



# **ELECTRONIC PERSPECTIVES**

VINTAGE ELECTRONIC MUSICAL INSTRUMENTS



**TOM RHEA**

Copyright © 2023 Electronic Perspectives LLC

All rights reserved. No part of this book may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without permission in writing from the publisher.

Portions of this book are adapted from articles that originally appeared in *Contemporary Keyboard & Keyboard* magazine in 1977-1981, © Thomas L. Rhea.

[www.electronicperspectives.com](http://www.electronicperspectives.com)  
[www.drtoMrhea.com](http://www.drtoMrhea.com)

Graphic design and image restoration by Joseph Bastardo  
EP Logo by Joseph Bastardo with Muriel L. Palmer Rhea  
Slipcase Title Page and Inner Title Page consultation by Henry H. Owings

Significant support for printing thanks to:  
Vince Pupillo, Sr. ([www.EMEAPP.org](http://www.EMEAPP.org))  
Wally De Backer ([www.forgottenfuturesmusic.org](http://www.forgottenfuturesmusic.org))

Library of Congress Cataloging-in-Publication Data  
Electronic Perspectives: Vintage Electronic Musical Instruments

Printed in China by Artron Printing America

ISBN 978-0-578-70772-3



# Contents

---

Overview.....	2
The Cahill Telharmonium, Part I.....	4
The Cahill Telharmonium, Part II.....	12
The Cahill Legacy.....	18
The Hammond Organ, Part I.....	26
The Hammond Organ, Part II: Hammond And The FTC.....	34
Photoelectric Instruments, Part I: The WCAU Photona.....	42
Photoelectric Instruments, Part II: The Superpiano.....	46
Photoelectric Instruments, Part III: The Cellulophone.....	50
The Syntronic Organ.....	54
Photoelectric Acoustic-Sound Instruments.....	58
Prelude To The Electric Piano.....	70
The Neo-Bechstein Electric Piano.....	76
B.F. Miessner's Electronic Piano.....	80
Electric Pianos: The Early Miessner Legacy.....	84
B.F. Miessner's "Stringless Piano".....	96
The Pianos Of Harold Rhodes.....	102
First Electronic Keyboard: Singing Arc, 1899.....	116
De Forest's Music Of The Lamps.....	118
Jörg Mager — Multi-Keyboardist Of The 1930s.....	120
The <i>Unkeyboards</i> of Professor Theremin.....	124
Martenot's Musical Waves.....	150
Hugo Gernsback's Pianorad.....	170
Early One-Tube-Per-Note Organs.....	172
The Novachord.....	174
Monophonic Keyboards Of The '40s And '50s.....	188
The Hellertion.....	202
The Trautonium.....	214
Sala & The Mixtur-Trautonium.....	224
What Is Electronic Music?.....	230
On Synthesis & Synthesizers.....	272
The First Synthesizer (1929).....	276
The Hanert Synthesizer (1945).....	282
The Grainger-Cross Free Music Machine.....	288
Burnett Cross, Designer Of Free Music Machines.....	292
Harald Bode's Four-Voice Assignment Keyboard (1937).....	294
Harald Bode's Melodium & Melochord.....	296
Harald Bode's Frequency Shifters & Vocoder.....	298
Osmond Kendall's Composer-Tron.....	310
Dr. Kent's Electronic Music Box.....	312
The RCA Synthesizer.....	314
The RCA Synthesizer & The Basics Of Binary.....	316
The RCA Synthesizer & Monophony.....	318
The RCA Synthesizer, Timbre Control Then & Now.....	320
The RCA Synthesizer, Glide & Temperament.....	322
The RCA Synthesizer & Its Synthesists.....	324
The Synket.....	326
Hugh Le Caine's Electronic Sackbut.....	328
Raymond Scott's Clavivox & Electronium.....	336
The Moog Synthesizer.....	342
Buchla Electronic Musical Instruments.....	366
Music & The Computer.....	374
Audio Track Notes.....	387
CD Tracklist.....	391

## Principals' Bios

### Brian Kehew



A polymath in music and audio: musician, author, historian, keyboardist, synthesist, mixer, stage technician, and producer. He's no jack of all trades—he has stellar credits in these interests: tour technician for The Who since 2002, and sub for John Bundrick. Performer with Air, Hole, Dave Davies and Moog Cookbook; co-producer for Fiona Apple's *Extraordinary Machine*; studio work with glitterati from Aretha

Franklin to Tiny Tim; consultant-programmer for Moog, Alesis, Casio, Solaris, and Polyfusion; author for *Tape Op*, *Keyboard* magazine, and *Beatlefan*. Brian and Kevin Ryan spent 15 years researching & writing *Recording The Beatles: The Studio Equipment and Techniques Used to Create Their Classic Albums* (2006). A book on Sir George Martin's music is in process. He mixed Rhino's *Woodstock 50—Back to the Garden: The Definitive 50th Anniversary Archive*, a 38 CD collection. Brian Kehew curated and produced the audio tracks for this publication, and is a significant contributor of historical artifacts for this project.

[www.briankehew.com](http://www.briankehew.com)

### Joseph Bastardo



An artist and musician whose eye for detail, indefatigable energy, and thorough mastery of pertinent tools mark him as a true graphic arts professional. His design portfolio includes work for clients all around the world and he has released several albums of electronic music on various independent record labels. Joe provided graphic design for this book and the associated website. His fastidious restorations

of photographs and graphics brought worn images (seen in all too many places) to sparkling new life. His layouts seem to intuitively manifest what Susanne K. Langer calls *significant form*. His experience as a synthesist, composer, and performer informed his work for this publication. He worked his magic quickly and efficiently, and he shows budding capabilities as an historian in the field. I look forward to working with Joe in the future.

[www.josephbastardo.com](http://www.josephbastardo.com)

### Tom Rhea



Introduced analog synthesizers internationally as a Moog clinician, functional design consultant, artist relations specialist, documentation writer, and marketing executive. He authored articles in *Computer Music Journal*, and wrote owner's manuals, e.g. *Minimoog Model D Operation Manual* (1974). A noted historian, his PhD *The Evolution of Electronic Musical Instruments in the United States* (1972), and *Keyboard* magazine

"Electronic Perspectives" columns are cited in *The New Harvard Dictionary of Music*, *The New Grove Dictionary of Musical Instruments*, and *The Grove Dictionary of Musical Instruments, 2nd edition*. He conceived of, and wrote the first music for *Oxylights*, the world's largest permanent music & light installation (Niagara Falls, NY), recognized in *The Guinness Book of World Records*.

[www.drtrhea.com](http://www.drtrhea.com)

## Foreword by Larry Fast

Creative people using tools in an expressive medium such as those employed by electronic musicians often don't have the luxury or the inclination to spend time contemplating the origins of those tools. The excitement of the "new" too often overshadows everything else. All too often, when a technology is rapidly emerging, its origins are lost. Or the landmarks and even the dead ends are not recognized for what they are as they are happening. It is only once someone has the perspective, knowledge and insight to chronicle the recent past that the various threads can be woven to create a meaningful history.

When "Electronic Perspectives" first appeared in *Contemporary Keyboard* magazine in 1977, the modern era of synthesizers was only a little more than a decade old. The longer pre-narrative of sonic creation by electronic means was woven into developments of less than a century of electrical and electronic history. And yet Tom Rhea managed to probe those elements of a history which was still in the making. The historian in me was captivated with this slice of history of a field in which I was already immersed and was developing at lightning speed.

I thought I knew a good deal about the origins and development of electronic instruments. Maybe I did about the theoretical underpinnings of the best-known digital and analog instruments. But so many clever, and a few not-so-clever, designers had invented and developed instruments that I was only marginally aware of. And a surprising number were completely new to me. Tom Rhea's articles during the years the column ran provided a wonderful first draft survey of the emerging history across the field of electronic instruments.

Each monthly installment provided another piece of the complex mosaic making up the field. We got to read Tom's wonderfully researched accounts of instruments that would make up the dominant trends and others which were the equivalents of those branches on the human evolutionary tree which split off to nowhere. Tom's approach wasn't to pass judgment, but to present what had happened. Dreamer inventors and visionaries experienced success, failure or something in-between with their creations. And Tom's mini-histories of the individual instruments related a bigger story where instruments which weren't a rousing commercial success, or maybe never came to market, could still have outsized influence on later developments.

My background as an historian recognized that in his multi-part series, extending over several years, Tom was giving us the foundation for making sense out of the stew of creative electronic designer/inventors. Musicians using these tools were bringing electronic creativity to a boil in the commercial market and recording and live music touring industry. In Tom's vignettes of electronic music history, the long view of technology history, puts this evolution into context. The snapshots of history collected in this book have increased in usefulness with the passage of time.

-Larry Fast

Larry Fast pioneered the celebrated series of electronic music albums under the aegis of Synergy. He worked with Peter Gabriel for some 10 years, and contributed to numerous platinum selling recordings by other world-renowned artists. Larry's commissions include those from Disney, XM Satellite Radio, and Tribune Broadcasting. His feature film and documentary work includes *Saving The Great Swamp: Battle to Defeat the Jetport* broadcast by PBS, for which he served as co-producer and historian/writer. He is a recognized technology history specialist who serves on the Board of the Thomas Edison National Historical Park. His developments in infrared audio technology have earned several patents.

## Foreword by Brian Kehew

Tom Rhea's "Electronic Perspectives" columns were unexpected when they first appeared. In those days (1977-1981), they stood in sharp contrast to the forward-looking pages of *Contemporary Keyboard* magazine. The rest of the magazine leaned toward the newest electronic instruments, the coming of software. Even the ads were promoting The Big Future.

*Keyboard* magazine—as it came to be called—was largely a forward-looking venture. The concept of "vintage electronic musical instruments" was not really sensible yet. This was technology, and *forward* means *better* . . . older technology would therefore be *worse*—and useless to study.

Yet, here was a different direction altogether, with this picture of a grinning man—Tom Rhea, who seemed to know everything there was to know about early electronic musical instruments. Barring the Theremin and Hammond organ, I had never heard of most of these instruments, and certainly they were *all* difficult subjects to find anything about. This Rhea man was certainly a scholar (he had a PhD in this) and had certainly spent a lot of time unearthing this information—and getting it *the hard way*.

These were the pre-internet days for researchers like Tom, with card catalogs, engineering and music indices, telephone books, letters written, books in library stacks, old newspapers and magazines, flights to interview pioneers using his cassette tape recorder. The most "modern" thing Tom had was *microfilm*, with which he researched the entire *New York Times* from its inception to the date he completed his dissertation (1972). Imagine trying to find out how a never-manufactured European instrument existed, much less finding any reliable information on its technology or uses. Gathering such detail was well-nigh impossible when Tom started in the late 'sixties.

Today—some 50 years later—we have gone further with most of these instrument histories. Others have taken up the torch and followed any one branch of the tree as far as possible. Some of the instruments now have their own books or web pages, and more is being uncovered daily. But this was the start—someone chiseling his way through granite—and one of the first looks *backward* to understand the course of electronics in music. It was—and *still is*—a great opportunity to learn something from those creative attempts at developing newer and better sound.

Sometimes Tom's column still shows us all there was to find—the one photo that exists—or the few stories of an extinct instrument that no one alive today has ever heard. His columns are but a skeleton, to be fleshed out—a great starting point for other work. Other books, dissertations, and websites have relied heavily on Tom's research to build their own deeper stories. It might be difficult to find "new" places that don't have Tom's latent fingerprints.

While the history of electronic music has often been written from a parochial *American* viewpoint, Tom's dissertation, and this popularization through the pages of *Keyboard* magazine, lean toward a balanced view that includes contributions worldwide. American inventions are here (as they should be) but European instruments are just as evident. This alone made Tom's early research different—and opened doors to other researchers to follow the less-traveled path.

The title word *Perspectives* in his columns is the key here. "History *helps* you . . ." Tom has said. Those who can *see behind* are more likely to understand where the forward-looking paths will be. There are also deeper concepts to be learned from this work in your hands. Significant or not, the "dead-ends" of history are fascinating stories. Consider the *human* side—the costs, the time, the emotional toll on a hopeful inventor whose work never reached an audience.

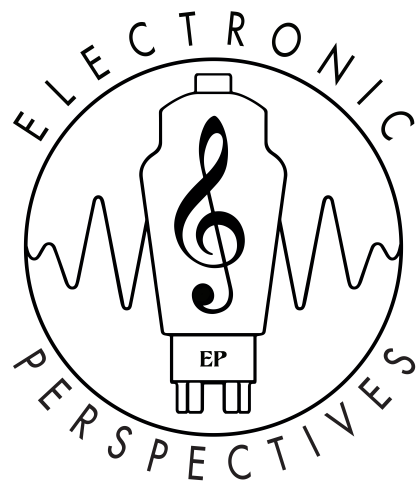
Some of their works had been totally neglected until these columns came out. Sometimes the greatest innovations failed, yet more pedestrian ideas persevered, and even influenced others' work.

As you go through these pages, step back and ask yourself about the deeper concepts beyond the simple story. The Cahill Telharmonium held great promise and took massive investments of capital and time, but its promise never flowered. But, it did echo *later* in the Hammond organs of the 1930s—which continue to function as totally valid instruments in today's world. It is fascinating to weigh the work spent to amplify a basic piano tone in those days—an effort which is truly trivial today. One can study the many devices designed just to create new waveforms, or the creation of human-instrument interfaces that made an instrument appealing—or not.

Tom Rhea retains a deep reservoir of information on this history. As with any good researcher, he went further into the subjects than the minimal necessity—and he continues to collect information on a few key subjects. Tom's depth of knowledge, and the gift of gab he learned as a synthesizer "clinician," make him an excellent panelist or lecturer at history-based events. He's spent his life in and around music, easily communicating all the myriad things he has learned. This book is a small sampling of what he still carries around in his head. It is a stepping-off point for the things he has learned and taught worldwide. Step off!

**-Brian Kehew**

*Brian Kehew is a Los Angeles-based producer, author, and musician. His book Recording The Beatles (with Kevin Ryan) is a classic in the field of audio technology. Much of his work involves archiving and mixing classic historical music for Warner Brothers Records. He also specializes in the history of synthesizer development and vintage audio technology.*





# Introduction and Acknowledgments

---

I'm not certain it takes a village to raise a child, but it seems to take one to get a book into print.

There. That's just one of my many opinions, or should we say perspectives? "No, I'm not biased, I'm opinionated." That's what I said to a heckler who challenged my preference for the Moog synthesizer at one of my many public demonstrations, or "clinics." I've earned the right to have opinions—at least about electronic musical instruments and their history. This book outlines a few of those opinions, and a slice of that history. It's certainly not a comprehensive history—it's a Valentine for those who love electronic musical instruments. I know too much about the field to imagine that a definitive history could ever be written. Now, that's something that definitely would take a village! My friend and fellow researcher, the late **Hugh Davies** came closest, albeit in non-narrative form, by authoring many entries in *The New Grove Dictionary of Musical Instruments*, and in *The Grove Dictionary of Musical Instruments, Second Edition*. Hugh offered to share authorship of those articles, so I may be the only "academic" in history who turned down writing for *Grove* (due to what I considered to be their scandalously low pay scale). Thanks Hugh, for citing my research so generously and voluminously.

First of all, profound thanks to my parents **Charles K. Rhea, Sr.** and **Ellyn Cecelia Paradiso Rhea** for always being there for me (one or both of them, as they were divorced from each other twice, and married to each other three times)! This reminds me of my "career" working for Moog Music and Moog Electronics—I was fired twice and quit three times. (Bob Moog never fired me.) Reckon I learned something about love from Mom and Dad. Not sure what it is . . .

It has been my great fortune to have had many good teachers, and not a few powerful mentors. To enumerate the former would take a lot of ink, but I would like to mention some of the latter who helped shape my *life* as well as my intellect. I'm leaving out academic titles, as I've never used mine. I had to choose "drtomrhea.com" as my website only because some graphics artist out in the Midwest has the temerity to have *my* name locked up.

My foremost mentor was my late older brother **Charles K. Rhea, Jr.** He taught me how to be a *warrior* when working on a project. When one is precocious academically, and possibly musically, as I apparently was, it's easy to become complacent. I thought everything *had* to be easy—it certainly seemed that way. Only when Charlie told me ". . . when I'm working on a problem for a client, it *hurts* until I get the answer," did I realize that I had been just skating by, not really working. Deepest thanks, Charlie.

Those who successfully guide our initial forays deserve special credit. These include my first piano teacher **Mrs. Ethyl Williams** in Chattanooga, TN and my high school band director **Carlton Ray Morris** at Deshler High in Tusculumbia, AL.

At Florida State University (FSU) my trumpet teachers were **Robert T. Braunagel** and **Clifford K. Madsen**. Cliff taught me a great deal about playing the trumpet, but more about how to become a decent human being. Thank you "Brownie" and "Dr. Mad Sin" (strictly my appellation). I had so many excellent teachers there. A special shout out to **Rick Powell**, a mentor from that FSU period who became a lifelong friend, and a pioneer in the use of synthesizers in Christian music. Rick, we hardly knew ya . . .

At George Peabody College, now part of Vanderbilt University, members of my dissertation committee tried to pound some sense into my head about the realities of the world. (I was not a quick study in this regard.) Thanks to **Charles H. Ball**, **James H. Hogge**, and **Gilbert Trythall**. Particular thanks to Charlie Ball for urging me to write my Ph.D. dissertation using intelligible language rather than resorting to what he called "educanto." I had so many excellent teachers there, as well. **Sue Goss**, wife of Donald Goss, a fellow graduate student at George Peabody, taught me how to use the English language more effectively at her kitchen table. Thank you, Sue—those writing skills took me to many places.

During my many years working at Moog Music and Moog Electronics, I learned not only much about the principles of music technology, but valuable life lessons from **Robert A. Moog** and **David A. Luce**, known jocularly as "Mogen David" around the plant. I knew them as "a Moog," and "a Luce," and enjoyed deep friendship with both. Dave taught me to play golf, which I might get back to when this book is completed. I greatly enjoyed working with **Jim Scott**, for whom I acted as a functional design consultant. We made better musical instruments together, and he reinforced the necessity of instrument design "from the outside in," i.e. starting with the front panel and performance controls that the musician sees and touches. I became a better Owner's Manual writer for it. Thanks Jim, for putting up with my "bellowing with rage" (his description). Now, I'm "mellowing with age." Prior to those many years, I worked briefly for **Les Trubey** and **David Van Koevering**, early distributors of Moog synthesizers under the aegis of the Vako name. Les taught me to "hold steady" under pressure. Dave taught me his wild, wooly and effective brand of sales techniques, and to "not blur" when interacting with strong personalities. I can still hear David saying "don't blur—don't blur" any time I disagreed with him. No "Yes Men" for David Van Koevering! Thank you, gentlemen.

Thanks to my first wife **Mary Alice "Tricka" Treat Rhea** for sticking with me through thick and thin during those early years.

Of course, Librarians played a major role in shaping my dissertation and this book. **Jean Bowen**, Librarian, Museum of the Performing Arts, New York Public Library at Lincoln Center; **William Lichtenwanger**, Head of the Music Section, Library of Congress; and **Shirley M. Watts**, Head Librarian of the Music Department at George Peabody College assisted immeasurably. **Marilyn Craig**, **Lois Griest**, and **Miss Birdsong**, Reference Department at Joint Universities Libraries (JUL) of Vanderbilt University ferreted out sources for obscure publications I had uncovered and brought hard copies to me from places as distant as Russia via Interlibrary Loan. (Remember ILL in its heyday?) **Mr. McClelland**, who worked at Vanderbilt, produced some 80 large scale photographs of some of the images I had collected, and mounted these on archival acid-free stock. Thanks to all of you for taking a genuine interest in me and my Ph.D. dissertation *The Evolution of Electronic Musical Instruments in the United States* (1972 George Peabody College—now of Vanderbilt University). I realize that some may not resonate with my pedestrian "cabbages and Kings" viewpoint about historical research—photos from prestigious institutional archives found alongside graphics from **Popular Mechanix**. For those who seek a more rigorous treatment than this book provides—replete with footnotes and bibliography, please reference my dissertation—available on my *drtomrhea.com* website. These "Electronic Perspectives" columns are a popularization of that research.

## Thank You!

---

Who are those who have facilitated the *possibility* of this book's production? First, a tip of the hat to **Jim Aikin**, editor of my "Electronic Perspectives" columns that appeared monthly in *Keyboard* magazine during 1977–1981. Those eponymous columns are the spine of this book, and define its limits, both temporally—not much past 1981—and in subject matter. This book isn't comprehensive—particularly given the mandated *keyboard* focus, but I've stretched its scope well beyond those columns. Jim never made an edit that didn't improve my prose. Reckon we knew we were birds of a feather upon discovering that each of us knew how to use the verb "comprise" properly! ("Compose" and "comprise" are *not* synonyms.) Thanks, Jim.

**Mark Vail**, author of *The Synthesizer: A Comprehensive Guide to Understanding, Programming, Playing, and Recording The Ultimate Electronic Musical Instrument*, and other seminal books in the field, provided all the editions of *Keyboard* magazine that featured those 52 "Electronic Perspectives" columns. Mark sent those magazines to my dear friend and *uber-tech* **Stephen Masucci**, restoration expert for all things analog, musical, and electronic: synthesizers, instruments, recording consoles, amps, etc. Steve hand carried those magazines to **Wally De Backer** (stage name **Gotye**), for whom Steve has restored numerous Georges Jenny Ondiolines (see text), electronic percussion devices, and some very arcane instruments. Wally, who has published incredibly accurate and beautiful research in the field under the aegis of *Forgotten Futures*, has generously taken an interest in my historical research. He commissioned **Mike Buffington** to scan and clean up those "Electronic Perspectives" columns, which he did—meticulously. **Larry Fast** and **Brian Kehew** wrote insightful Forewords for this book. Many thanks to all of you.

Beaucoup thanks to **David Mash**, renowned educator, superb musician, and Wizard of all things musical and technical. He hired me initially as his Assistant Chair, and then ensured that I stayed on as a faculty member for some 30 years, even though we were both alpha males who didn't immediately realize just how much we were and *still are* in agreement. But for David, I wouldn't have my defined benefit retirement that makes it possible to fool around putting books such as this together. I hope to at least break even with this enterprise. If not, it's still a Zen-like mission, something that *ought to be done*. I can presently *afford* to create this book (and likely lose money in the bargain) thanks to you, David.

Special thanks to **Brian Kehew**, coauthor of the inestimable tome *Recording The Beatles*, famed audio restoration and remastering artist, and author of other landmark publications. Brian asked **John "Captain Nemo" Blackford** to dummy up some cover suggestions for this book prior to my even starting the process of production. John's ideas via Brian inspired me to actually get going on this formidable task and are the basis of the photo array on the front of the slipcover. Of course, Brian is also Curator and Producer of the audio portions of this publication—which may turn out to have greater value than the printed matter. **Brian Kehew** and **Wally De Backer** have digitized essentially all of my archive of audio interviews of pioneers, photographs, writings, and other artifacts. I hope to present these materials on my website in future. Maybe it only seems to take a village—perhaps it just takes a coterie who *burn with brilliance*.

Warmest thanks to **Wendy Carlos**, with a special shout out to **Annemarie Franklin**, for providing unique photographs, extending great wisdom, and for sharing our laughs—through clenched teeth—about the Comedy of Humanity.

Many people contributed to the nuts and bolts production of this book. First and foremost, my then-undiscovered gem of a graphics artist (and musician) **Joseph Bastardo**, who designed every page in this book. He pulled rabbits out of hats, often as we sat side by side creating layouts. Joe scanned and enhanced hundreds of artifacts for this project. His fastidious restorations of photos and graphics brought tired images—seen in all too many places—to sparkling new life. His layouts seem to intuitively manifest what Susanne K. Langer calls *significant form*. His eye for detail, indefatigable energy, and thorough mastery of pertinent tools mark him as a true graphic arts professional.

For the record, a few typos, dates, and grammatical errors in the original "Electronic Perspectives" columns have been corrected. This publication represents the definitive versions. A few magazine pages and other images have been edited for historical accuracy. **Joseph Bastardo** made these quite difficult adjustments seamlessly!

**Peter Donhauser**, renowned authority who wrote *Elektrische Klangmaschinen: Die Pionierzeit in Deutschland und Österreich* and *Musikmaschinen: Die Geschichte der Elektromusik* revealed the mysteries of accessing German Archives and making contact with those Archivists. **Joel Chadabe**, author of *Electric Sound: The Past and Promise of Electronic Music* has provided invaluable insights perennially about the entire field. **Gayle Young**, author of *The Sackbut Blues: Hugh Le Caine, Pioneer in Electronic Music*, provided valuable guidance to Canadian Archives. **Daniel R. Wilson** brought new facts to light about Futurism and the Intonarumori. **Fred DiLeone** of Vintage Vibe Pianos and **Jon Borducci** of Tropical Fish Vintage Instruments commissioned new photographs of vintage Wurlitzer and Rhodes electric pianos (photo credits in text). **Mike Buffington** and **Andy Baron** provided brilliant photographs, and incredibly detailed information about Leon Theremin and his instruments. **Pril Smiley**, who was there, provided insight into the RCA Synthesizer and its group of composers. **Irwin Chusid** provided voluminous information on all things Raymond Scott and Sun Ra. **Rosalind Hall** was especially kind in providing insights into Australian Archives and the process of gaining permissions to print. **Christophe Duquesne**, **Lippold Haken**, and **Edmund Eagan** provided photographs of the Onde, Pyramid, Haken ContinuumMini, and Eagan Matrix Expander. **Naoyuki Omo** provided photos of his latter-day ondes Martenot, the Ondomo. Thanks to **Dave Brown** for the rare photo of the Raymond Scott Motown Electronium. Thanks to **Douglas Burnett Cross** for information about his uncle Burnett Cross. Special thanks to **IONE** and **Maggi Payne** and **Rick Smith** for providing photographs of Pauline Oliveros and Buchla instruments. Thank you, **Priscilla** and **Barton McLean**, for generously sharing artifacts from your long careers together. **Doug Jackson**, Hammond organist and aficionado, gave me invaluable hard copies of Hammond Company memorabilia that **Alan C. Young** had shared with him. Thanks to **Matt Traum** for assistance in garnering images of wind synthesis pioneers. Thanks to **Milan Guštar** for his comprehensive *Elektrofony I & II* books in Czech that detailed USA patent numbers for a variety of instruments. Major kudos to **Jean Laurendeau**, author of *Maurice Martenot, luthier de l'électronique*, who has helped not only this effort, but the entire field to gain a better understanding of the ondes Martenot due to his publications, performances, and pedagogy. Thank you **Douglas** and **Régine Heffer** for assistance locating French publications. **Frederik Adlers** graciously lent me Harold Rhodes' *Sit Down and Play* ([www.fenderrhodes.com](http://www.fenderrhodes.com)). **Ian Helliwell**, author of *Tape Leaders*, clarified information regarding British composers of electronic library music ([tapeleaders.co.uk](http://tapeleaders.co.uk)).

# Introduction and Acknowledgments

I've been fortunate to know a number of the early pioneers and figures in the field, and have interacted significantly with some of them. They've kindly given me many photographs and graphics. My heartfelt thanks for this largesse to: **Milton Babbitt**, **Harald Bode**, **Edith Borroff**, **Donald F. Buchla**, **Wendy Carlos**, **Joel Chadabe**, **Emmett Chapman**, **Irwin Chusid**, **Suzanne Ciani**, **Burnett Cross**, **Hugh Davies**, **Wally De Backer**, **Peter Donhauser**, **John Eaton**, **Gerry O'Grady**, **Lejaren Hiller**, **Brian Kehew**, **Earle L. Kent**, **Gershon Kingsley**, **Hugh Le Caine**, **David A. Luce**, **Max V. Mathews**, **Benjamin F. Miessner**, **Abraham Moles**, **Robert A. Moog**, **Harold Rhodes**, **Curtis Roads**, **Clara Rockmore**, **Oskar Sala**, **Eric Siday**, **Pierre Schaeffer**, **Walter Sear**, **Jim Scott**, **Raymond Scott**, **Nyle Steiner**, **Robert J. White**, **Alan C. Young**, and **Gayle Young**. In several cases, I've been able to reciprocate by providing resources for their publications. Some of these people have passed on, and their artifacts are now located in formal archives and institutions. I've tried to indicate current provenance for such, even though I often have a copy that was given to me personally. I've possessed some of the photographs and graphics that appear in this book so long, I frankly can't recall who gave them to me. As someone who deeply respects intellectual property, I invite surviving family members, and such institutions or archives to contact me if I've not provided proper attribution in this book.

Thanks to archives, museums and others for access to images: **David Gleason** and **Frank Berry** for access to magazines (worldradiohistory.com); **Uncle Sam** for U.S. patents available by patent number at (patft.uspto.gov/netahtml/PTO/srchnum.htm); **Terry Smythe**, **Michael Kukral**, **Keith Bigger**, and **Glenn Thomas** (The AMICA Bulletin); **Sue Verzella** and **Warren Ashworth** (Nineteenth Century Magazine, Victorian Society of America); **Arian Sheets** (Witten-Rawlins Label Collection, National Music Museum, The University of South Dakota); **Margaret Downie Banks** (Conn Archive, National Music Museum, The University of South Dakota); **Edith Borroff** (College Music Society Symposium); **Carolyn Grant** and **Jonathan Piper** (Museum of Making Music); **Caroline Haas** and **Anne Biber** (Technisches Museum Wien); **Lesley Ruthven**, **Jade Leonard**, and **Mick Grierson** (Daphne Oram Trust, Goldsmiths, University of London); **Andria Hoy** (ClevelandOrchestraArchives); **Robert Sherman** (The Nadia Reisenberg and Clara Rockmore Foundation); **Mike Buffington** and **Andy Baron** (RCATheremin.com); **Zoe Webb** (Redpath Chautauqua Collection, University of Iowa Libraries); **Vincent Pupillo Sr.**, **Vincent Pupillo Jr.**, **Drew Raison** and **Benjamin Luce** (EMEAPP: Electronic Music Education and Preservation Project); **Michelle Moog-Koussa** (Bob Moog Foundation); **Jean Laurendeau** (Document famille Martenot, Document Ginette Martenot-Lazard, Document ADDOM); **Michel Ferland** (ATMA Classique); **Valerie Jackson**, **Kurt Cripe**, **Daniel Fisher**, and **Chuck Surack** (Sweetwater Sound); **Peer Bode** and **Rebekkah Palov** (Institute for Electronic Arts, School of Art and Design, NYSAC at Alfred University, Alfred, NY); **Peter Weibel** (Harald Bode Archive, Zentrum für Kunst und Medien (ZKM), Karlsruhe, Germany); **Gerhard Steinke** (Gerhard Steinke Archive); **Wally De Backer** (Forgotten Futures); **Anna Krutsch** and **Irene Püttner** (Deutsches Museum, München, Archiv); **Marcel Ruhl** (Stiftung Deutsches Technikmuseum Berlin, Historisches Archiv); **Martina Müller** (Fraunhofer Heinrich Hertz Institute Berlin); **Matt Traum** (Patchman Music); **Annekatriin Förster** (August Förster GmbH); **Jeroen van der Schaaf** (Basta Music); **IONE** (The Pauline Oliveros Trust); **Heather Gaunt** (Grainger Museum Collection, University of Melbourne); **John Leimseider**, **Don Kennedy**, and **Claire Neily** (National Music Centre, Canada Science and Technology Museum); **Stan Warnow**, **Deborah Scott Studebaker**, **Carrie Makover**, and **Liz Adam**

(Reckless Night Music LLC); **Rick Smith** (The Buchla Archives); **David Vallancourt** and **Mindy Farabee** (Columbia University Engineering); **John Bewley**, **Cory Jacob Davis**, **Scott W. Schwartz** (Sousa Archives and Center for American Music, University of Illinois at Urbana-Champaign); **Roanne Wilcox** (Caramoor Center for Music and the Arts); **Jody Kravitz** and **Robbie Rhodes** (Mechanical Music Digest); **Emmett Chapman**, **Dan Chapman** and **Yuki Chapman**, **Greg Howard**, **Jim Reilly**, and **Bob Culbertson** (Stick Enterprises www.stick.com); **Maximilian Zauner** (Wienbibliothek im Rathaus).

Heartfelt thanks from Joseph Bastardo and me to **Hal Belmont** of ARTRON Printing of America for production & printing guidance.

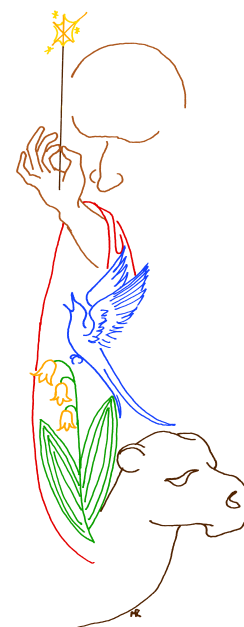
Many thanks to the late **Donald F. Buchla**, who pointed out to me—as we sat at his kitchen table—the desirability for authors in the field to write about what they *know*, rather than trying to write yet another primer or “comprehensive” text. Thank you, Don.

Thanks to: **Michael Lehmann Boddicker**; **Joel Chadabe**; **Irwin Chusid**; **Wally De Backer**; **Brian Kehew**; **Michelle Moog-Koussa**; **Laurie Spiegel**; and **Rick Wakeman** for “advance praise” quotes.

Loving thanks to my wife **Muriel Louise Palmer Rhea**—to whom I've dedicated this publication—for understanding why I had to get this done—even if it may not make sense in strictly financial terms.

Thunderous applause to all, I literally wouldn't and *couldn't* have done it without you! Of course, errors or oversights caused by cracks due to my lack of understanding or diligence are on my head alone. Wabi-sabi. Cracks are how the light gets in (as per **Leonard Cohen**).

I'm a fan of **Carl Gustav Jung** (excepting the astrology), and I suspect that *Electronic Perspectives* didn't happen accidentally. It took a lot of *synchronicity* and serendipity. Perhaps it *does* take a village. But the critical factor that determines the *excellence* of any enterprise is: exactly *who* are the people in the village? My grateful thanks to all the generous and talented people who populated my village in order to make this publication possible. Like Muriel and me, all of you will get your reward in, uh . . . Heaven.





## Thank You!

---



This book is dedicated to my wife Muriel Louise Palmer Rhea.  
Singer-songwriter, graphics and textiles artist, adult ice skating competitor and Coach.  
She writes the songs that make my heart sing.

*Synguru Graphic (opposite page) © Muriel Louise Palmer Rhea  
First published in Front Street Trolley 1976 Nashville, TN—original in B&W  
Colorized by Joseph Bastardo in 2017*