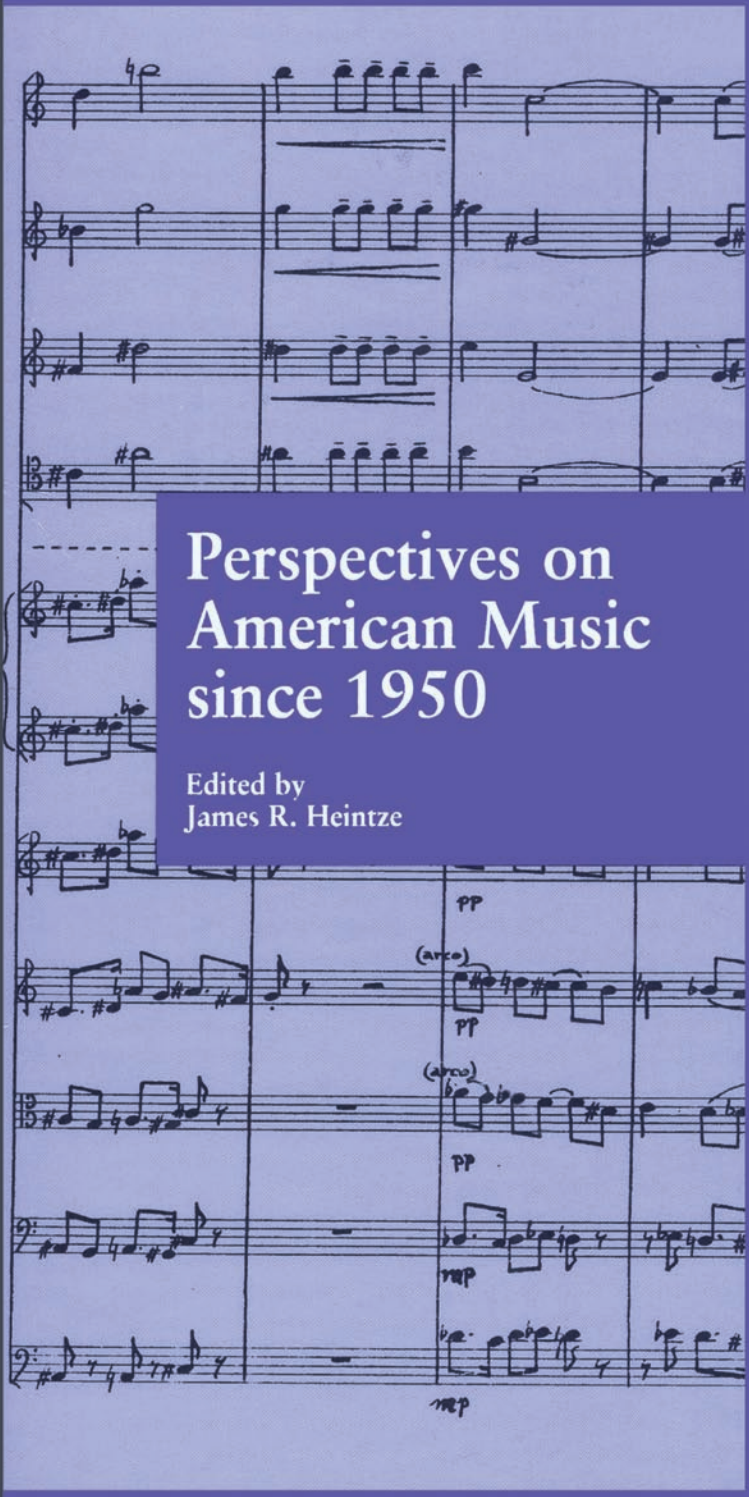
Perspectives on
American Music
since 1950
Edited by
James R. Heintze
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Perspectives on American Music since 1950

ESSAYS IN AMERICAN MUSIC
VOLUME 4
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Essays in American Music

James R. Heintze and Michael Saffle, *Series Editors*

American Musical Life
in Context and Practice
to 1865
edited by James R. Heintze

Music and Culture
in America, 1861–1918
edited by Michael Saffle

Perspectives on American
Music, 1900–1950
edited by Michael Saffle

Perspectives on
American Music
since 1950
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Contents

Series Foreword

Essays in American Music celebrates the rich and varied heritage of this country's music by bringing together articles written by distinguished scholars about significant and unique events, persons, places, and compositions. It continues a tradition in the historiography of American music that dates to the mid-1800s when the first calls went out requesting that information about American music be collected so that a history of the music of this country could be written.

> We have been for some time engaged in collecting materials for a series of papers upon this subject, which are intended to embrace a General History of Music in this country, from the settlement of Plymouth to the present time. Doubtless there are many who can render us important assistance in this undertaking, by forwarding all the information they may possess, which has any bearing upon the matter in question. We should be happy to receive from our friends throughout the country, any particulars relating to music they may be able to furnish—either statistical or anecdotical—which will aid us in carrying out our plan.
>
> *Musical Review*, 23 May 1838, 35.

The historiography of American music has advanced considerably since those first attempts to codify this country's musical heritage, although the importance of individual efforts in gathering and reporting that information remains the same. Today readers may choose from a vast body of literature on American music, including several excellent histories and surveys, numerous critical studies and facsimile editions, monographs on individual musicians, topical studies, and reference works (including bibliographies, indexes, encyclopedias, and

dictionaries) as well as articles in journals devoted specifically to American music. Yet the content of the topics addressed in the essays contained in this series offers evidence for the fact that there is still much to discover about this country's musical past. The purpose of this series is to provide a sampling of areas of research currently under pursuit and, nearing the onset of the twenty-first century, to provide a stimulus for future research into American music.

The volumes in the series progress chronologically. Volume One covers the period prior to 1865. Volume Two focuses on the period 1861–1918; and subsequent volumes examine the remainder of the twentieth century. All of the contributors to the series are recognized authorities in their respective areas of investigation and represent prominent organizations devoted to the study of American music, including, for example, the College Music Society, the Sonneck Society for American Music, the Hymn Society in the United States and Canada, and others. Within the space allotted to them, all contributors have provided essays on topics of their choice and were encouraged to apply their own critical points of view.

James R. Heintze
Michael Saffle

Introduction

Perspectives on American Music since 1950 reflects the broad range and diversity of the American classical and jazz idioms of the postWorld War II era. Throughout the period, new musical ideas, expressions, and explorations emerged that led composers and musicians in unprecedented directions. The essays comprising the present volume are arranged by subject in roughly chronological order, although references refer as well to the 1940s.

Lloyd Ultan presents a survey of electronic music from the 1950s to the present shedding light on the use of new technology, as well as key composers and musical works.

The compelling, brilliant music of Elliott Carter is examined by Jeremy Beck with a study of the tonal practice of one of the composer's early vocal works, *The Rose Family*, written in 1942. An analysis of Carter's early techniques for composing "appear to point toward some of his later developments," and may provide a better understanding of Carter's overall approach.

Louis Goldstein discusses how disparate influences—painters' techniques, "irregular symmetrical" patterns woven in Asian rugs, and the concept of time—may have helped free Morton Feldman from using predictable and controlled elements in his compositions, thereby enabling him to rely on his sense of instinct.

Johanne Rivest discusses the limits of indeterminacy in John Cage's *Concert for Piano and Orchestra* and concludes that contrary to his intentions, pure indeterminacy was not obtainable by the composer.

American experimental music was a dynamic force in American contemporary music after 1950, yet a simple consensus definition of what it is has not been proposed. Alex J. Lubet examines the nature of

this music, identifies its composers and influences, and brings this idiom into focus.

The American musical tradition of the second half of the twentieth century was a significant force in helping to shape American society. Some musicians played important roles in that process. Michael Meckna examines Louis Armstrong as an African-American spokesperson and cultural ambassador.

Bassist Brian Q. Torff examines the life of jazz pianist Mary Lou Williams from his unique vantage point of having performed extensively in concert with her. He shares his experiences and introduces Father Peter O'Brien who, perhaps more than anyone else, has worked tirelessly to preserve the Williams legacy.

David Diamond is an outstanding and prolific composer of chamber music. James R. Heintze provides a survey of the composer's ten quartets with special attention to the premiere at American University in 1966 of String Quartet No. 10.

Mickey Thomas Terry explores the cultural perceptions of African-American organ literature and the need for more performances and publications in this important genre.

Bonnie Hedges introduces Emerson Meyers, an eminent Washington composer, conductor, pianist, and teacher, and provides the first printed catalogue of his personal papers.

Keith Ward provides a comprehensive and poignant look at the musical works and recordings that have been created in response to HIV and AIDS, and concludes that the music is a powerful testimony of twentieth-century American society.

David DeVenney provides a sequel to his study of American choral music published in 1993 as he examines important works written since 1985.

Milton Babbitt, one of the most important composers of his day, is still musically active in his eighties. Andrew Mead writes about Babbitt's more recent compositions and concludes that "this is music that rewards listening."

New Orleans is considered by many to be the Dixieland jazz capital of the world. However, John H. Baron reminds us that an examination of the musical heritage of New Orleans should also include a study of the city's classical music. The author introduces five outstanding contemporary New Orleans composers.

My sincere appreciation is extended to Michael Saffle of Virginia Polytechnic Institute and State University for his suggestions and

support, to all of the contributors who graciously answered my call for essays, and to the staff of Garland Publishing for making this book possible. Thank you as well to the Historical Society of Washington, D.C. for allowing me to reproduce materials from their collections, as well as all of the publishers and individuals whom I have acknowledged individually below the illustrations printed in this volume.

James R. Heintze

Perspectives on American Music Since 1950

CHAPTER 1

Electronic Music: An American Voice

Lloyd Ultan

Electronic music is as American as the Broadway show, jazz, and rock and has a history comparable in time frame to these sister American musical arts. Its development has been as rigorous, whimsical, and energetic as most things distinctly American. Its styles are as diverse as the myriad of composers who have contributed to its literature. Of all forms of music that have flourished in this country, among both laypersons and professionals, electronic music may be the least understood and least widely recognized for the vital artistic and cultural statement its cumulative output represents.

THE DEVELOPMENT OF ELECTRONIC MUSIC

To fully understand the significance and implications of the assertions put forth in the preceding paragraph, a brief history of technological developments (mostly American) that made this art form possible should prove helpful. The first recorded efforts to apply electricity to the production of music, however, comes from France in the mid-eighteenth century in the form of an electric harpsichord developed in 1759 by Jean-Baptiste Laborde. Not a practical performance instrument, it consisted of a small keyboard attached to a glass globe on which the performer placed a hand. Movement of the performer's hand across the globe created static electricity, which in turn was translated into electrical impulses that activated small glass bells—a fragile sound that provided the instrument little relationship to the harpsichord (except perhaps for the use of a keyboard as the triggering device).

Alexander Graham Bell's discovery in 1876 of the possibility of transmitting sound (the voice) by means of electricity became the first powerfully tangible motivating force in the long path of developments that would bring us to the level of technology that we currently enjoy (and we must quickly assert that even today we are in a relative state of infancy in the development of this art form and its technological resources). His discovery was followed by only two years (1878) by Thomas Edison's development of the phonograph, the first in a long line of record/playback devices that ultimately became central to a large proportion of electronic music.

These two developments were followed in rapid succession by discoveries by a parade of Americans who provided all the foundations for the emergence of a vast electronics industry, which, ultimately, has changed almost everything we know in our daily existence. In 1898 Thomas Edison brought a new dimension to his phonograph by designing a stereo version (with two horns protruding to provide the sound for each of the channels). In 1906 Lee De Forest invented the triode, a vacuum tube making amplification possible. Prior to his work, efforts at the development of a variety of pieces of equipment for the use of electricity in producing music (e.g., Thaddeus Cahill's Sounding Staves and the effort at a first wire recorder, Vladimir Poulen's Telegraphone, in 1898) were frustrated by the lack of ability to amplify the sound to comfortable listening levels. Also in 1906 Cahill tried a major commercial venture to bring electronically generated music into the home (through telephone lines—not having other amplification yet available) and invented the Dynamaphone, a "thirty-ton monster" mounted on railroad cars in Connecticut, on which music was performed by teams moving a variety of devices to control the electrically generated sounds produced.

Early electronic music devices were developed in Europe—the Theramin (by Leon Theramin, in 1919); the Ondes Martinot (by Maurice Martenot, in 1928); and the first prototype of a synthesizer, using four oscillators and punched paper cards—not unlike a player piano—developed in 1929, in France, by A. Givelet and E.E. Compleaux. However, the first major electronic musical instrument that had a very long lasting impact—to the present—was the Hammond organ, developed in 1928 by Laurens Hammond in Minneapolis. In 1932 stereo recording took a major leap forward when Bell Labs recorded the Philadelphia Orchestra, with Leopold Stokowski conducting. Although the technology was offered to RCA for

marketing at that time, the impact of the depression of the 1930s on the projected market dissuaded officials at RCA from proceeding. A tangential effort at producing music electronically was developed by Norman McLaren in 1939. This was a technique called "drawn sound," in which carefully controlled patterns were "scratched" on film.

The one traditional instrument that experienced the most dramatic changes resulting from the growing electronic technology was the guitar. This gentle, subtle, intimate instrument was transformed into a powerful, assertive, and extremely flexible musical device beginning with the first successful "pickup" that was developed for the Hawaiian lap steel guitar (the "Frying Pan") in 1931. Guitar use of electronics, first for amplification and then for greater tonal and dynamic versatility, became an important part of the technology of electronic music with the first solid-body electronic guitar, the "Broadcaster," marketed by Leo Fender in 1948. The Fender guitar signaled the growing popularity of the electronic instrument for solo playing and as a featured instrument in a wide variety of bands. This growth resulted from the new equality provided by the enormously expanded dynamic and coloristic range and the dramatic redesigning of the basic instrument. The guitar could now compete comfortably with the loudest of the brass, wind, and percussion instruments while retaining its capacity for delicate, expressive, and sensitive playing.

DEVELOPMENTS: 1950 TO 1970

Recognizing the indispensable contributions of the preceding inventions and the extended period of development of the basic resources for electronic music, the true explosion of creative activity exploring these resources as a new potentially highly expressive artistic medium essentially began in the early 1950s. The tape recorder, developed by the Germans during the Second World War, started to become commercially available, and compositional experimentation with an array of devices used in various other electronics (e.g., oscillators, filters, and various modulators), which were recognized to have potential for musical sound generation and modification, was pursued with considerable interest. The first significant electronic compositions (which will be discussed below) employing this early stage equipment, date from 1951–52.

One of the most significant technological steps that was taken at this time was the design and construction of the first major synthesizer

in 1955, the RCA Mark II developed by Harry Olson and Herbert Belar. The synthesizer was installed in 1959 at the Columbia-Princeton Center for Electronic Music (on the campus of Columbia University), one of the earliest and most renowned centers for the creation of and experimentation with electronic music. Many of the most important composers of the period worked at this studio on the Mark II. The synthesizer required several walls of equipment and occupied one good-sized room, with a control panel strategically placed. It employed punched cards in a manner similar to the 1929 synthesizer prototype described earlier but was significantly more sophisticated in the numbers and variety of components it provided and thereby the greater ease of achieving sophisticated sounds and sound relationships.

Although computers in rather primitive form were around since the 1930s, the technology to make music through computers was not developed until the 1950s and beyond. The first high-speed digital tape recorders were developed in 1956–57. These recorders operated at approximately 100 inches per second, a speed required by the large amounts of data that had to be processed in "real time" for the design and production of sound on computers. At the same time, Max Matthews, working at Bell Labs, developed MUSIC 1, the first computer language for producing music. He subsequently worked on refining the computer's ability to respond to the substantial and complex requirements of music in a series of programs called MUSIC 2, MUSIC 3, MUSIC 4, and MUSIC 5.

Another area of electronic music technology, voltage-controlled analog synthesis, was developed by Robert Moog, working out of Trumansburg, New York. First marketed in 1965, the Moog synthesizer featured a sturdy, easy-to-use design and a comparatively modest price. It rapidly found form in various self-contained, even modestly priced synthesizer packages, and competition for the rapidly expanding market became vigorous. The Moog synthesizer was quickly followed by the Buchla (developed by Donald Buchla in California), the ARP, and an array of others from Europe. Each of these had its own distinctive characteristics (e.g., the moisture-sensitive touch plates used instead of a keyboard for triggering sounds or sound events on the Buchla, and the matrix configuration of the ARP) which contributed and responded to differing aesthetic preferences.

During this same period other components required for the successful creation and production of electronic music continued to be refined and modified, providing for much finer quality and more

flexibility in the realization of compositional ideas. The tape recorder grew from a monophonic device of mixed reliability (e.g., in speed fluctuation) to a stable, multitrack discrete channel recording and playback system with several noise reduction options. Tape used in recording was originally coated paper that could break easily, but over time, tape quality was improved through the introduction of mylar, which had a tendency to stretch under tension-distorting recorded sound, and polyester which proved to be stronger and far more reliable. Also during this period, the microphone went through considerable development, with a variety of different types becoming available. The differences included directionality (unidirectional and bidirectional) and degrees of sensitivity defined by the construction and materials used (crystal, dynamic, condenser, and ribbon microphones). These components—tape recorder, tape, and microphone—are central to the electronic music of this period. The music could not have existed without them and was substantially improved and facilitated as they improved. Together with the synthesizers and other miscellaneous equipment (e.g., mixing panels and splicers), they constituted the daily working tools of the electronic composers active between 1950 and 1970. Although they continue to be important devices in today's composers' toolbox, in part they have been supplemented or supplanted by other equipment developed after 1970.

THE MUSIC

Although the above review of the history of the development of the technology required for electronic music reveals a very strong American contribution and reflects the inventiveness and ingenuity often associated with this society, ultimately it is the resultant music that is important. In the traditional orchestral, operatic, and chamber music arenas, there has been something of an inferiority complex rampant in this country, characterized by a strong sense of intimidation by the well-marketed masters of European heritage. Figures like Beethoven, Mozart, Brahms, Verdi, and Wagner have assumed a posture that is bigger than life. Brilliant and irreplaceable as these and many other compatriot composers are, every culture and every time has room to contribute artists of equal stature although their modes of expression and languages may be very different. There are many composers of our time and our culture, different as they may be from the European traditions, who are deserving of equal credit and

attention. These include composers as different in musical voice as Leonard Bernstein, Aaron Copland, Elliott Carter, Alan Hovhaness, William Schuman, and Steve Reich. Each of these composers represents a very personal style that speaks from and to the growing diversity in and the distinctive characteristics of America.

Equally as significant as the cultural differences between Europe and America, and the manner by which they were manifested in the music, is the time when American music started to come of age. The world itself was changing dramatically during the period 1950 to 1970. It was a time of cultural cross-fertilization, new aesthetic values, along with many other value reassessments, and new social perceptions and needs. Changes that occurred during the movement of American music out of its adolescence were significant and had a profound impact on the new audiences thirsty for the concert experience. In effect, the aesthetic expectations of the eighteenth and nineteenth centuries were celebrated and set apart from those emerging through the twentieth.

Rather than recognizing the importance of the new works of art that were commenting on and challenging the conditions of the world from which they were emerging, however, some critics and audiences at the time placed these new musical forms in competitive juxtaposition with the earlier traditions and, because these new forms were different and more socially or politically (and certainly aesthetically) challenging, found them wanting. This critical reaction was especially exacerbated by the growing dependence of the large professional performing ensembles on business management and marketing—the more comfortable, and easier to understand the icons were, the easier they were to sell and the more security they offered for the bottom line. The new forms did not offer this financial security and therefore were not immediately welcomed into the musical repertoire.

It should come as no surprise that a music that is at times totally dependent on an entirely new sound vocabulary would at first face extraordinary obstacles in gaining acceptance. Such acceptance is always based on familiarity, understanding, and extensive exposure to the broad musical language as well as the distinctive characteristics inherent in any single work. It does not come easily. Electronic music was essentially born at a time when artistic and intellectual interests, as most others in American society, were intoxicated by the rigors and precision of science and the exhilaration of freedom of expression. Two extreme approaches resulted: compositions in which the highest

possible levels of control were exerted, and compositions in which the greatest amount of freedom possible was the pervading principle.

Both of these approaches had their roots in the early twentieth century and were extremely clear and accurate reflections of the tenor of their time. Following the Second World War and the achievement of atomic power, American society virtually worshiped science. At the same time, there was an increasingly louder voice asserting equality and freedom among races and between genders, with an array of challenges of prevailing values and attitudes thrust forward. Art in general reflected society's mood and conflicts and, in its own way, played a forceful role in the debate. Electronic music was in the unique position of being in its infancy and groping for its own standards of excellence simply as a workable mode of expression while being perceived by some as the exemplar of what was good and bad about new music. The techniques were so crude in the early stages that the composers' primary goal at the time was to simply get a composition put together that had some credibility as music—by whatever definition (and the available definitions had become quite numerous and diverse during this turbulent time). A closer look at the works introduced during the period 1950 to 1970 will help in understanding these views.

The first concert of electronic music in the United States occurred on 9 May 1952 at the McMillin Theater at Columbia University. Presented were works by Vladimir Ussachevsky and Otto Luening as individual and collaborative composers. In *1952 Electronic Tape Music*, the two composers revealed the early approaches taken to this new medium and the problems they confronted. The complexity ("agony" may be the better word) of the process was described by Ussachevsky who spoke of the "urgent borrowing of equipment . . . the hundreds of decisions on how and where to edit, how to 'mix' it all, to cut tape (often bravely)."[1] In his essay Ussachevsky went on to relate the hundreds of splices necessary, the experiments with recording techniques, the difficulties trying to synchronize several tape recorders, and the many other challenges that were faced. The works themselves—*Sonic Contours*, *Incantations*, and *Fantasy in Space*—used acoustic sounds (piano, voice, flute) as their basic materials. These were manipulated in a variety of ways (e.g., speed changes, cutting and splicing, and electronic distortions, such as feedback) to produce the final work. This type of electronic music (using and manipulating natural, or acoustic, sound), called *musique concrète*, is typical of the early electronic music that was produced both in the United States and

in Europe. The subject matter, as reflected in the works' titles, has a certain degree of whimsy about it, essentially suggesting that the works are not dealing with philosophical issues but are descriptive of ideas or moods perhaps a step beyond studies or études. Although scores were provided for these works, Ussachevsky made it clear that "a good deal of the time conventional notation [was] stretched to the utmost to represent what [was] happening on tape." In fact, he pointed out that "the *raison d'être* for the score . . . was a desire to secure the protection of statutory copyright in the United States . . . ."[2]

Ussachevsky and Luening, both of Columbia University, shared the directorship of what was to become the Columbia/Princeton Center for Electronic Music with their colleagues from Princeton, Milton Babbitt and Roger Sessions. The center became a very active place, operating at times on a twenty-four-hour-a-day basis. In addition to these four, composers from around the world worked there from its earliest days, including Mario Davidovsky (Argentina), Halim El-Dabh (Egypt), Bülent Arel (Turkey), and Charles Wuorinen and Charles Whittenberg (both Americans). The installation of the RCA Mark II synthesizer stimulated a completely different compositional approach. The possibility for generating sounds electronically (rather than depending on acoustic sounds as the source materials), the options the Mark II provided for sound manipulation, and the high degree of precision and speed it was capable of providing for sound events and sound synchronization opened up new vistas to the composers and attracted artists with different aesthetic values. Milton Babbitt would compose a number of important works on the Mark II, and Charles Wuorinen would go on to win the first Pulitzer Prize for an electronic composition (*Times Encomium*, 1970) with a work done at the center.

Babbitt's earliest contribution in this medium from the Mark II was simply entitled *Composition for Synthesizer.* It is representative of much of Babbitt's artistic commitment (in acoustic and electronic works)—dependent on precise mathematical organization and a rich palette of sound color. Quite far removed from the more romantic views reflected in the works (and titles) of Ussachevsky and Luening, Babbitt's work provided an exemplary reflection of one of the extreme postures of the time—highly intellectual and mathematical, devoid of overt emotional content, and approaching and challenging the limits of human perception. This was music from and for the laboratory rather than music to excite one's senses and alter one's metabolism rates. Yet Babbitt's disciplined approach and the enormous intellectual prowess

that he brought to his work immeasurably contributed to increased understanding of the possibilities inherent in this new medium and defined ways by which the complex issues embodied in dealing with sound and electronics would have to be addressed.

Though not a prolific composer, Babbitt created a number of substantial works on the Mark II including *Phonemena* (1970), a piece that he composed in two versions—one for voice and tape, the other for voice and piano. This is one of the few times that a composer provided both an electronic and an acoustic version of a work. It is also in a genre not typically associated with Milton Babbitt, that is, work for tape to be performed in real time with a performer working with acoustic sounds (in this case, voice). The similarities between the two versions are clear and striking in those aspects we would expect—contours, rhythmic relationships, and general character. The differences are even more striking, as might be expected, in the use of sound color—the piano being essentially monochromatic and the synthesizer being virtually infinite in its coloristic capabilities. It is interesting to the author that the many people he has witnessed who have heard these two versions are almost evenly split in their preference.

Another work of Babbitt's that deserves mention in this context is his *Occasional Variations* (1971). This tape piece follows in the stylistic tradition that Babbitt had long since established before it was commissioned. What is noteworthy about the piece is the venue for which it was composed and the imagination and daring of the person commissioning the work. *Occasional Variations* was commissioned by Katherine Jouett Shouse, who was responsible for establishing the Wolf Trap Farm Park for the Performing Arts, the first such park in this country, in Vienna, Virginia. A forward-looking champion of the American creative artist, Katherine Jouett Shouse wanted the park to look toward the future as part of its commitment. (This work will be discussed at greater length below.)

Charles Wuorinen received his academic training at Columbia University studying with Ussachevsky and Luening and went on to become an extremely prolific composer in virtually all genres. One of his significant works is *Time's Encomium*, commissioned by Nonesuch Records and composed at the Columbia-Princeton Electronic Music Studios between 1968 and 1969. Wuorinen used the RCA synthesizer at the center for the basic materials of the composition but turned to the analog sound processing resources of the center that developed through the 1960s. In his liner notes on the recording released by Nonesuch, he

points out, "Thus the work consists of a core of synthesized music, most of which appears in Part I, surrounded and interlarded with analog-studio transformations of that music."[3] Here, Wuorinen clearly lays out the structure and concept of the work. In doing so, he also relates a specific characteristic of the RCA synthesizer, showing why it was so very well suited to composers like Milton Babbitt and others working with the twelve-tone equal-tempered scale and the rhythmic precision that it was so well designed to handle. At the same time, his remarks reveal the expressive limitations inherent in the system and the need to turn to other analog equipment developed in the years following the installation of the RCA unit at Columbia. The Wuorinen work is an interesting example of a composer endeavoring to bring the two worlds of electronic equipment and composition together, although the piece clearly reflects its overwhelming dedication to and derivation from the order and control mode of compositional thinking prevalent at the time.

With the exception of Babbitt's *Phonemena*, we have not considered the idea of electronically generated or modified sound being used in performance with other performers, whether vocal or instrumental. There were serious problems connected with the design of such compositions, since the acoustic performers were human and subject to the imprecision and instinct for interpretation inherent in performance, while the tape portion of such compositions was rigid and not subject to bending of time (and, at best, awkward in any effort to bend dynamics). Stopwatches, a variety of cueing methods, and scores providing instructions when to turn the playback system on or off were used. Many works appeared that tried to address the problems of coordinating performers and taped compositions, since it was soon recognized that active instrumentalists or vocalists on stage were an important part of any concert setting—the "live" component gained increasing importance as the sterility of the atmosphere of strictly tape compositions became apparent. One very fine work composed at the Columbia-Princeton Center that was very successful in bringing the electronic box and the human performer together was Charles Whittenberg's *Electronic Study No. 2* (1962) for tape and string bass. Bertram Turetzky premiered the piece in Hartford, Connecticut, in 1964 and subsequently performed the work at least forty times. Like many other works done at the center, the piece employed the serial techniques prevalent at the time and was highly structured. At the same time, the composer quite consciously endeavored to weave the sounds of the tape

with those of the string bass, and a very complementary fabric resulted, giving the piece a unity and compositional integrity that contributed to a highly expressive work that communicated more quickly with general audiences than many of its counterparts. In the early stages, Turetzky used a stopwatch to perform the work but related later that he quickly came to "feel" the piece and found less of a need to use the watch. The give-and-take between the two partners in the work is such that at times it can be difficult to discern which is sounding at any given moment. It is very much in the spirit of chamber music in the traditional sense of the word. It is intimate, it communicates beyond the technology and the craft, and it provides for a dialogue between the performers.

Our discussion of the music to this point has focused on the work and personalities associated with the Columbia-Princeton Center. Because it is the first major center for electronic music in this country, and given the prominence of the composers associated with it, such extended attention is both appropriate and essential. The center and the composers who have worked there at one time or another have had a profound impact on the evolution of electronic music in this country and throughout the world. But, beginning in the 1960s, a large number of other composers, approaches, and centers emerged and contributed significantly to the increasing interest in electronic music both from the artistic and the technological points of view.

When Robert Moog introduced his voltage-controlled analog synthesizers in the early 1960s, several avenues opened up. First, the high quality of the equipment and its moderate price permitted many universities to establish studios, and a great many faculty composers and students moved into an area that was, for all practical purposes, not previously available to them at a level that would permit music of much sophistication to be created. The Moog synthesizers provided a vast world of possibilities and, being modular, each site could develop as complex a system as its motivation and finances would permit. Second, through the use of keyboard and ribbon controllers, the nature of the synthesizer was more performance oriented, allowing for (or subject to) the abilities or inadequacies of the individual performer. It allowed for additive and subtractive synthesis, with varying degrees of precision, and became a serious player in the new music scene of the time. Subsequently, recognizing market demand, Moog made other models available (e.g., the MicroMoog and the MiniMoog). These were more compact, less complex to use for the untrained, and considerably less expensive. The popularization of electronic music was clearly under

way. The electronic synthesizer became essentially something anyone could have in his or her home, band, or school.

In an effort to demonstrate the versatility and richness of possibilities available in this new medium, Wendy Carlos released several ingenious recordings of major works of the standard literature transcribed for synthesizer. In some instances she sought to emulate the sounds of the instruments that ordinarily would have played these works, and in others she reorchestrated them with a new electronic vocabulary. These *Switched On . . .* recordings (1960 and after) went a long way to popularize electronic music and to open the minds of the public and professional musicians to the possibilities inherent in this medium. Further contributing to the electronic music energy of the time, a Moog Quartet was established that toured the country, performing live on four Moog synthesizers. The Moog synthesizer also became a popular teaching tool in colleges and universities throughout the country, with programs of students' compositions prepared on the instrument increasingly more common.

At this time, another analog synthesizer was developed that, although it had essentially the same capabilities as the Moog, operated in a very different manner. That is, instead of using a traditional piano keyboard configuration for its principal triggering device, it employed moisture-sensitive pads that responded when contact was made. The Buchla synthesizer, developed by Donald Buchla, reflected the input of Morton Subotnick, a prominent composer. Although clearly a very fine synthesizer—as reflected in Subotnick's works—the Buchla was never manufactured in large numbers and never gained the popularity of the Moog.

Morton Subotnick's work represented a dramatically different compositional philosophy from that which prevailed among composers like Babbitt and Wuorinen at the Columbia-Princeton Center. His pieces reflected more programmatic content, presented itself as more intuitive, and in some respects might be viewed as closer to the Romantic tradition in music. Works like *Silver Apples of the Moon* (1967) and *The Wild Bull* (1968), followed by others (e.g., *Two Butterflies*, 1974), reflected similar compositional stylistic attitudes and were composed on the Buchla synthesizer. Like Wuorinen's *Time's Encomium*, they were commissioned and released by Nonesuch Records.[4] They were strictly self-contained tape (or, upon release, LP) compositions that through sound pictures presented the programs of their respective subjects (e.g., the poem *The Wild Bull*, which depicted

the life and environment of the animal). The sound imagery in *The Wild Bull* is very strong and evocative, the color range very broad, and the structure derived from the flow of the text of the poem. The extramusical source materials for Subotnick's ideas were clearly very important in the design of his compositions. This was confirmed in a talk presented by the composer about his *Two Butterflies* at the Composer's Residency Program, Wolf Trap Farm Park in 1971, in which he described in detail the structure of the wings of the butterflies and how the physical patterns of these insects were influential in the design of the composition.

Of the tape pieces of the period, the works of Subotnick, in this author's opinion, are possibly the most expressive, least cerebral, yet carefully conceived and composed, and communicative in the more traditional (emotional or sensual) sense of the word. Subotnick seemed less interested in creating "studies" (by whatever name) or the idea of experimentation than in composing music that had greater immediacy of communication while not compromising on artistic sophistication and integrity.

During this period, other forms of electronic music began to assert differing aesthetic interests and compositional techniques. There also were clear social concerns that began to attract the attention of composers, as reflected in the subject matter of their work. One example of a return to a form of musique concrète was the 1966 piece *Come Out* by Steve Reich. This work derived its materials from the recorded voice of a young man who was brought into a police station after having been arrested in a riot. He spoke of "squeezing the bruise to let the blood come out to show them" (apparently the police paid more attention to those who were bleeding). The phrase "come out to show them" became the sole sound material for Reich's piece, which was essentially based entirely on tape manipulation. Several channels of the tape, each repeating the subject phrase continuously, were played simultaneously, with the channels gradually going out of phase with each other. The overlaying of the tracks created an increasingly thicker texture, with a sense of rhythm developing from the articulation of the words that were slowly becoming indistinguishable. It is a fascinating work that represents the beginnings of a compositional philosophy later to acquire the designation "minimalism." The approach became a popular movement in both acoustic and electronic music for the next two decades.

Yet another approach to the use of electronics in creating music is reflected in Allan Bryant's composition *Pitch Out* (1967). This work is composed for four amplified homemade string instruments resembling long-necked guitars. The piece is accompanied by a graphic score, visually attractive in its own right, that seeks to represent the sound events that are produced by the various techniques the composer delineates for the performance of the work. The sounds are produced by such techniques as tapping, sliding, plucking, and using various objects on the strings to produce a varied sound spectrum. The instruments are tuned from high to low, and the different colors on the score represent the different instruments. The result is an aurally fascinating fabric of sound that is well organized and not difficult to follow on the highly unconventional score.

Experimentation of all kinds persisted throughout this period. *I of IV*, a real-time studio performance composition by Pauline Oliveros, is a good example of the kinds of experimentation with serious compositional goals that were being pursued. The work, which dates from 1966, explores the use of an array of sine-tone square wave generators in an unedited and unspliced tape recording of real-time performance. The amplification of combination tones and tape feedback were the driving technical forces of the piece. The results produced a fragile spectrum of crystalline sounds, subtle rhythms, layers of sustaining or undulating sounds, and contrasting short sweeps against more sustained or brief bell-like sounds. Although Oliveros used equipment that typically is incorporated into a synthesizer/tape composition, the techniques she employed are quite different from those that would apply to works done on the RCA Mark II, or the Buchla or Moog synthesizers. Oliveros was one of many composers looking into the seemingly unlimited array of possibilities for working with the electronic resources available. Different aesthetic motivations, financial and equipment resources, and levels of expertise in working with the equipment all contributed to the wide array of experimentation that was taking place.

Finally, groundwork for the direction that would become predominant in the decades to follow was being done in various locations around the country. As noted earlier, the computer was being viewed for its music potential as early as the 1950s. Its own development was taking place outside of public scrutiny (or awareness) throughout the period, and only a few actual compositions utilizing the computer started to appear in the late 1960s. Composers Barry Vercoe,

Charles Dodge, and J.K. Randall were among the Americans exploring the creative musical possibilities embodied in the computer.

As see in our discussion so far, electronic music was born into a new, emerging world and, in some respects could almost be viewed as the distinctive voice of that world—a very American voice in a strongly American-dominated world. From the first electronic music concert in New York introducing the early works of Ussachevsky and Luening to the social statements of Steve Reich's *Come Out* and *Where Is Yesterday*, by The United States of America rock band, the first two decades of electronic music exposed a new art that captured the imagination of composers and a youth culture that flourishes today.

It was suggested at the opening of this essay that electronic music was an especially American voice and mode of musical expression. This statement should not be misconstrued to imply little or no creative activity in this medium took place elsewhere, for there were many composers of major significance who made important contributions to the thinking and the literature. Foremost among these were Pierre Schaeffer, Herbert Eimert, Karlheinz Stockhausen, Pierre Boulez, Edgard Varèse, Hugh Le Caine, and Luciano Berio. Major electronic music centers started very early in this music's history in such places as Cologne, Milan, Paris, and Stockholm. The music attracted composers from every part of the world and has flourished through the study and diverse contributions from all of the many outstanding talents that have worked in the medium. Regardless of the breadth of this activity and the diversity of the artists associated with it, however, the fact remains that the greatest preponderance of technological development and creative activity was born and flourished in the United States. The very quick adoption of the earliest commercial technology available to the popular idioms of music and the subsequent worldwide acceptance (demand might be more accurate) of electronics as a fundamental essential in the various popular idioms must be noted considering that the use of electronics in popular music created so enormous a market that it became the driving force behind the burgeoning development of hardware and software as the decades have unfolded. From the early efforts of such groups as The United States of America, which used electronics as an integral part of their style, to virtually every pop band in existence today, electronics in one form or another has become possibly the uniform defining quality of these various idioms.

The decades that have occupied our attention so far in this discussion, 1950 to 1970, saw the birth of an entirely new resource for

musical expression, an occurrence that is unique in music history in so compressed a period of time. The period represented a frenzy of activity to develop, master, and further develop (then master again) the tools and techniques required for artistic expression in this medium. This was accompanied by an almost frenetic exploration of all the hitherto undreamed of possibilities electronic music offered—possibilities that have contributed to the dissolution of the prior clear divisions between the arts (dance, theater, film) and the emergence of a new medium of great artistic potential loosely referred to as multimedia art. The new medium contributed to the development of new musical forms (e.g., the evolving generative forms of the minimalists) and provided for the use of both random sound events and extraordinarily precise controlled sound events, permitting composers to express, capture, and extend their musical ideas far beyond the limitations of acoustic performance. These capabilities brought their own legitimate bases for challenge and doubt. Did they lose the "human" dimension? Were the results too machinelike, lacking the capabilities of capturing or expressing emotion? Could these new sounds even have emotional content since emotional reactions are normally associated with the familiar references of human experience? Are humans capable of even hearing the minuteness of time-segment definitions and the intricacies of relationships that were now possible? Can electronically produced and processed sound be woven meaningfully into those acoustic sounds that are so integral a part of our aural tradition, especially the human voice?

The above questions, among many others, occupied the composers, music professionals, and interested listening public since the advent of this new medium. Different composers sought their own answers in their own personal way, the answers shaping their decisions as to which equipment to use, which techniques to employ, as well as determining the most basic driving force—their own aesthetic values within the context of the society in which their work was born. In the final analysis, the issues were not new, for the same kinds of questions were raised when other instruments were developed throughout music history, from the first organ to the saxophone and guitar. The aural learning process for electronic sound and the music to which it contributed started in the 1950s and continues today.

DEVELOPMENTS: 1970 TO THE PRESENT

The 1970s open with what may seem an unlikely but yet clear indication of the wide recognition and acceptance electronic music was beginning to achieve as an integral part of the expansive spectrum of the musical genre. This was dramatically symbolized in 1971 by the world premiere of the work commissioned about a year earlier for the opening of Wolf Trap Farm Park. Milton Babbitt was invited to compose a work to commemorate the opening of this park, with his efforts resulting in a piece called *Occasional Variations*. This work, composed on the RCA Mark II synthesizer, is a tape piece conceived for performance in the Wolf Trap Farm amphitheater, which was designed to accommodate approximately 3,500 people under cover (but still an open-air concert facility) that could also accommodate about 3,000 additional patrons on the bowl-shaped hill gently sloping down toward the stage (there were estimates that as many as 10,000 people were present at the first concert on the July 4th weekend of 1971). Recognizing that this national park and its concert facility were intended to reach a broad audience representing an unlimited variety of tastes—for all the people—this then imaginative and daring commission was a forceful assertion of Katherine Joett Shouse's belief that electronic music was already recognized as and would continue to be a voice having meaning for all people. Her vision and Babbitt's response to it set the stage for an energetic and prolifically productive period to follow, one that continues to gain momentum at this writing.

This decade also bore witness to a rapid change of developmental focus for the equipment used in the creation and performance of electronic music and set the stage for the burgeoning of a literature employing this mode of artistic expression. The increasing interest in the possibilities offered by the growing availability of computer-based technologies that could be applied for musical goals rapidly became a driving force that ultimately would have profound effects on all aspects of electronic music, regardless what aesthetic or production form it took. Analog technology was continuing to be refined to an extremely high level and digital technology was rapidly being adopted for new sound generation and processing equipment. The two technologies were shared in some equipment (e.g., the Oberheim Expander) and interfacing equipment was developed to make possible the use of analog instruments together with the new digital ones.

A few of the major universities were the primary centers for the exploration and creation of electronic music from the early 1950s. In the 1960s, with the development of the moderately priced and more user-friendly Moog, Buchla, and ARP analog synthesizers, a number of other universities that were unable financially to participate in this new area of research and creative activity became active centers for the teaching and creation of electronic music. This interest grew with the increased practicality, availability, and feasibility of computer resources in the university setting, and several important research centers developed. In 1969 Richard Moore left Bell Labs to establish one of the first of these, CARL (Computer Audio Research Laboratory), at the University of California at San Diego. After a few years of preliminary activity (also dating from 1969), in June 1975 the Center for Computer Research in Music and Acoustics (CCRMA) was established at Stanford University under the influence of prominent personalities such as John Chowning, Leland Smith, and Max Matthews, whose work together at Stanford began at least as early as 1969. These two prominent centers, along with others around the country (and throughout the world, e.g., IRCAM, in Paris), were responsible for much of the important research that produced the spectrum of digital synthesizers, samplers, and other equipment that soon became the primary electronic music tools. Software (CSOUND and CMIX) that was entirely computer-based, that is, for the design, control, and production of sound directly from the computer to an audio system, was developed at these major university centers and became the primary mode of synthesis for many of the "academic" composers who were working in and attracted to these centers. At the same time, the research done here ultimately provided such resources as FM synthesis (as used by Yamaha in the DX-7) and wavetable synthesis (as used in the Ensoniq ESQ-1) and a body of software that became critical to the new world of electronic music that was rapidly opening up to what became a vast professional and layperson's market. In addition, the centers spawned most of the early digitally produced compositions.

This was a period of feverish activity in the development of new electronic music instruments and sound processing devices and in the output of composers. The market for the new equipment was exploding with recognition of the quality of work that could be done by comparative novices in their own home and the ease of use of the equipment in the home setting, in professional studios, or for many in

pop ("garage") bands of various stylistic conceptions and instrumental combinations.

As noted in the first part of this essay, the first efforts at developing a computer language for the generation and production of sound by means of a computer began with Max Matthews in the 1950s. Although an early functional language emerged from his work and that of others, there was no readily available equipment for the general market that was designed to apply the new resource to music composition—it was essentially a university-based research/composition tool rather than a widely available resource for composers not having such an affiliation. Other computer languages and programs for music were developed in the decades following. Barry Vercoe's CSOUND, a software program developed around 1986 at the Experimental Music Studio, Media Laboratory, of the Massachusetts Institute of Technology, was an especially sophisticated program for the synthesis and control of sound exclusively within a computer. Further tending to restrict the general adoption of the university-developed computer-music programs (e.g., CSOUND) was their dependence on a thorough knowledge of the computer language in which they were written (e.g., C). These programs, as they developed, became extremely detailed and versatile, providing composers with precision and thereby the possibility of subtle control of every detail of their work.

At the same time this highly sophisticated work was being done in these universities, a broader commercial public demand for more flexible quality resources for making music electronically was becoming quite apparent. As a result, the early 1970s saw the beginning of the development of practical electronic music equipment designed to employ digital (computer) rather than (or, in some instances, in addition to) analog technology for musical purposes. Jon Appleton, at Dartmouth, together with engineers Sydney Alonso and Cameron Jones, was one of the first (in 1972) to develop such equipment, the Synclavier, and to compose works employing this new technology, one of the earliest being his *Georganna's Farewell* (1975). Several other companies were quickly entering the digital music instrument market, including the Fairlight and Syntauri systems.

With the advent of digital technology in the form of dedicated computers (i.e., computers designed to perform very specific and limited functions), the development of digital musical instruments in the United States and elsewhere expanded throughout the 1970s and 1980s. Synthesizers, samplers, sequencers, sound-processing devices,

and other supporting equipment became the center of the home or professional digital studio. Analog equipment, the tape recorder and the microphone, continued in their preeminent role in these studios, but some of their functions were giving way to the new technology (e.g., the more sophisticated and "cleaner" editing functions possible on sequencers). However, the number of companies producing digital equipment and their inevitably different approaches to addressing the same electronic music challenges led to a new and ultimately quite serious problem. Different formats were chosen by different companies, making communication between systems impossible. This led to proprietary protectionism and a severe limitation on users, requiring them to stay with equipment of a single format in order to be able to interact and communicate successfully. The formats for the many different music instrument manufacturers were proprietary, instruments from different manufacturers did not "speak" to each other (i.e., digital messages sent from one piece of equipment had no meaning to another that was manufactured by a different company using a different format). If composers preferred a piece of equipment from one company and a different piece of equipment from another, it was not a choice available to them unless the two pieces of equipment were to be used entirely independently–not typically a productive procedure in any electronic music. This communications stumbling block produced a clumsy and severe constriction, preventing users bringing together instruments of different manufacturers.

In 1983, the same year that IBM introduced the personal computer, a new computer code was developed that permited different digital formats to communicate with each other–initially for music, but later applied to other needs (e.g., stage lighting). The new code, Musical Instrument Digital Interface (most widely known by its acronym, MIDI), was accepted by the music instrument manufacturers as the industry standard. Any instrument designed to employ MIDI would be able to communicate in specific ways with others so designed. Proprietary control remained an important instrument-defining characteristic (e.g., the manner of sound synthesis being used, including frequencing modulation, wavetable, phase distortion, and linear arithmetic synthesis).

The MIDI standard is maintained and periodically refined or expanded by the International MIDI Association. The goal in establishing the code essentially was that every possible action and relationship between sounds that can be defined as a part of a musical

performance or incorporated into the design of a musical sound would be represented numerically, thereby being able to be incorporated into the code and becoming available to the digital composer. Two different types of messages were identified: channel and system. The latter was subdivided into two classes: common and real-time.

Channel messages include:

Note off
Note on
Control change
Program change
Polyphonic aftertouch
Pitch aftertouch

System messages include:

Common Messages	Real-time Messages
System exclusive	Timing clock
MIDI time code	Start
Song position pointer	Continue
Song select	Stop
Tune request	Active sensing
End system exclusive	System rest

There were a number of undefined slots in the code, allowing for its further development. Also, there have been a number of revisions of the code since its initial adoption in 1983. These included the incorporation of a "sample dump" protocol and the very important adoption of the general MIDI standard. The latter created a specified order of instrumental sounds that provided consistency between all MIDI instruments adopting this new standard. That is, an acoustic grand piano sound was always to be in the first position, a violin sound would always be number 40, and every other instrumental sound of the 128 included would always be assigned to the same slot, thus allowing for much simpler operation.

Although to one unfamiliar with the intricate working of electronic music, even a cursory glance at this listing of messages can convey the universality of the functions called for (e.g., "note on" and "note off"). The fact is that in working with electronic music, especially pronounced in digital electronic music, *every* action and function must be defined. The note must be started, its pitch and timbre defined, its volume level or changes identified, its shape (attack, sustain time, and

decay) articulated, and its moment of stopping specifically identified. This is true for every sound or combination of sounds however simple or complex they may be. Such requirements impose new and quite demanding responsibilites on the composer yet, at the same time, provide an enormous level of control. By use of the MIDI code, several different instruments having completely different modes of synthesis or sound generation can be employed to produce rich textures and both subtle and exciting interrelationships, which can greatly enhance the expressive possibilities available to the composer/performer.

As noted above, the personal computer came on the market the same year the MIDI code was adopted—1983. The significance of this fact is that, whereas prior to that time all equipment interconnections, composing, and editing were done by means of one piece of hardware or another, the two critical components necessary to facilitate all of these processes became available essentially together. This led to a rapid move to dependency on computer-based software for performing a great many of those functions formerly handled, in a much clumsier manner, by the use of hardware. Sequencers and editor/librarian software probably were the two most important initial developments. From that point on, the development of increasingly more sophisticated software became a primary force in electronic music in the United States. These new tools took several forms that included software for producing conventional and nonconventional musical scores. Other software was also developed that provided an approach to the fabrication and manipulation of sounds that was entirely computer-based. But the three specific types mentioned (sequencing, editor/librarian, and score producing) remain the principal types of software employed.

A closer look at the three principal types of software that emerged during this period will help in understanding the compositional processes that became prevalent and contribute to a clearer insight into the music, varied as it was, that ensued. The development of scoring software became more than simply a tool for producing publisher-quality scores. The first commercial software of this kind to become available was Personal Composer, developed by Jim Miller in 1983. It was a powerful program (meaning that it had broad capabilities to perform a variety of useful functions that included MIDI recording and playback, a built-in patch and patch-bank librarian, patch editing capabilities (specifically for the FM synthesis system of the Yamaha DX-7 and TX-816), and some other useful capabilities. When

compared to earlier commercial software, it was reasonably user friendly and has become increasingly more refined and sophisticated over the years. The program, which has evolved significantly since its earliest versions (largely through the programming of Dennis James after Jim Miller's premature death), has remained one of the very finest of its type currently on the market.

Personal Composer, as well as other programs that followed–Professional Composer (unrelated and designed for the Macintosh computer), Score, and Finale–permitted the composer to lay out the score from a single line to a large number of staves, spacing as necessary, and offered graphics that, in many instances, had MIDI capability (i.e., would respond to MIDI messages for playback over any suitably equipped system). Unlike most of the other comparable programs, the original DOS version of Personal Composer also incorporated a designing program that allowed composers to create their own graphics and, where appropriate, to make them responsive to MIDI commands. Each stave in the score could have an instrument (or instruments) assigned to it, allowing for playback with a reasonable sound simulation of the scoring (limited only by the capabilities and quality of the sound generator to which the computer was attached). This design provided the composer of "conventional" music (i.e., music composed for acoustic instruments and requiring a score and parts) with resources never before available—the ability to enter a conventional score into a computer and to hear a reasonable facsimile playback of the score immediately, the ability to print a professional-looking hard copy of the score, and the ability to extract instrumental or vocal parts.

Clearly an important part of the evolution of digital music technology, the scoring programs described above were essentially developed to serve the composer of conventional music rather than the electronic music composer. The programs that were more importantly a part of the toolbox of the electronic music composer were those that provided for dealing with sound in a more abstract and fluid manner, that is, programs that provided for the manipulation of sound parameters, the storage and recall of the newly designed sounds, and the recording and modulation of these sounds. Whereas initially all sound shaping was done on the hardware devices available, the computer quickly became the vehicle of choice for performing this and other functions. Memory and speed increased rapidly; additionally the ease of playback through the available synthesizers or samplers and the versatility inherent in the computer contributed to this becoming the

fundamental component of a studio—increasingly so as sound cards became available and entirely computer-based programs for sound design were developed. A closer look at the two remaining principal types of programs will assist in more adequately understanding the nature of electronic music through the latter portion of this period.

Sequencing programs, computer versions of the hardware sequencers that first served these functions, have become indispensable tools in the electronic studio and are far more versatile and easier to work with than their hardware precursors. Note at the outset that these sequencers are dramatically different from those employed in analog systems. The latter were much closer to the historical use of the term "sequence" in that they provided multiple repetitions of a prescribed musical pattern that could be performed at different pitch levels producing sequences of events. Although they had other functions as well, they were designed primarily for that function. The computer/digital sequencer is principally a recording device that has enormous editing and layering capabilities. In some respects, these programs have had the most profound impact on the nature of much of the music that has emerged since the development of MIDI. For example, the resurgence of the historically popular compositional technique of layering voices was a direct result of MIDI. Not unlike the thirteenth-century motet, which typically utilized this technique (i.e., one voice was composed, a second was composed over it, and a third over that, with these voices having a considerable amount of independence), the multitrack concept of the computer sequencer of today provides that opportunity once again. The sequencer tracks can be designated individually with different timbres (to the limits of the sound-generating devices available), potentially making possible enormously dense and timbrally complex textures. Rhythmic subtlety and complexity are possible beyond the human capacity to distinguish relationships, with the composer able to manipulate beats at levels such as 120th of the individual beat regardless of speed. In the now commonplace "cut and paste" processes that have become so familiar to most computer users, any component of a track or multiple tracks can be copied or looped (i.e., repeated any specified number of times) at will with great ease and with or without a change of timbre. A great many other editing functions can be performed quickly and easily.

Sequencing programs provide composers with a remarkable array of sound-manipulation techniques and precise editing capabilities over their music. At the same time, they impose on composers an enormous

increase in their artistic-judgment responsibilities. This results from the fact that decisions once not within composers' purview now affect the artistic results of their work. The most obvious example is that of timbral choice since, in the past, composers were limited by the acoustic instruments or sounds available and the refinements of the sounds were controlled by performers. Now composers can construct their own sounds and shape them in any way.

Electronic music on tape has been criticized for its lack of infinite and unpredictable flexibility that human performance brings to music. Each composer must address this issue in constructing his or her work. Decisions must also be made as to when refinements that may be easy to accomplish technically are lost due to human conditional or physical limitations. For example, if the rhythmic interplay between two or more sounds becomes too subtle or too complex, the results may be a passage that is perceived as incoherent, a jumble of sound, while in fact some very sophisticated relationships may have been designed by the composer. The draft of composition, that is, the ability to produce sound designs and to manipulate the various components of a piece of music, has developed to an extremely high level, but it has forced composers to identify the human limitations within which successful aurally intelligible work can take place. Possibly for the first time, composers can intellectually and artistically design and bring to fruition compositions, the structural components of which are beyond human capacities–out of audible range, too fast for individual events to be grasped and placed in context, or of such complexity that the mind cannot decipher the conceptual meaning of the music. Of course, these new extended resources offer different potential uses (e.g., events moving so fast that they cannot be individually deciphered may produce the effect of an expressive new timbre that can be used effectively in the music).

The editor/librarian software-like sequencing programs derive from the hardware that preceded it in that it provides the composer with the capability of designing sounds in terms of a specific sound generator and permits the storage, cataloging, and easy access to every sound created. Literally hundreds of timbres can be created with great or tiny nuances of difference between them and can be called upon quickly and easily for use in any composition. The editor portions of these programs, usually able to accommodate the specific requirements of seemingly endless numbers of sound generators, can handle different forms of sound synthesis (e.g., FM, wavetable, linear/arithmetic, and

phase distortion). The kinds of functions these subprograms (one for each sound generator) perform will typically include all of the sound-designing techniques available from the earliest analog synthesizers and many others peculiar to the specific device. These may include selection of waves; sound sources, which will serve as the basis for constructing the desired sound; the shaping of the envelope (attack, sustain, and release functions—singular or multiple) for several of the wave components; filtering; and several types of modulation. This work is complex, requires extreme care and sensitivity to sound, and can be very tedious. It is also a "compositional" function totally unique to electronic music and has no precedent in history. It provides the electronic music composer with a tremendous new resource while imposing an enormous new artistic and technical challenge. The creation of sounds and their potential for extremely subtle nuances or overwhelmingly powerful statements can contribute significantly to either the success or the failure of a composition.

In the past, we have accepted and, by conditioning, if in no other way, understood the sounds of music and where they were coming from–violins, pianos, clarinets, etc. The sounds themselves were familiar and provided a universal reference for all concerned. They were taken for granted, and both the composer and the listener could start with the music itself. In electronic music, an entire new dimension has been added that changes the composer/listener dynamic and their respective responsibilities. All sounds are new–never heard before. There is no universal aural realm of reference except the sounds of the past, and they are more likely to impede than to assist in making this new music comprehensible and aesthetically acceptable. Both the listener and the composer face a difficult challenge of communication that comes from the lack of a mutual sound vocabulary and references, aesthetic or otherwise. In this new music, the vocabulary may be different for every composition, requiring composers to be willing to explicate their work and listeners to be willing to remain open and receptive to new ideas. If either is unwilling to participate in this process, communication will not take place. In serious art, this does not lend itself to casual, recreational, entertainment listening. These are the factors that have contributed to the widely diverse spectrum in the application of electronics to music from the highly intellectual/aesthetic process suggested here to the use of "washes" of electronic sound as little more than sound "wallpaper"—simply providing a sound environment that is not intrusive but can be pleasing for the particular

setting. At the same time, electronics for the composition and production of music has become so integrated into almost every facet of life over the past few decades that there are times we are not aware the sounds we are hearing are electronic. This increasing comfort level and familiarity with such sounds portend the time when the composer/listener relationship may return to the more familiar patterns of the past—a mutually understood sound basis and working vocabulary. Ultimately, the test is in the music produced and the public's acceptance of that music.

The enormous amount of "pop" music that is produced each year and the very heavy commitment "pop" ensembles have made to electronics are possibly the most forceful ways of proving any assertion that electronic sound in music is widely accepted by the public. This virtually universal adoption of electronically generated or modified sound is a defining characteristic of a multiplicity of musical styles, and the vast audiences that enthusiastically support these performers should quickly lay to rest any concern that electronic sound has difficulty appealing to or communicating with a broad segment of the population. Having dispelled any concerns of that sort returns us to the music itself. It cannot hide behind a myth of novelty or unfamiliarity, not having human experience reference, but must be judged by its inherent content, ability to communicate, and quality. This is not to suggest that because the many styles of "pop" music employing electronic sound have vast audiences they all represent high quality. There are other factors that influence music choice judgments and many different references for what constitutes quality within sharply divergent styles. Electronics can be recognized as having no more importance in such decisions than the instrumentation of any conventional ensemble.

As noted in the first part of this essay, the application of electronics to the guitar for "pop" ensembles began in the United States in the late 1930s and early 1940s. The usage became widespread over the decades that followed. At this writing, it seems more the exception than the rule to find such groups not using some electronic equipment. At a minimum, amplification is integral to almost all "pop" bands, since "loud" seems to be a reflection of the general noise level of society (not limiting our reference to sound noise alone) and, as a result, is equated with "good." "Pop" is an American voice that has become unabashedly universal. The music has a powerful commercial value, with an enormous market for recording sales, TV appearances, and live concerts. This has made it highly competitive and subject to powerful

marketing forces that make and break artists at times without regard for their musical contribution.

One form of music that has gained popularity in the United States during the 1980s and 1990s is "new age music." This generic title covers an array of subareas of music, including "space music," "ambient music," "trance music," and "music for meditation." There appears to be some controversy as to whether or not each of these terms has its own distinctive definition. What links these various forms of new age music are the different resources used—acoustic instruments and voices, as well as electronic equipment. Yet, even when acoustic sound sources are employed, new age is largely music of the electronic domain, for when acoustically generated sounds are used, they often are so modulated or enhanced by sound processors that they appear as electronic as the electronically generated sounds with which they often keep close company.

Recognizing that generalizations are always limited in value, this music is typically characterized by a rather seductive, contemplative, almost hypnotic, mood. The music is designed to provide a release from life's tensions and, in some ways, offers an escape from the frenetic pace of contemporary living. This is accomplished by what is often referred to as "washes" of sound, long, sustained, slightly undulating sounds moving over and around each other in a somewhat embracing way. These often appear in several layers (tracks) that add to the richness or lushness of the effect. Sounds like a sustained wind or waves against a beach are typical references for their potential associational value. Some may have unobtrusive melodies or coloristic effects embedded on top of the layers of sound wash, but the music is not typically melodically based. These pieces tend to use a fair amount of repetition of materials and are often fairly extended in scope, establishing a stable sound environment for their effect to be fully assimilated.

New age music is widely used almost as a sound version of wallpaper, with no negative implications intended in that reference. That is, it is music designed to create an unobtrusive mood for those occupied in other activities. It may be desired by the composer that the music be listened to in a conscious way (e.g., analogous to a classical music or jazz concert), but typically, it's heard as background music. Among the composers active in this genre are Yanni, Brian Eno, Tangerine Dream, Steve Roach, and David Parsons.

The American film industry has dominated cinema production from its inception in the late nineteenth century, and music has been an integral part of it. While rarely have works composed for films been considered standalone, they have often been abridged and edited to be coherent works for commercial release. Composers for film, and subsequently television, have been driven by different forces than composers of any of the other genres. Their primary responsibility has been to enrich, enhance, inform, or otherwise support the unfolding film story line, atmosphere, or individual scenes. In film and television can be seen one environment that is most suitable to electronic music. Everything from simple sound effects, to elaborate musical soundscapes can be created electronically.

The use of electronics in generating a film score may be more commonly expected in the science fiction genre, but it has been incorporated in films dealing with a variety of subjects. When fine equipment is used well in producing an orchestral score electronically, the listening audience may never be aware of the presence of electronics—the ideal result for the composer producing a conventional orchestration electronically. From James Horner's scores for conventional films, such as *Aliens*, *Apollo 13*, and *Field of Dreams*, to Philip Glass's work in *Koyaanasqatsi*, electronic music has allowed composers to feel freer, to have a more compelling need, and to have a greater comfort level with moving from one sound resource or technique to another to accomplish the compositional goals prescribed by the film for which they are composing.

Commercials on radio and television are about as American as anything can get. Together with the large number of television documentaries, infomercials, sitcoms, and various special shows, this area of musical activity has become an enormous industry in this country. Literally hundreds of these compositions, from short snippets of highly focused music to extended (half-hour or more) scores, must be produced quickly on an ongoing basis. Because of the nature of this type of music, which emphasizes speed of production and cost-effectiveness, most composers active in this arena are doing their work in sophisticated studios that produce anything from electronically generated recorded orchestral scores to exotic explorations of electronic sounds that make no reference to familiar acoustic sounds. Composers such as Brian S. Bennett (with well over 100 films, documentaries, television shows, commercials, infomercials, and theatrical productions to his credit) may have their own studios, which permit very high

quality and efficient production of the music they are commissioned to produce. It is in this area that electronics truly earns its keep in terms of economics. It expedites work at a quality level that probably would be impossible by any other means.

The preceding genres of music—pop, new age, and visual related (film, video, commercial, multimedia, and theatrical)—all have fairly specific audiences and pragmatic functions to serve. They often adopt informal formulas that quickly carry from one composer to another. Also, they may experience a rather limited longevity, since tastes can be fickle and the need to keep the focused attention of the audiences is economically driven. There is one genre of music employing electronics that is not required to succumb to those expectations and temptations. It is the one to which we have the greatest difficulty assigning a name. Various traditional (and newly adopted) terms periodically used include: "classical," "serious," "concert," "academic," "high art," and "aesthetic." Each of these offers some credible information about the music and each has problems of accuracy or unwanted implications. Regardless of the term used, the music embodied in this general grouping is typically composed for audiences who see its function as providing listening stimulation, intellectual challenge, concert suitability, social insights (obvious or obscure). It is a music to be listened to for its own character, content, and artistic merit, and for no other extra-musical/artistic purposes. As a result, the electronic music composers working in this area tend to produce very individualized pieces that may or may not relate to the work of any other composer or style. An attitude of total intellectual and artistic freedom prevails.

A number of the most prominent electronic music composers of the preceding period—Milton Babbitt and Morton Subotnick in the United States, and, in Europe, Karlheinz Stockhausen and Pierre Boulez—have continued their contributions well into the post-1970 era. But a new generation of composers has emerged. Their individual importance may remain to be determined, but their numbers and contributions are abundant. Composers of the first generation spanning the 1970 reference date (and it is *only* a date used for convenient reference), such as Barry Vercoe, Charles Dodge, Jon Appleton, Philip Glass, and Larry Austin, have established reputations as serious contributors to this general genre, while each has a dramatically different and personal style and artistic interests. These composers over the decade or so that followed were joined by Scott Wyatt, James Mobberley, among others,

who were in turn joined by Cort Lippe, Scott Miller, Zack Settl, and others who entered the scene in the 1990s.

As suggested earlier, the technology and compositional approaches represented in the works of these composers span the entire spectrum of possibilities. Some (e.g., Vercoe, Lippe, and Dodge) choose to work exclusively with a computer using software such as CSOUND or programs they develop individually that permit them to accomplish everything that must be done to produce a composition through the computer. The resultant works may be in any style and may be designed to be performed exclusively as tape pieces or in concert with live performers. Aesthetically, of course, the works are as diverse as the composers producing them. Typically, they do not employ MIDI, but, recognizing the freedom composers have to choose what they want when demanded by their compositional needs, all options are available.

Other composers work almost exclusively with MIDI equipment and software. Although many assert the technology has a long way to go, MIDI equipment and software have become so sophisticated that compositions of great substance have been accomplished. One fine example is the *Concerto for MIDI'd Grand*, by Steve Solum, which premiered at FISEA (the Fourth International Symposium on Electronic Arts) in 1993. This work, composed for the Yamaha MIDI grand piano remains close to the traditional concerto form, is in the tradition of the solo organ concerto, and employs the full resources of the grand piano as a solo instrument while controlling the "orchestra" of MIDI equipment and sounds from the same keyboard. It is an impressive work that, in addition to calling upon traditional performance skills of the pianist, opens up an entire new range of challenges that almost approach the creation of a performance choreography for a pianist.

Composers working in electronic music in the late 1990s have a broad range of technological alternatives available to them and are free to choose those resources that will provide the greatest expressive capabilities for the particular aesthetic demands of any given composition. Strictly computer-generated, MIDI system-designed pieces, as well as works that employ live performers have all been part of the electronic music scene in the United States.

The twentieth century has witnessed the promulgation of an amazing array of compositional/aesthetic biases and the active examination of a variety of intellectual and artistic modes of expression, many far removed from the traditional references and values that were brought to this volatile era. The amount of deliberate

experimentation and conscious abandonment of earlier practices and prevailing principles is unprecendented in all music history. In consort with the prevailing major social, political, scientific, and religious upheavals and the challenges that have been thrust at almost all traditional precepts, the arts in general, and electronic music in particular, has been in the forefront of this period of reexamination. As a result, at the end of this century we are left to reflect on what has happened and, consciously or not, to attempt to assimilate the often conflicting ideals and rich but extraordinarily diverse body of literature with which we now have been provided.

The twentieth century has been a surging movement, from the heights of the industrial revolution to the explosion of the digital technology of the information age. The changes have occurred with an urgency, magnitude, and speed unprecedented in history. Together with and integral to the enormous social, political, scientific, ethical, and spiritual challenges, debates, and reevaluations, the advent of electronic music technology and a resulting large body of literature have directly paralleled this period. Aesthetic values have been in the throes of profound change apart from the advent of any new technologies. At the same time, it is clear that the emergence of electronic means for designing and producing musical compositions, by the nature of the medium and all of the new sound parameters it opened up, contributed significantly to the unfolding new era. In addition to the traditional role of the musical art that was well met by a large number of gifted composers who adapted themselves with remarkable adroitness to the new technological demands, characteristics of the society's new needs dictated by the development and global adoption of new media were quickly and effectively met by electronic music composers. The final three decades of this century clearly reflect the convergence of technological advancement, changes of social needs, a search for new aesthetic values and an energetic pursuit of the excitement and rewards that the future may hold.

Speculating about what the future may be for electronic music is presumptuous indeed. At the same time, such an effort can be both an exhilarating challenge and an exercise that may help one obtain a perspective of the present and its possibilities that cannot be accomplished by any other means. So, in a spirit of adventure, some speculations will be offered. These speculations are based on information at hand, experience in and understanding of the past, and a

conscious awareness of the social, economic, political, and technological changes currently under way.

American society is based on a complex of value systems that consciously or intuitively determine the nature and direction of its unfolding. These may seem independent of each other and appear to stand apart, but, more often than not, they are integrally related to and often dependent on each other. Our society today is going through dramatic changes that are unprecedented in history. The functional independence of individual cultural entities has been forced into global exposure and strong external influences however actively individual groups may try to resist. Instant global communication, extremely rapid transmission of information, and a degree of mobility of people, goods, and services defy resistance to the global community that we are rapidly becoming. This single complex of profound changes is sufficient to reveal to us a vision of the future wherein there are no remaining functional boundaries. At the same time, the rapid increase in the sophistication of scientific and technological tools has led to an increasing acceleration in the acquisition of knowledge and an increasing availability of devices that continue to have a dramatic impact on our quality of life than heretofore imagined.

It should not be surprising that the current period is one of aesthetic groping, that our musical technology must still be recognized to be in its infancy and that the nature of human experience and cross-cultural assimilation has yet to provide a secure reference for focused artistic insight and expression. As a result of this turbulent and volatile environment, the electronic music composer works with a continuously evolving technology that may be antiquated before a piece is complete, interacts within a society that clings to the icons of the past while watching its traditional values crumble, or functions in an unfamiliar and complex business and legal climate that itself is changing rapidly.

The further development and refinement of technological resources is critical and will continue into the foreseeable future, with the ultimate goal being universality of behavior for similar equipment and complete ease of operation. The obvious analogy is the pianist being able to sit down at any piano and play without learning a new layout. Of course, there may be a different touch, one may prefer a more brilliant or delicate tone color, and certainly one instrument may be better in tune than another, but they are all pianos and function in exactly the same way. The pianist does not have to be a technician to become an artist on the instrument. This kind of generalized skill

should become characteristic of the electronic music composer. The requirements of being a technician at a fairly high level will inevitably be bypassed, and the electronic music composer will be able to concentrate on his or her art and will be able to expect the results of that creative work to be realized with reliable consistency from one performer to another and one piece of equipment to another.

The digitization of all aspects of sound production and transmission (including digital television and radio) portends a consistent quality level never before attainable. In addition, it will make possible extremely precise editing of music at fractions of a second that may not even be discernible by the average listener. Clearly, digital sound technology embraces the computer and the seemingly endless array of options it opens up to the composer and potential audience. Uploading and downloading of compositions without any loss of quality has implications for the recording and publications industries, with a wide spectrum of legal ramifications yet to be identified, let alone resolved. Questions as to composers' need for publishers or recording companies may arise, along with concerns regarding protection of rights and possibly new modes of reimbursement for creative efforts (the role so forcefully assumed by the licensing agencies–ASCAP, BMI, and SESAC). Marketing, as onerous as that may seem to some, has been an integral part of musical life in the United States. It has played a role in determining our musical tastes (more strongly than many might have liked or considered "healthy"). With the advent of the possibility of instant global distribution by any individual, the role of the professional marketer in music is likely to undergo significant change and may well be supplanted by individual or cooperative group Internet marketing.

There are other changes that have far more profound implications and reflect the nature of American society and its heterogeneous composition. The Pilgrims and Puritans brought their hymns, the Africans brought their singing style and rhythmic energy, the Europeans brought their individual folk traditions and a highly developed structured musical art form, and the Asians and Latin Americans have brought new instruments, new styles, and new concepts of musical form and manners of expression to our shores. This mixing of cultural and artistic traditions will accelerate and span out as a global phenomenon in the decades ahead. The results are likely to be witnessed in several ways. Individual cultural entities are likely to aggressively protect and promote their own personal modes of

expression. Composers will inevitably be influenced by the diverse manners of expression active in their environment and will reflect those influences, consciously or not, in their assimilation into their works. Finally, it is likely that one or more "universal" styles will emerge that may be neutral of all distinguishable cultural styles and characteristics, one (or more) that will express a musical aesthetic that reflects the global community that is rapidly emerging and the universal social/environmental references that inevitably will be integral to such a community.

In the suggestions offered above, the author is speaking of music that is not specifically designed for commercial purposes. Although such music undoubtedly would be influenced by these same social and cultural changes, commercial music will always be designed to meet the specific perceived needs of the function it serves. At the same time, as a result of economic forces, the probability is that such music will become almost exclusively the domain of electronic composers (as it is in very large measure now).

One area not touched on to this point is the increasing numbers of sophisticated home studios and the growing active interest of nonprofessionals in creating and producing their own electronic music. The cost of high-quality equipment has been reduced to levels that make very fine studio work possible in the home. Music has always been a richly rewarding outlet for "everyday folks" in all cultures, people who used whatever resources were available to them–reed flutes, fiddles, accordions, guitars (or other pick or strum type instruments), percussive instruments, and other suitable sound-producing devices their ingenuity might generate. The growing expansive availability of computers that routinely will have fine sound cards in them will contribute to this explosion of interest in home-produced music through electronics. That interest is likely to be reinforced by increased leisure time and an ever-growing quest for rewarding uses of that time. The implications resulting from a burgeoning of music produced in this context may prove to be enormous and certainly highly unpredictable. The perceptions that may be revealed by the artistically untrained but culturally immersed nonprofessional in an environment in which those views can be disseminated widely and quickly could be profound in their immediacy of communication and their influence on the artists of the society.

Electronic music, by any of its various definitions, has experienced an extremely rapid evolution from nonexistence early in the twentieth