

MARK BALLORA

Professor, Music Technology
School of Music/School of Theatre (joint appointment)
Honors Adviser, School of Music
Graduate Faculty, School of Music, Theory and Composition Area
Affiliated Research Faculty, Arts and Design Research Incubator (ADRI)
College of Arts and Architecture
The Pennsylvania State University
227 Theatre Bldg.
University Park PA 16802-1901
(814) 863-3386
ballora@psu.edu
<http://www.markballora.com>

EDUCATION

- 2000 **Ph.D., Music Technology**
McGill University, Montreal
Dissertation: *Data Analysis Through Auditory Display:
Applications in Heart Rate Variability*
Supervisors: Bruce Pennycook (Faculty of Music)
Leon Glass (Faculty of Science, Dept. of Physiology)
- 1996 **Master of Arts, Music Composition**
New York University, New York, NY
Composition Instructor: Justin Dello Joio
- 1995 **Master of Music, Music Technology**
New York University, New York, NY
Thesis: *History and Current Developments in Stereophonic Audio*
Supervisors: Kenneth J. Peacock, Robert Rowe
- 1984 **Bachelor of Arts cum laude, Theatre Arts**
UCLA, Los Angeles, CA

COURSES/PROGRAMS CREATED AT PENN STATE UNIVERSITY

Bachelor of Music, Music Technology Option, coordinator
Music Technology Minor, Co-administrator
INART 258A Fundamentals of Digital Audio [for music technology minors]
INART 258B Fundamentals of Digital Audio [for Music majors not concentrating in music technology]
MUSIC 434 History of Electroacoustic Music
INART 50 Science of Music
MUSIC 451 Software Programming for Musicians
MUSIC 453 Sound Synthesis
IST 402 Auditory Display and Sonification: Sound as Information

TEACHING AND RELATED WORK EXPERIENCE

- 20017-pr. **Professor, Music Technology**
Joint Appointment: School of Music/School of Theatre
Graduate Faculty, School of Music, Theory and Composition Area
Schreyer Honors adviser (non-Music Education)
The Pennsylvania State University, University Park, PA

- 2007-17 **Associate Professor, Music Technology**
Joint Appointment: School of Music/Department of Integrative Arts
[Joint appointment switched to School of Music/School of Theatre, effective Fall 2011]
Graduate Faculty, School of Music, Theory and Composition Area
Schreyer Honors adviser (non-Music Education)
The Pennsylvania State University, University Park, PA
- 2001-06 **Assistant Professor, Music Technology**
The Pennsylvania State University, University Park, PA
- 2000-01 **Instructor, Music Technology**
The Pennsylvania State University, University Park, PA
- 7/2006 Acted as consultant to Montclair State University, Montclair, NJ. Provided technological evaluation of the Chapin Hall Renovation and Addition plan.
- 1998-00 **Instructor**
McGill University Faculty of Music, Montreal, Quebec
- Basic Materials of Western Music I
 - Electroacoustic Music Techniques I
 - Personal Computer Applications in Music
 - Fundamentals of New Media
 - Introduction to Digital Audio
- 1997 **Instructor**
- Christ Union College, Taichung, Taiwan, Departments of Music, Language
 - Species Counterpoint
 - English
- 1991-95 **Instructor**
Brooklyn Music School, Brooklyn, NY
- Kindermusik
 - Music Theory
 - Public School Outreach:
Integrating music into grade 3-5 reading, writing, science and social science curricula
- 1992-95 **Graduate Assistant**
New York University Music Technology program
- 1987-93 **Graphics Operator/Workflow Coordinator**
Lehman Brothers Inc., New York, NY

PUBLICATIONS AND PRESENTATIONS

Mark Ballora and Jenni Evans - *Spaghetti of Storms - an installation of tropical storm data sonifications*. International Conference of Auditory Display June 20-23, 2017, The Pennsylvania State University.

Panelist at DC Art Science Evening Rendezvous (DASER). Presentation: "Seeing with Your Ears: Data Sonification." Cultural Programs of the National Academy of Sciences, March 16, 2017.

Mark Ballora. "Extended Abstract: Music of Migration and Phenology: Listening to Counterpoints of Musk Ox and Caribou Migrations, and Cycles of Plant Growth." *Proceedings of the 22nd International Conference on Auditory Display (ICAD 2016)*, July 2-8, 2016, Canberra, Australia, 169-172. DOI: 10.21785/icad2016.016

Mark Ballora. *Digital Audio and Acoustics for the Creative Arts*. Oxford University Press, 2016.

"Sonifications of the Universe (and more)." Installation/residency. Borland Project Space, Penn State College of Arts and Architecture, November 2 – December 12, 2016.

Mark Ballora. "Piece Description: Growth of the Universe (in log time)." *Proceedings of the 41st International Computer Music Conference*, September 25 - October 1, 2015, University of North Texas, Denton, TX.

Mark Ballora, "Studio Report: Music Technology at the Pennsylvania State University." *Proceedings of the 41st International Computer Music Conference*, September 25-October 1, 2015, University of North Texas, Denton, TX.

Mark Ballora. "Two examples of sonification for viewer engagement: Hurricanes and squirrel hibernation cycles." Extended abstract, *Proceedings of The 21st International Conference of Auditory Display (ICAD 2015)*, July 8-10, 2015, Graz, Austria.

Mark Ballora. "Sonification Strategies for the film *Rhythms of the Universe*." Lecture presentation, the 20th International Conference of Auditory Display (ICAD 2014), June 22-25, New York, NY, USA.

Matthew Kenney, Mark Ballora, Susan Brantley. "Isotopic Data Sonification: Shale Hills Critical Zone Observatory." Poster presentation, the 20th International Conference of Auditory Display (ICAD 2014), June 22-25, New York, NY, USA.

Jeff Rimland, Mark Ballora. "Using Vocal-Based Sounds to Represent Sentiment in Complex Event Processing." Poster presentation, the 20th International Conference of Auditory Display (ICAD 2014), June 22-25, New York, NY, USA.

Jeffrey C. Rimland, Mark Ballora. "Using Complex Event Processing (CEP) and vocal synthesis techniques to improve comprehension of sonified human-centric data." *Proceedings of the Society for Photo-Optical Instrumentation Engineers (SPIE) v. 9122, Next-Generation Analyst II*, 9122-2.

Mark Ballora. "Sonification, Science and Popular Music: In search of the 'wow'." *Organised Sound* 19(1), (April 2014), 30-40.

Mark Ballora. "Electronic and Computer Music." Chapter in *Music in American Life: An Encyclopedia of the Songs, Styles, Stars, and Stories that Shaped our Culture*, Jacqueline Edmondson, ed. ABC-CLIO Greenwood. October 2013, 387-395.

Mark Ballora. "Seeing with Your Ears: Visualizing Data with Sound." Presentation given at Gordon Research Conference on Visualization in Science and Education, Bryant University, RI, July 21, 2013.

Jeffrey C. Rimland, Mark Ballora, David L. Hall. "Hard and Soft Information Fusion in Sonification for Assistive Mobile Device Technology." *Proceedings of the 19th International Conference on Auditory Display (ICAD 2013)*. July 6-10, 2013, Lodz, Poland.

Mark Ballora, Curtis Craig. "Consilient Spheres of Influence in a Land Grant Setting." *Organised Sound* 18(2) (August 2013), 201-206.

Jeffrey C. Rimland, Mark Ballora, Wade Shumaker. "Beyond visualization of big data: a multistage data exploration approach using visualization, sonification, and storification." *Proceedings of the Society for Photo-Optical Instrumentation Engineers (SPIE) v. 8758, Next-Generation Analyst: Information Systems and Networks: Processing, Fusion, and Knowledge Generation 2013*, 8758-22.

Mark Ballora, George Smoot III. "Sound: The Music of the Universe." *Huffington Post TED Weekends*. February 23, 2013.

Agnieszka Roginska, Mohanraj Hariharan, Mark Ballora, Kent Friedman. "Immersive sonification for displaying brain scan data." *HEALTHINF 2013, 6th International Conference on Biomedical Electronics and Devices*, Barcelona, Spain, February 11-14, 2013.

Mark Ballora, Robert J. Cole, Heidi Kruesi, Herbert Greene, Ganesh Mohanan, David L. Hall. "Use of Sonification in the Detection of Anomalous Events." *Proceedings of the Society for Photo-Optical Instrumentation Engineers (SPIE) v. 8407, Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2012*, 84070S (May 1, 2012); doi:10.1117/12.918688.

Mark Ballora, Nicklaus A. Giacobe, Michael McNeese, David L. Hall. "Information Data Fusion and Computer Network Defense," chapter in *Situational Awareness in Computer Network Defense: Principles, Methods and Applications*. Cyril Onwubiko, and Thomas Owens, eds. IGI Global, Inc. 2012.

Mark Ballora. "Opening Your Ears to Data." TEDxPSU presentation, Penn State University, November 13, 2011 [online at youtube.com].

Mark Ballora, Robert J. Cole, Heidi Kruesi, Herbert Greene, Ganesh Mohanan, David L. Hall. "Use of Auditory Displays in Anomaly Detection." *National Symposium on Sensor and Data Fusion*, October 24-28, 2011, Washington, DC.

Mark Ballora, Nicklaus A. Giacobe, David L. Hall. "Songs of cyberspace: an update on sonifications of network traffic to support situational awareness." *Proceedings of the Society for Photo-Optical Instrumentation Engineers (SPIE) v. 8064, 80640P* (2011); doi:10.1117/12.883443.

Clinician, Rockland County Music Educators' Association Conference Day, Orangeburg, NY, November 11, 2010. Two presentations on digital audio basics and a step-by-step guide to creating a podcast.

Mark Ballora. "Sound as Information: Sonification as Art and Science." Invited presentation at EIMAS 2010 (Encontro Internacional de Música e Arte Sonora), September 13-18, 2010, Federal Universities of Rio de Janeiro and Juiz de Fora, Brazil.

Mark Ballora. "Building A Program From Scratch: Creating A Music Technology Presence At Penn State University." *EMS10 (Electroacoustic Music Studies Network), Teaching Electroacoustic Music: Tools, Analysis, Composition*. June 21-24, Shanghai, China.

Mark Ballora, Brian Panulla, Matt Gourley, David L. Hall. "Preliminary Sonification of Web Log Data." Poster presentation, *International Conference of Auditory Display (ICAD)*, June 11-15, 2010, Washington, DC.

Mark Ballora, Brian Panulla, Matt Gourley, David L. Hall. "Preliminary Sonification of Web Log Data" Poster/Demonstration, *International Computer Music Conference*, June 1-5, 2010, Stonybrook University, NY.

Mark Ballora, Curtis Craig. "PSU Studio Report." *International Computer Music Conference*, June 1-5, 2010, NYC/SUNY Stonybrook University, NY.

Mark Ballora, David L. Hall. "Do you see what I hear? Experiments in multi-channel sound and 3D visualization for network monitoring." *Proceedings of Society of Photo-Optical Instrumentation Engineers (SPIE) vol. 7709, 77090J (2010)*; doi:10.1117/12.850319.

"Beyond Visualization – Sonification." Invited chapter in *Human-Centered Information Fusion (Artech House Electronic Warfare Library)* by David L. Hall and John M. Jordan. Artech House Publishers, 2010.

"Can You See What I Hear? Experiments in Sonification." Invited presentation, *NATO IST-085 Visualization Research, Theory, and Practice*. University Park PA, October 8, 2009.

Presentation on *Singularity*, New York University Department of Music and Performing Arts Professions, March 2009.

Workshop leader: "Sound as Information and Sonification." *The 14th International Symposium on Electronic Art (ISEA2008)*. Held July 25 - August 3, 2008, Singapore.

Mark Ballora, S. Lee Hong, Brian Panulla, David Hall, "Information through Sound: Understanding Data through Sonification." *Proceedings of ISEA2008, The 14th International Symposium on Electronic Art*. Held July 25 - August 3, 2008, Singapore. pp. 47-49.

Keynote presenter, International Conference of Music Education, National Taichung University, Taiwan, October 13-14, 2007.

Ballora, Mark, "On Teaching the History of Electro-Acoustic Music." *College Music Symposium*, v. 46, Fall 2006.

Ballora, Mark. "Teaching Electroacoustic Music: Issues of History, Context, Pedagogy, and Student Expectation." 2006 Symposium of the Electroacoustic Music Studies Network (EMS06), Beijing, October 19-21, 2006. <http://www.ems-network.org/spip.php?article227>.

Mark Ballora, Bruce Pennnycook, Plamen Ch. Ivanov, Leon Glass, Ary Goldberger. "Heart Rate Sonification: A New Approach to Medical Diagnosis." *LEONARDO* 37(1) pp. 41-46, 2004.

Mark Ballora. "Square One: Get With the Interaction." *Electronic Musician* 20(3), February 2004, pp. 88-94.

Mark Ballora. "Square One: Look Through Any Window." *Electronic Musician* 20(8), July 2004, pp. 70-75.

Mark Ballora. "Square One: You've Got the Power." *Electronic Musician* 20(11), September 2004, pp. 82-88.

Mark Ballora. "Square One: Can You Believe Your Ears?" *Electronic Musician* 20(13), November 2004, pp. 84-89.

Mark Ballora. "Square One: Standing Tall." *Electronic Musician* 21(1), January 2005, pp. 76-81.

Mark Ballora. "Square One: Get with the Program." *Electronic Musician* 21(4), April 2005, pp. 78-80.

Mark Ballora. "Square One: What's in a Word?" *Electronic Musician* 21(5), May 2005, pp. 88-90.

Mark Ballora. "Square One: Some Like It Hot." *Electronic Musician* 21(6), June 2005, pp. 88-90.

Mark Ballora. "Square One: Loop Your Dishwasher." *Electronic Musician* 21(8), August 2005, pp. 96-98.

- Mark Ballora. "Square One: Vive La Difference." *Electronic Musician* 22(3), March 2006, pp. 70-72.
- Mark Ballora. "Square One: Frequency vs. Pitch." *Electronic Musician* 22(9), September 2006, pp. 78-80.
- Mark Ballora. "Square One: New Tricks for an Old Dog." *Electronic Musician* 22(10), October 2006, pp. 84-86.
- Mark Ballora. "Square One: Open Sound Control." *Electronic Musician* 24(11), November, 2008, pp. 64-66.
- Mark Ballora. *Essentials of Music Technology*. Prentice Hall, 2003.
- Mark Ballora, Bruce Pennycook, Plamen Ch. Ivanov, Ary Goldberger, Leon Glass, 2003. "Data Analysis through Auditory Display: Applications in Heart Rate Variability." Poster presentation, Society for Arts in Healthcare Conference. San Diego, CA. April 9-12, 2003.
- Mark Ballora. *Essentials of Music Technology*. Prentice Hall, 2003.
[Spring 2006: Translation into simplified Chinese contracted for sale in People's Republic of China.]
- Mark Ballora, Bruce Pennycook, Plamen Ch. Ivanov, Ary Goldberger, Leon Glass. "Detection of obstructive sleep apnea through auditory display of heart rate variability." *Computers in Cardiology 2000*, Cambridge, Massachusetts.
- Mark Ballora, Bruce Pennycook and Leon Glass, 2000. "Sonification of Heart Rate Variability Data." Demonstration/poster at the International Conference on Auditory Display, Atlanta, Georgia.
- Mark Ballora, 1999. "Concert Review: McGill Faculty and Guests Series: A Concert of Live Interactive Electronic Works, March 16, 1999." *Computer Music Journal* 23(4).
- Mark Ballora, Bruce Pennycook, Leon Glass, 2000. "Audification of Heart Rhythms in Csound." *The Csound Book*, R. Boulanger and B. Vercoe, eds. MIT Press.
- Mark Ballora, 1996. "Current Stereophonic Developments and their Musical Implications." *4th International Conference on Music Perception and Cognition*, McGill University.

MUSIC AND MULTI-MEDIA PRODUCTION

Drifting. Sound design and mixing. A play by William Doan, directed by Andrew Belser. Workshop production presented at Dixon Place, New York, March 8, 2015.

Rhythms of the Universe. Film short conceived by George Smoot and Mickey Hart. 2013. 360° Productions, Inc. in association with the Berkeley Center for Cosmological Physics at the Lawrence Berkeley National Laboratory.
Sonifications of astronomical phenomena.

Sonification designs and online liner notes
Superorganism. The Mickey Hart Band. 360° Productions, Inc. 2013.

Squid Sarabande
For flute choir. Published by BRS Music, Inc., FC#331. 2011.
Selected as a finalist in the 2012 National Flute Association newly published music competition.

Leaves of Memory
For solo oboe. Published by BRS Music, Inc., WW#304. 2013.

Flauto Zydeco
For flute choir. Published by BRS Music, Inc., FC#339 2013.

Sonifications of EEG Brain activity
Used in "Life's Rhythms Reimagined," a Featured Presentation by Adam Gazzaley and Mickey Hart given at the AARP's 2012 Life@50+ National Event & Expo in New Orleans, September 22, 2012.

Sound design for musical sculpture of Golden Gate Bridge, performed by Mickey Hart
Golden Gate Bridge 75th Anniversary Festivities
Crissy Field, San Francisco. May 27, 2012.

Sonification designs and liner notes

Mysterium Tremendum. The Mickey Hart Band. 360° Productions, Inc. 2012.

Squid Sarabande

For flute choir. Published by BRS Music, Inc., FC#331. 2011

Selected as a finalist in the 2012 National Flute Association newly published music competition.

Tree Growth

Included in the 60x60 “UnTwelve Mix” and “Scarlet Mix,” which were presented at International Computer Music Conference in New York (6/10) as well as in a variety of concerts worldwide.

Moth Dance

Presented by the PSU University Dance Company, New England Regional Conference of the American College Dance Festival Association, February 7, 2008

Performed at Penn State March 27, 28, April 5, 2008

Part of Continuous Presentation series at International Computer Music Conference 2008, Belfast, Northern Ireland.

RED

Original music for dance/theatre production produced by the Errol Grimes Dance Group, Kumble Theatre, Long Island University, Brooklyn Campus, New York, November 15-18, 2007.

Collaborator, Background audio, *Kite Project*, an exhibition created by Helen O'Leary and Sarah Schwartz.

June 30 – July 29, 2006. The Dock, St. George's Terrace, Carrick-on-Shannon, Ireland.

Let's Crack Some Eggs

Original music for dance/theatre production produced by the Errol Grimes Dance Group, La Mama ETC, New York, April 6-16, 2006. Additional music created for revival at Kumble Theatre, Long Island University, Brooklyn Campus, New York, March 17-21, 2010.

Singularity for flute and computer processing

- Lecture/performance held at the Open University of Kaohsiung, Taiwan, June 12, 2004
- Lecture/performance held at Tainan National College of the Arts, Taiwan, June 14, 2004
- Florida Electroacoustic Music Festival, April 2005
- National Flute Association Convention, August 2005
- Sonorities 2006, Queen's University Belfast, April 2006
- SIGGRAPH Art Gallery, August 2006
- MusicAcoustica2006, Beijing, October 2006
- International Computer Music Conference Digital Jukebox/Radio series, November 2006
- SuperCollider International Symposium, Wesleyan University, April 2009

Heart Rhythms: Healthy

- SEAMUS 2002 (University of Iowa)
- Dartmouth's Electric Rainbow Coalition, August 2003,
- Used as background audio for art exhibition “With Love” at Ayse Taki Galerisi in Istanbul, February 7-17, 2007.

G•E•M•S: Vox Machina

Enhanced CD created by the Group of the Electronic Music Studio, McGill University, 1999

Distributed by McGill Systems, Inc.

Multi-media programming (Macromedia Director), coordinated all aspects of CD production

Paradise Workshop

Sound/music score for trilogy of animated films. Writer/animator: Jeffrey Lerer.

Premiered at Bennett-Siegel Gallery, NYC, 1989, 1990; presented in Pollack Hall, McGill University, in three concerts of the Electronic Music Studio, 1998-99.

Three Ticket Slot

Sound/music score for animated feature. Writer/ animator: Jeffrey Lerer.
Excerpt included on PBS broadcast *The 90s Next Election Special*, October 1992.

The Toad, December 17th

Music composition, sound effects design, audio production, acting in two original radio dramas created by Union Signal Corp., New York City, 1991, 1994. Broadcast on WBAL, New York City; syndicated by NPR Playhouse.

In and Around Your House

Music composition for modern dance production, conceived and choreographed by Tere O'Connor Dance Theatre Workshop, New York City. 1987.

Wall Street Nightmare

Incidental music for theatre production presented by Bond Street Theatre Coalition, New York City. Paulina Klimovitskaya, Director. 1990.

The Love of Don Perlimplin and Belise in the Garden

Incidental music for theatre production presented by Drama League of New York Directors' Projects. 1988.

FELLOWSHIPS, AWARDS AND PROFESSIONAL ASSOCIATIONS

- 2017 PI, National Academies Keck Futures Initiative interdisciplinary seed grant, "Layers of Meaning: How the Ocean's Natural Acoustics and the Music of its Datasets Can Reveal Hidden Connections," \$50,000
- 2017 Co-PI, National Academies Keck Futures Initiative interdisciplinary seed grant, "Sonifications of Oxygen and Temperature Data in the Ocean: Creating a 'Data Stethoscope' to Detect the Ocean's Vital Signs," \$50,000
- 2017 PI, NSF discretionary grant, "ThinkTank for ICAD 2017," \$22,600
- 2015 Faculty Research Grant, Penn State University, \$6,160.
- 2011 Co-Principal Investigator, "Sonification Concepts for Signal Anomaly Detection." Sponsor: Raytheon Corp. Time period: May 16-August 22, 2011. Budget: \$30,000.
- 2010-11 Sabbatical, spent with the College of Information Sciences & Technology as a sonification research consultant
- 2007 Interdisciplinary Group award for Audio Research Symposium, Penn State Institute for Arts & Humanities, \$1,500
- 2004 Faculty Research Grant, Penn State University, \$4,150
- 2000 Faculty Research Grant, Penn State University, \$4,000
- 1995-98 Max Stern Fellowship, McGill University
- 1995 Music Composition Award, NYU
- 1991,94 National Endowment for the Arts, Radio Drama Production Grants
- 1991 Centennial Scholarship, NYU
- 1980-84 Regents Scholarship, UCLA
- 1980 Chancellor's Scholarship, UCLA
- Member: Pi Kappa Lambda, Audio Engineering Society, SEAMUS, International Computer Music Association

PROFESSIONAL SERVICE

- Organizing Committee member, Electroacoustic Music Studies Network 2011 Conference (EMS11)
Maintained the conference web site, designed the printed program, served as a music reviewer
- External reviewer for Wake Forest Department of Music, February 2017.
- Conference chair, International Conference of Auditory Display, June 2017.

NARRATION PERFORMED WITH ORCHESTRA:

- Mr. Smith's Bowl of Notes*, composed by Gregory Smith.
Presented by the Nittany Valley Symphony, State College, PA. Michael Jinbo, director. February 26, 2017.

Anna's Way. Concept, production, background visuals and solo bass by Barry Green; story by Alan Scofield.
Presented as part of a residency with the Penn State bass studio, April 16, 2016.

Dr. Seuss' The Sneetches, music composed by Lorenzo Palomo, story by Theodor Geisel (Dr. Seuss).
Presented by the Nittany Valley Symphony, State College, PA. Michael Jinbo, director. February 21, 2016.

The Remarkable Farkle McBride, music composed by Bill Elliott, story by John Lithgow.
Presented by the Nittany Valley Symphony, State College, PA. Michael Jinbo, director. January 25, 2015.

The Composer Is Dead, music composed by Nathaniel Stookey, story by Lemony Snicket.
Presented by the Nittany Valley Symphony, State College, PA. Michael Jinbo, director. January 20, 2013.

The Three Little Pigs (Twisted Tuba Tales), composed by Todd Fiegel.
Presented by the Penn State Tuba Studio, Velvet Brown, director, October 30, 2011

A Major-Minor Mystery, composed by Gregory Smith.
Presented by the Nittany Valley Symphony, State College, PA. Michael Jinbo, director. December 6, 2009.

Zoo Song, composed by Gregory Smith.
Presented by the Nittany Valley Symphony, State College, PA. Michael Jinbo, director. December 10, 2005.