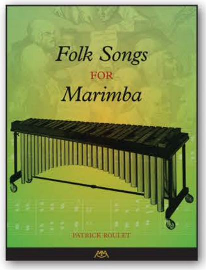
This method features 2 and 4 mallets in accessible to advanced exercises, studies and solos and clear strategies for pedaling, dampening, and tips on how to practice.
00233778 ....$14.95

ORDER TODAY FROM YOUR FAVORITE MUSIC RETAILER AT
HALLEONARD.COM/MEREDITHMUSIC

MUSIC FOR MARIMBA

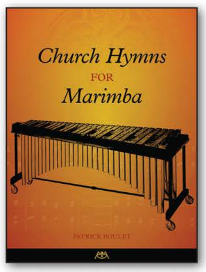
by Patrick Roulet

The songs in these collections are arranged three ways: the tune by itself, a two-mallet version using rolls and/or double stops, and a four mallet version. The collections are ideal for beginning, intermediate, or even advanced mallet players who are looking for four-mallet sight reading material. The songs can be performed individually or together in a group.



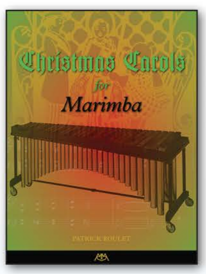
FOLK SONGS

Songs: America the Beautiful • Danny Boy • Greensleeves • Loch Lomond • Scarborough Fair • Shenandoah • Were You There • and more.
00130946...............$14.95



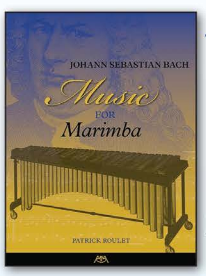
CHURCH HYMNS

Songs: Amazing Grace • Be Thou My Vision • For the Beauty of the Earth • Holy, Holy, Holy • Joyful, Joyful, We Adore Thee • Let Us Break Bread Together • Praise God from Whom All Blessings Flow • Rock of Ages • and more.
00118823...............$14.95



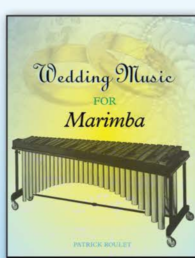
CHRISTMAS CAROLS

Songs: Away in a Manger • Carol of the Bells • The First Noel • Hark! The Herald Angels Sing • It Came Upon the Midnight Clear • Jingle Bells • Silent Night • We Wish You a Merry Christmas • and more.
00121882 ....$14.95



JOHANN SEBASTIAN BACH

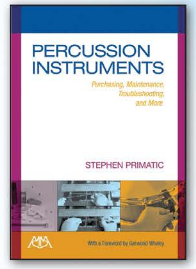
Songs: Jesu, Joy of Man's Desiring • O Sacred Head, Now Wounded • Sheep May Safely Graze • Gavotte • Badinerie and Minuet from Orchestral Suite No. 2 • Bourreé • and more.
00152242...............$14.95



WEDDING MUSIC

Songs: Air from Water Music • Canon in D • Jesu, Joy of Man's Desiring • Sheep May Safely Graze • Bridal Chorus • Trumpet Tune • Rondeau • Autumn from The Four Seasons • Wedding March.
00244366...............$14.95

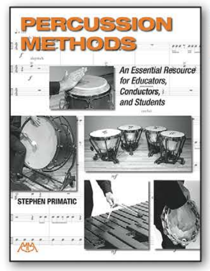
PERCUSSION REFERENCE



PERCUSSION INSTRUMENTS
PURCHASING, MAINTENANCE, TROUBLESHOOTING & MORE

by Stephen Primatic

This comprehensive text is ideal for anyone who has struggled with questions on purchasing, maintaining, troubleshooting or storing your percussion instruments.
00153574.. $14.95



PERCUSSION METHODS
AN ESSENTIAL RESOURCE FOR EDUCATORS, CONDUCTORS AND STUDENTS

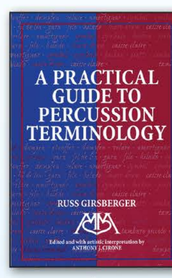
by Stephen Primatic

Perfect for college percussion methods classes or as a quick reference for directors, this book provides concise descriptions and recommendations covering all important percussion instruments and techniques.
00144941.. $29.95

THE DRUM AND PERCUSSION COOKBOOK
CREATIVE RECIPES FOR PLAYERS AND TEACHERS

ed. Rick Mattingly

With outstanding records of performance, workshop clinics, recordings, research, composition, leadership and teaching, 57 authors provide their favorite articles in this book.
00317183.. $24.95



A PRACTICAL GUIDE TO PERCUSSION TERMINOLOGY

by Russ Girsberger, edited by Anthony J. Cirone

Confused with the growing list of percussion instruments and terms? This book provides both definitions and an artistic interpretation of how each term is applied to the literature.
00317082.. $14.95

DISTRIBUTED BY
HAL•LEONARD®
7777 W. BLUEMOUND RD. P.O. BOX 13819 MILWAUKEE, WI 53213