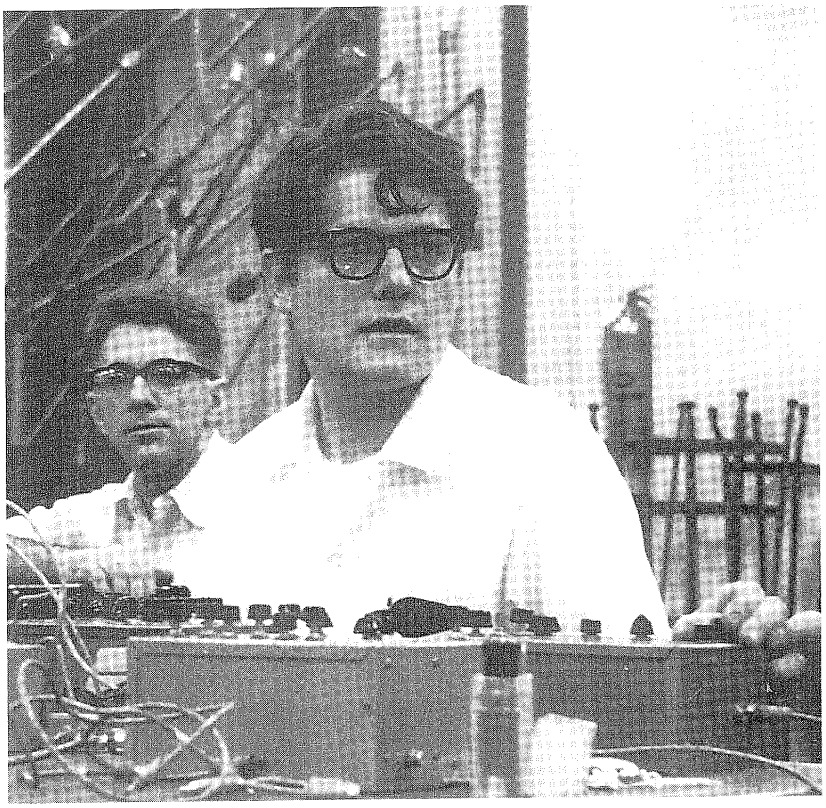
CHAPTER 3

Early Electronic Music in the United States and Latin America

I was at a concert of electronic music in Cologne and I noticed that, even though it was the most recent electronic music, the audience was all falling asleep. No matter how interesting the music was, the audience couldn't stay awake. That was because the music was coming out of loudspeakers.
—John Cage



David Tudor and Gordon Mumma performing *Mesa* in 1966.
(Gordon Mumma)

Electronic music activity in the United States during the early 1950s was neither organized nor institutional. Experimentation with tape composition took place through the efforts of individual composers working on a makeshift basis without state support. Such fragmented efforts lacked the cohesion, doctrine, and financial support of their European counterparts but in many ways the musical results were more diverse, ranging from works that were radically experimental to special effects for popular motion pictures and works that combined the use of taped sounds with live instrumentalists performing on stage. The first electronic music composers in North America did not adhere to any rigid schools of thought regarding the aesthetics of the medium and viewed with mixed skepticism and amusement the aesthetic wars taking place between the French and the Germans. This chapter traces the works of early experimenters with tape music in North America leading up to the establishment of the first well-funded institutional studios such as the Columbia–Princeton Electronic Music Center in New York.

LOUIS AND BEBE BARRON

The first piece of electronic music for magnetic tape composed in America was most likely a little work called *Heavenly Menagerie* by Louis (1920–89) and Bebe Barron (1927–2008). Bebe dated the work to 1950, about the time that she and her husband acquired their first tape recording equipment.[1]

The Barrons were musically inclined and creatively blessed. She had studied music with Wallingford Rieger and Henry Cowell. He had studied music at the University of Chicago and also had a knack for working with a soldering gun and electrical gear. Having just married and moved to New York in 1948, the couple decided to try their hand at the business of music recording. They started their enterprise mostly because it seemed like an interesting thing to do. They didn't really expect great success:

> We had to earn a living somehow so we opened a recording studio that catered to the avant-garde. We had some pretty good equipment, considering. A lot of it we built ourselves. Then the commercial equipment began to come onto the market. We were able to purchase some of it. We had a really thriving recording business. There was nobody who was competition. So, we did all right.[2]

New York City in the early 1950s was the base of operations for America's experimental in art culture—avant-garde music, film, painting, dance, and writing all thrived in the growing bohemian atmosphere of Greenwich Village. The Barrons were at the epicenter of the post-war American cultural revolution and were soon collaborating with many rising composers and filmmakers. They were in a unique position to do so because the Barrons had assembled the first electronic music studio in America. "The only people that I knew who were working before us were Schaeffer and Henry in France," explained Bebe.[3] *Heavenly Menagerie* was a purely electronic work that grew out of the Barrons' interest in avant-garde music.

One reason for the Barrons' early success with their electronic music studio was that they had a short-lived monopoly on tape recording equipment. Just after World War II, when the secrets of the tape recorder were just being distributed in the United States, Bebe and Louis had two family connections that proved to be instrumental in

getting them into the business of electronic music. The first was a link to the man who invented the Stancil-Hoffman tape recorder, one of the first American-made magnetic tape recorders to be manufactured following World War II. The other connection was a cousin working for the Minnesota Mining and Manufacturing Company (3M). The Barrons had a Stancil-Hoffman tape recorder custom-made for them and through their cousin they were able to obtain some of the earliest batches of magnetic recording tape developed by 3M. By the early 1950s, the Barrons' studio at 9 West 8th Street in Greenwich Village was a well-equipped, if not entirely orthodox, hub of electronic music gear. Bebe recalled:

> We were using the same equipment that the classic electronic music studios were using, although we were more limited because, number one, we were considerably earlier than most of them and we had to make a lot—in fact almost all—of our own equipment. We were also limited financially because we were trying to support ourselves. We didn't have an institution behind us.
>
> We built this monstrous big speaker and it sounded wonderful. It had a very heavy bass, which I always loved. That was the speaker we worked with. I believe it was one of those big old theater speakers. We built the encasing out of fiberglass. We had electronic oscillators that we built ourselves. We had one that produced sine and sawtooth waves and one that produced sine and square waves. We had a filter that we built; a spring reverberator; several tape recorders. The Stancil-Hoffmann was built primarily for playing loops, which we had just discovered and were wildly excited about. We had a setting on the front of the machine that enabled us to play loops very easily.[4]

In their partnership Louis did most of the circuitry design and Bebe did much of the composing and production. Both became adept at soldering circuits and editing tape. They were both influenced by mathematician Norbert Weiner's book, *Cybernetics: Or, Control and Communication in the Animal and the Machine* (1948), and this carried over into their approach to circuit design:

> We never considered what we did at that point, [to be] composing music. It really wasn't at all like music because we were not concerned with note-by-note composition. What we did was build certain kinds of simple circuits that had a peculiar sort of nervous system, shall we say. They had characteristics that would keep repeating themselves.[5]

The Barrons met composer John Cage at a monthly gathering of the Artists' Club on 8th Street in New York City, where participants took turns explaining their work and projects to others. Cage had conceived a work for magnetic tape and saw in the Barrons an opportunity to establish a working relationship with a well-equipped sound studio. David Tudor (1926–96), composer and longtime Cage collaborator, later recalled:

> In those days one did not have easy access to electronics, so John Cage tried to find something like we now would call a grant situation and a friend of ours [Paul Williams] gave us $5,000 to start experimenting with magnetic tape so we could use an electronic studio and pay an engineer [the Barrons].[6]

Figure 3.1 Louis and Bebe Barron in their Greenwich Village electronic music studio, 1956. The studio was equipped to record electronic sounds onto magnetic tape and synchronize them to motion picture images using 16 mm magnetic film recorders. (Bebe Barron)

Figure 3.2 Second view of the Barrons' electronic music studio in New York City. The workbench in the foreground was used by the couple to make circuits for generating electronic sounds for such films as *Forbidden Planet*. (Bebe Barron)

In 1951, Cage organized the *Project of Music for Magnetic Tape*. He and fellow composers Earle Brown (1926–2002), Morton Feldman (1926–87), Christian Wolff (b. 1934), and David Tudor all began to explore the tape medium with the technical assistance and studio facilities of Louis and Bebe Barron.

JOHN CAGE AND THE PROJECT OF MUSIC FOR MAGNETIC TAPE

By 1950, while many of his contemporaries, particularly in Europe, were exploring serialism as a means for determining every aspect of written music, Cage was investigating **chance operations** as a way to create music for which the outcome was not preconceived—composition that was indeterminate of its performance. Although polar opposites in most every respect, serialism and chance music begin with a similar motivation—that of disengaging a composer from their natural instinct for making pretty music. Serialism subverts convention through an elaborate set of rules for choosing which notes and dynamics occur in a series—but the sound themselves are all part of the accepted musical scale. Cage also wanted to remove the composer's taste in entirety from the process of composition. He opened his ears to any and all possible sounds, pitched and unpitched. His method of composing removed not only his taste from the outcome, but also the minutest degree of control or personal choice over the music. In about 1950, he

LISTENING GUIDE 3.1

Title: *Forbidden Planet: Overture* (reprise)

Artist: Bebe and Louis Barron **Year**: 1956 **Duration**: 2:16

Genre: Soundtrack

Electronic Instrumentation: Oscillators, reverberation, tape manipulation, and homemade audio signal generators.

Background: Bebe and Louis Barron produced electronic music for film and television from their private studio in New York City. Their music was more atmospheric than rhythmic, due in part to the difficulty of manually synchronizing the output of multiple tape recorders during their mixdowns. Much of their equipment was built by hand, including audio oscillators, a filter, spring reverberation, and sound-producing circuits that they soldered themselves (see main text). Many of their composition techniques took advantage of tape loops for repeating patterns, tape echo, and reverberation, all of which are evident in this part of their famous electronic score for the motion picture *Forbidden Planet*—the first feature film score produced entirely using electronic music.

	Listen For: The use of echo and repeated sound patterns (tape loops) to provide form and structure to the piece as well as electronic tones played manually to give the music an organic feeling.
0:00–0:30	A short loop with a repeated bass rhythm and bubbly sounds begins the piece. After a few seconds these serene pulses are joined by one, then two, and three manually played tone generators producing harmonizing, unbroken flute-like tones. At about 0:20, one of the tones begins to waver and another becomes louder as it descends in tone. Notice the pronounced use of reverb, especially for the bubbling sounds that continue during this passage. The sounds become darker and more intense.
0:30–1:10	The calm is suddenly broken by a loud, intense, deep vibrating tone with the qualities of a sawtooth wave. Note the heavy use of echo to extend the effect of the tone sequence. The section becomes thickly layered using loops, more echo, and siren-like tones that rise and fall threateningly.
1:11–2:05	Calm is restored momentarily as the density of the sound is reduced to two harmonizing tones, followed by the signature *Forbidden Planet* sound of descending sine waves treated with heavy vibrato (used in accompaniment to images of a slowly approaching spacecraft) and a loud, booming drone that dominates this section of the work. Six to eight tracks of independently recorded tones can be heard during this passage.
2:06–2:16	The *Overture* ends as it began, with a short loop with a repeated bass rhythm and bubbly sounds.

Compare and Contrast

Klangstudies II (1952) by Herbert Eimert and Robert Beyer
Sorcerer: Main Title (1977) by Tangerine Dream
Fantasy in Orbit (1963) by Tom Dissevelt

established his own rules for doing so based on chance operations derived from the *I Ching*—the ancient Chinese *Book of Changes* that provided a methodology for choosing random number sequences.

Cage developed various schemes for composing with chance operations. He sometimes decided on the instrumentation for a piece ahead of time—such as prepared piano, strings, or radio sounds—although some works were also written for any number and kind of unspecified instruments. He then used random numbers to denote choices for any decision that had to be made regarding the characteristics of the sound, such as pitch, amplitude, duration, timbre, and envelope. Individual performances might also vary because his works often had interchangeable parts. In 1952, after establishing the Project of Music for Magnetic Tape, Cage was eager to combine his interest in chance operations with a music that could consist of many kinds of recorded sounds. Cage's interest in composing with the recording medium dated back to *Imaginary Landscape No. 1* in 1939, conceived for a small percussion ensemble and turntables playing recordings of electronic test patterns: "*Imaginary Landscape No. 1* used records of constant or variable frequency. We had clutches on those machines that allowed us to produce slides. You didn't shift from 33⅓ to 45 rpm, for instance, but you could go gradually through the whole thing."[7] Working with the Barrons gave Cage immediate and unfettered access to the kinds of equipment to which few composers had access in America in 1952.

Cage and the Barrons completed their first tape project, with the help of David Tudor, in January 1952. The piece was called *Imaginary Landscape No. 5* and although it used magnetic tape as the composing medium all of the sounds were copied from phonograph records. The score called for "making a recording on tape, using as material any 42 phonographic records."[8] Composed using the *I Ching*, the score was written on block paper where each square represented three inches of tape. Chance operations denoted the duration and amplitude of the recorded blocks of sound but not which specific phonograph records should be used. Cage chose as his source material a collection of mostly jazz recordings and the result was a collage of fragments lasting four minutes.

Having become familiar with the tape medium through *Imaginary Landscape No. 5*, Cage chose as his next project a work that would more fully explore the potential of using tape splicing techniques to control dynamic aspects of recorded sound. The money they had been granted was not going to last forever, so Cage determined that it would be best spent focusing on one ambitious undertaking. He called it *Williams Mix*, after their benefactor Paul Williams. Tudor recalled that, after *Imaginary Landscape No. 5*, Cage realized that "experimentation takes a great deal of money, so he decided that in order to have a result, they should make a project which would enable one to experience things to the greatest depth possible."[9]

The novelty of *Williams Mix* was that Cage relied on tape splicing techniques as a major compositional element of the piece rather than merely as a device for hiding transitions from one recorded sound to another. Instead of using sounds from previously recorded phonograph records as source material, Cage commissioned the Barrons to make an extensive set of field recordings with their tape recording equipment. *Williams Mix* consisted of hundreds of taped sounds edited together using unusual splices to change the envelope of the sounds. The score was a daunting 192-page graphical composition (see Figure 3.3). Cage conceived the work for eight tracks of magnetic tape played simultaneously. "Each page has two systems comprising eight lines each," wrote the composer. "These eight lines are eight tracks of tape and they are pictured full-size so

that the score constitutes a pattern for the cutting of tape and its splicing."[10] The work was begun in May 1952 and took the better part of nine months to complete. The completed work is only 4′ 15″ long.

The score required sound recordings made in six categories: city sounds, country sounds, electronic sounds, manually produced sounds (including musical instruments), wind-produced sounds, and small sounds requiring amplification to be heard. The Barrons were given the assignment of recording literally hundreds of sounds in the six categories required by the score. As Bebe Barron explained:

> It sounds like an easy assignment, but in those days, to record country sounds, small sounds, and so forth, it was a major assignment because we were in no way prepared to go out into the country. We did a couple of times and we took our most portable equipment with us, which was in no way portable.[11]

By Cage's account, the Barrons recorded between 500 and 600 sounds, although Bebe Barron's recollection is that it was somewhat fewer than that.[12] The resulting eight tapes were assembled over a nine-month period by a team consisting at times of Cage,

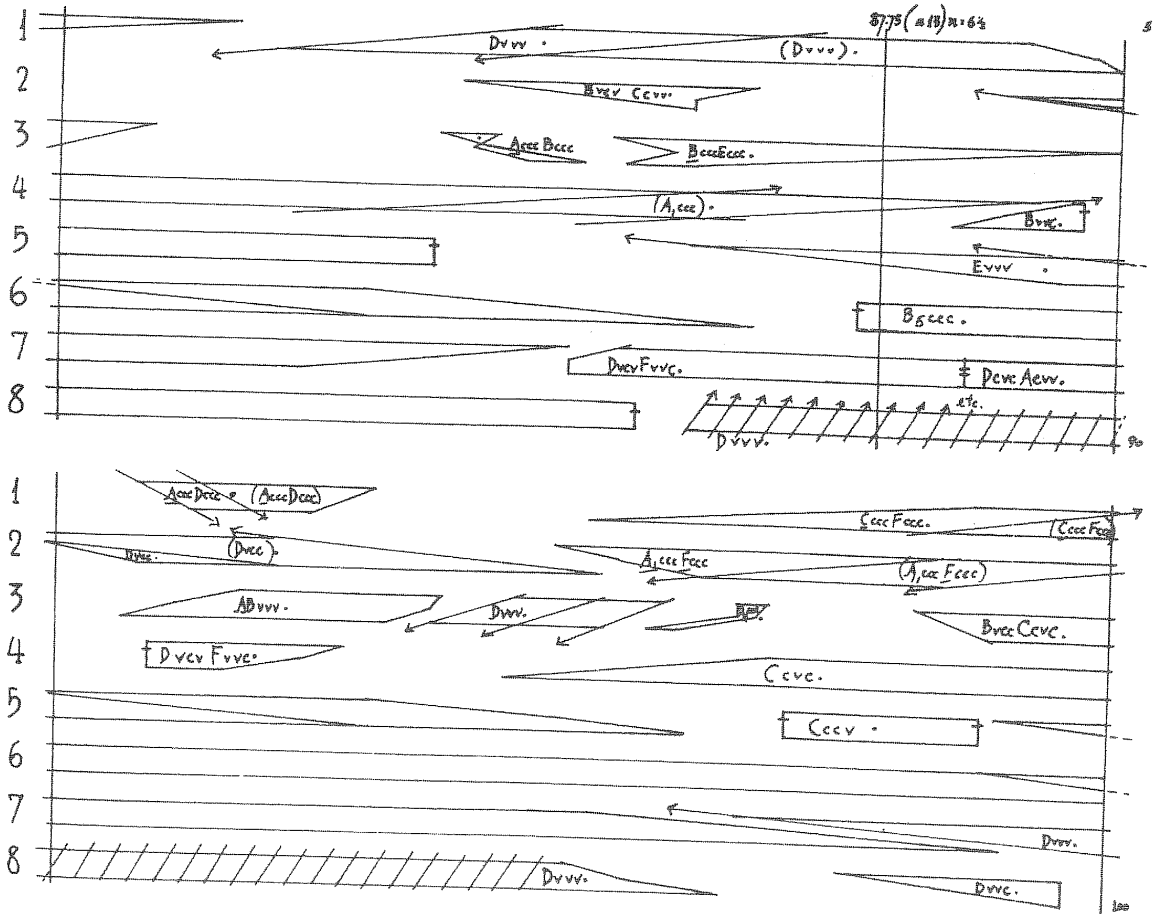


Figure 3.3 The score for *Williams Mix* by John Cage was actually a plan for making various kinds of tape splices. (Edition Peters)

Tudor, and the Barrons at their Greenwich Village studio, but also at various other places, including Cage's apartment. The splicing job was so laborious that any friend who happened to be in town or visiting was recruited to make a contribution. It required hundreds of *I Ching* operations to determine the various parameters that governed the assembly. The nature of each splice was determined by chance from a number of predetermined choices. However, one choice required the editor to freely make a splice in whatever pattern he or she wished, however irregular or unconventional.[13]

> We cut the tape into wild shapes. It was a tremendous editing job. We were obviously shaping the envelopes and we were putting tapes together so you could not discern where one piece of tape ended and the next one began, even though it may have been a totally different category.[14]

The piece received its first public performance in 1953 at the Festival of Contemporary Arts, University of Illinois. Cage was not unaware of the impact of his unconventional approach to splicing sounds on tape. In 1958, he wrote:

> The chief technical contribution of my work with tape is in the method of splicing, that is, of cutting the material in a way that affects the attack and decay of sounds recorded. By this method, I have attempted to mitigate the purely mechanical effect of electronic vibration in order to heighten the unique element of individual sounds, releasing their delicacy, strength, and special characteristics, and also to introduce at times complete transformation of the original materials to create new ones.[15]

One can imagine that a piece as radically experimental as *Williams Mix* was met with mixed reactions by other composers and the music-going public. One recorded performance of *Williams Mix* at Town Hall in New York in 1958 plainly reveals that the work was met with equal amounts of applause and verbal invective.

By 1954 the Project of Music for Magnetic Tape had run its course, largely because the participants became disenchanted with the restrictions of formal tape composition. Under the umbrella of the project, Cage and Tudor had produced *Williams Mix*, as well as *Imaginary Landscape No. 5*; Brown created *Octet I* (1953); Feldman composed *Intersection* (1953); and Wolff created *For Magnetic Tape* (1953).[16] After this, Brown, Feldman, and Wolff returned to experimental music using acoustic instruments, while Cage and Tudor continued to work with tape to some extent but also with the application of electronic music in live performance.

By 1954, the Barrons had established themselves as important providers of electronic music and sound effects for film. They collaborated with such celebrated avant-garde filmmakers as Maya Deren and Ian Hugo, who was married to the writer Anaïs Nin. The Barrons scored three of Hugo's films based on Nin's writings, including *Bells of Atlantis* (1952). For Deren, they assisted in the audio production of the soundtrack for *The Very Eye of Night* (1959) featuring the music of Teiji Ito. A few years later, when Madison Avenue became interested in using electronic music in commercial advertisements, the Barrons were one of the only options in town. They were competing with other private New York studios, particularly those of Raymond Scott (1908–94) and Eric Siday (1905–76).

LISTENING GUIDE 3.2

Title: *Williams Mix* (excerpt)

Artist: John Cage **Year**: 1952 **Duration**: 3:00

Genre: Tape composition

Electronic Instrumentation: Tape composition using recordings of natural sounds as source material.

Background: *Williams Mix* consists of hundreds of taped sounds edited together using unusual tape splices to modify the attack and decay characteristics of the sounds. It was realized as eight tracks of tape edited to splicing instructions determined by chance and documented in a 192-page graphic technical score (see main text). Sounds were collected in six categories: city sounds, country sounds, electronic sounds, manually produced sounds (including musical instruments), wind-produced sounds, and amplified small sounds. The piece took several people nine months to edit. The eight tracks were mixed down to a two-track stereo mix.

	Listen For: Sounds from the six categories and the variety of envelope characteristics of the sounds as determined by the splicing methods.
0:00–3:00	Because the piece was realized using chance operations, it contains no discernible pattern or structure. Sounds occur without any special intent to build form, drama, or expression, representing only themselves—sounds for the sake of sounds. In the course of the piece one can detect the sound of frogs at various speeds (1:28), voices sped up (0:30; 2:43), a piano (0:33), blasts of white noise (2:53), electronic oscillations (0:41; 1:14), ambient sounds (1:09), musical sounds at various speeds (0:45; 1:21), and occasional moments of silence (2:00). The sound is broken up or chunked because of the many randomly applied tape splicing techniques to cut from one sound to another. In the most extreme cases, one sound cuts directly into another using a vertical cut (2:44) and these transitions are so rapid that it results in a stuttering effect. Other times, the cuts produce a more gradual fade into a sound or fade out from a sound (0:12; 1:53), effectively creating a sense of pace in the form of a passing sequence of momentary fluctuations in amplitude or intensity.

Compare and Contrast
For Magnetic Tape (1953) by Christian Wolff
Intersection (1953) by Morton Feldman
Super Digital (2000) by Tetsu Inoue

The most celebrated output of the Barrons' studio remains the soundtrack to the science fiction movie *Forbidden Planet* (1956). Many previous movies—including *Spellbound* and *The Day the Earth Stood Still*—had used electronic musical instruments such as the Theremin as part of their scores, but *Forbidden Planet* was the first score for a major motion picture consisting entirely of electronic music. The producers of the film had not originally intended to use so much electronic music and had considered hiring Harry Partch (1901–74) to do most of the score. As Bebe Barron explained:

> We were hired originally to do 20 minutes of scoring. After they heard the 20 minutes of sample scoring that we did they got very enthusiastic about it. We were then assigned about an hour and ten minutes of scoring. They gave us a work print of the film. We took it to New York and worked there.

This in itself was unheard of, because most film scores were made in Hollywood at the time. The studio had wanted to move the Barrons and their equipment to the West Coast, but the couple would not be uprooted.[17]

The Barrons developed a method of working that was the organic equivalent of the simple circuits that they were building. Mixdowns of multiple tracks were accomplished using multiple tape recorders. They would manually synchronize the starting points of the two tapes that were to be mixed, count "one-two-three-go," and then push the playback buttons simultaneously. The output of each machine was fed into a third tape recorder that would record the two tracks as a mix onto one tape. Precise synchronization was not vital for their style of atmospheric music: "That was close enough sync for us. If it was a little bit out of sync, it usually enhanced the music. We were loose in our requirements."[18]

The sounds themselves were generated from homemade circuits. As Bebe Barron recalled:

> With *Forbidden Planet*, we built a circuit for every character. Then we would vary these circuits accordingly. We would consider them as actors. They were like *leitmotifs*. Whenever one character was on screen and another would appear, you would get the motif of both characters working. Of course, the form of the music was dictated by the film.[19]

The sound circuits they built tended to burn out eventually, never to be revived. They never knew how long one might last, so they made a habit of recording everything and then piecing it together using their tape recorders. About the life of their circuits, Barron recalled, "No matter what we did, we could never reconstruct them. They just seemed to have a life span of their own . . . We never could predict the movement of them, the patterns of them. It really wasn't like composing music at all."[20]

The Barrons edited the entire score of *Forbidden Planet* themselves. The music and sound effects were so stunning that, during a preview of the movie, the audience broke out in spontaneous applause after the energizing sounds of the spaceship landing on the planet Altair IV. An interesting bit of trivia involves the screen credit for the Barrons. It was originally to read, "Electronic Music by Louis and Bebe Barron." At the last minute, a contract lawyer became fearful that the musicians' union would be in an uproar if they called the score "music." The credit was changed to the more neutral, "Electronic Tonalities by Louis and Bebe Barron."[21]

John Cage and the Advocacy of Chance

A first impression upon learning that John Cage composed music using chance operations is that the result must have been chaotic, noisy, and disorganized. Although some of Cage's music might certainly be described as lacking conventional musical structure and harmony—particularly when electronic sounds were incorporated into the mix—much of the composer's music for conventional instruments produces the opposite effect: restive, harmonic, and unpredictable. Cage described many of his compositions as being *indeterminate* of their performance. What the composer meant by this was that, while the composition process itself was dictated by chance operations, the performance itself was not; the score was created using a system for making chance decisions about notes, duration, amplitude, timbre, and other possible dynamics, but the outcome was

determined once the score was being followed. Of course, many of Cage's works, particularly for live electronic performances, did indeed involve a degree of improvisation and on-the-fly decision-making by the performers, but even this aspect of his music was sometimes orchestrated through a carefully plotted sequence of decision points determined ahead of time by chance. Cage originally made his "chance" decisions by tossing yarrow sticks or coins, according to practices described in the *I Ching*. He later found a more productive way of deriving lists of random numbers through the use of computers. In the late 1960s, a friend of his at Bell Labs wrote a program that printed out a long list of randomly generated numbers. The printout was several inches thick and was produced using a large IBM computer that was programmed using keypunch cards. Cage used this list for several years. He kept the edge-worn printout on his work table, consulting it regularly, crossing off numbers as he used them, continuing page after page. He told me that, when the list began to run short, he asked his friend Paul Zukofsky, who had connections at Bell Labs, if he could replenish his supply of numbers by having the program run again. That was so many years later that the keypunch-card computer had since become obsolete and was no longer manufactured. After some scrambling at Bell Labs, one old but operational IBM mainframe of the correct vintage was found and a new printout was made for the composer. Cage had a million new numbers again. But the new printout came with the implicit warning that he had better find another source of random numbers for the next time around. He was able to do this with microcomputers by about 1984. He also found that the computers at IRCAM could assist him in this way as well. "I was delighted when I got to IRCAM," he told me, "to discover that I didn't need my printout because they have it in their computer there. You can have the I Ching whenever you want it!"[22]

CAGE IN MILAN

Following *Williams Mix*, Cage immediately returned to composing for instruments and further developing his use of chance operations. Except for an unfinished magnetic tape piece (1952), he did not work again directly with magnetic tape composition until 1958 and the creation of *Fontana Mix*. The occasion was a visit to Italy that brought him an invitation from Berio and Maderna to work in the *Studio di Fonologia Musicale* in Milan. The actual reason for his visit to Italy was to compete on a popular television quiz show, *Lascia o raddoppia* (*Double or Nothing*), where Cage was quizzed on his extensive knowledge of mushrooms. During five appearances on the program he won the equivalent of $6,000 by correctly answering questions put before him. The award money represented a turning point in the composer's financial situation:

> After the work in Milan, where I won the "Lascia o Raddoppia" prize, that was the first time I had any money to speak of. Otherwise I was as poor as a church-mouse and I was nearly 50 years old. Through the money I made there, and then through the invitation from Richard Winslow to become a fellow in the Center for Advanced Studies at Wesleyan, everything began to change and it was at that moment that Peters decided to be the exclusive publisher of my music. So everything came together at that point. I used the fellowship at Wesleyan to prepare fair copies of much of the music that I didn't have good copies of.

> Everything began to change. People, for instance, who didn't like my music could say they liked my writing [his book of essays, *Silence*, was published in 1961]—and vice versa.[23]

Fontana Mix, named after Cage's landlady in Milan, Signora Fontana, was completed at the Studio di Fonologia Musicale in November 1958. *Fontana Mix* was scored for any number of tracks of magnetic tape, for any number of players, or any kind and number of instruments. Its duration was unspecified and the composition was indeterminate of its performance, meaning that each realization of the work would be different. Cage had previously explored a number of novel scoring techniques for emphasizing the chance routines behind his composition methods. For example, notes for *Music for Piano 1* (1952) corresponded to imperfections in the paper upon which the piece was written. The *Concerto for Piano and Orchestra* (1957–58) had no overall score but explicit written instructions for orchestral parts in which notes were provided in three different sizes; the size could refer to the duration or amplitude of the note or both, a determination made by the performer. The score for *Winter Music* (1957) consisted of 20 unnumbered pages plus pages with performance instructions. The 20 pages were used in part or in whole by as many as 20 pianists and the individual performers were required to make decisions regarding the length of the program. *Fontana Mix* was his first magnetic tape piece to fully explore Cage's chance composition technique.

The score for *Fontana Mix* was itself an experiment (see Figure 3.5). It consisted of several transparent plastic sheets that were imprinted with geometric images. One sheet included a grid upon which the other transparencies were laid according to Cage's instructions. There were ten transparencies with points, ten with curves (six each), and a transparency with an even line. The parameters of the sound events were determined by laying these sheets on top of one another and interpreting the intersection of the graphic elements. For example, the height of a curve on the grid determined the amplitude of the sound. The duration of a sound would be determined by the point at which a curve first touched the grid and then left it. Spaces in between the intersection would mark silence. The relationship of sound and silence was thus spatially defined.

The source material for *Fontana Mix*, as first realized by Cage, contained a similarly eclectic blend of noise sounds, outdoor sounds, recorded music, and electronic effects made available at the Milan studio. Cage also included silence as a component of the mix and the whole was pieced together using chance operations to determine the sequence of the edit.

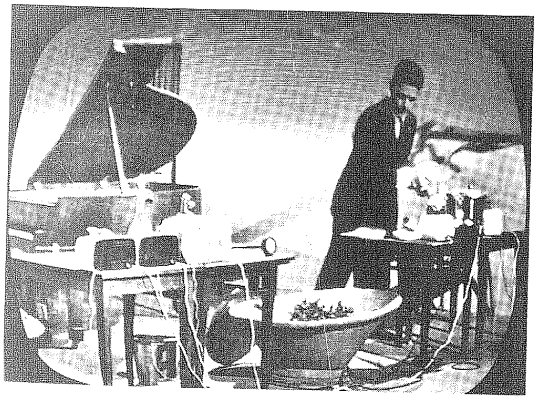
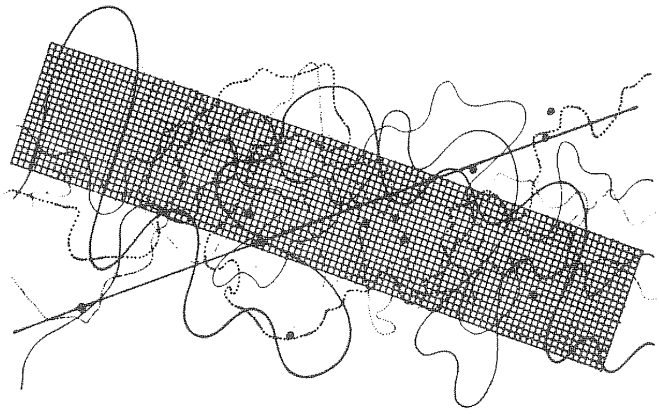


Figure 3.4 John Cage performing *Water Walk* on Italian television, 1959. (John Cage Trust)

From his work in Milan, Cage created a version of *Fontana Mix* for two tapes that was also released on record. It was 11′ 39″ long. The work was stunningly experimental and reinforced the American composer's reputation as chief advocate of the most avant-garde reaches of contemporary music at the time.

Fontana Mix was effectively the last major composition by Cage for magnetic tape alone. The taped sounds of *Fontana Mix* were redeployed by the composer in several live performance works,

Figure 3.5
Score of *Fontana Mix*.
(Edition Peters)



including *Water Walk* (1959), *Sounds of Venice* (1959), and *Theater Piece* (1960). Cage continue to explore the use of electronic media throughout his long career, particularly in collaboration with the Merce Cunningham Dance Company, for which he was a musical advisor for over 40 years. But rather than compose for recorded media alone, Cage extended the use of electronics to live performances, many of which were then recorded. Having the Merce Cunningham Dance Company to work with was probably responsible for maintaining Cage's interest in electronic music for he disliked the typical format of magnetic tape concerts at the time. Cage later remarked:

> I was at a concert of electronic music in Cologne [1952] and I noticed that, even though it was the most recent electronic music, the audience was all falling asleep. No matter how interesting the music was, the audience couldn't stay awake. That was because the music was coming out of loudspeakers.[24]

Cage's longtime musical collaborators in live electronic music included David Tudor, Gordon Mumma (b. 1935), David Behrman (b. 1937), and Takehisa Kosugi (b. 1938), all of whom figure importantly in the later history of live electronic music performance (Chapter 13).

A point is worth mentioning here about the apparent contradiction between "chance music" with indeterminate outcomes and the recording of such works. A magnetic tape composition, no matter how the material was conceived, remains forever fixed as a recorded performance in time. Cage was conflicted over this, because chance music should be just that: indeterminate of its performance. He once told the author:

> Everyone now knows that there's a contradiction between the use of chance operations and the making of a record. I mean not only myself, but I see no reason for living without contradictions. But I do think that one can live without recordings. And I do that. I don't play them, except when I use them in a live performance . . . I still believe that's true; that if you want music to come alive, that you must not *can* it.[25]

Having been Cage's discographer, the author can attest to the fact that the composer did not even own a record player.

EARLY ELECTRONIC MUSIC IN THE UNITED STATES

LISTEN

1 *Heavenly Menagerie* (1950) by Louis and Bebe Barron
Early tape composition (New York)

2 *Williams Mix* (1952) by John Cage
Produced at the Barrons' studio (New York)

3 *Fantasy in Space* (1952) by Otto Luening
Produced at the Columbia Tape Music Center (New York)

4 *Sonic Contours* (1952) by Vladimir Ussachevsky
Produced at the Columbia Tape Music Center (New York)

5 *Intersection* (1953) by Morton Feldman
Produced at the Barrons' studio (New York)

6 *A Poem in Cycles and Bells* (1954) by Luening and Ussachevsky
One of the first works for tape and live orchestra (New York)

7 *Forbidden Planet* (1956) by Louis and Bebe Barron
Soundtrack for the motion picture of the same name (New York)

8 *Linear Contrasts* (1958) by Ussachevsky
Early tape work using the RCA Music Synthesizer (New York)

9 *Stereo Electronic Music No. 1* (1960) by Bülent Arel
An RCA synthesizer piece by Turkish composer Arel (New York)

10 *Music from the Venezia Space Theater* (1964) by Gordon Mumma
Representative of the electronic music produced by Gordon Mumma and Robert Ashley for Milton Cohen's Space Theater (Ann Arbor)

THE COLUMBIA–PRINCETON ELECTRONIC MUSIC CENTER

Another important thread in the storyline of early tape music in the United States took place in academic circles. In 1951, around the same time that Cage was getting acquainted with the Barrons, composers Otto Luening (1900–96) and Vladimir Ussachevsky (1911–90) were both music instructors at Columbia University in New York City. The music department had acquired some tape equipment for the recording of music performances, including a dual-speed Ampex 400 tape recorder that could run at 7.5 and 15 inches per second, a Magnecord tape recorder borrowed from a radio store, and a Western Electric 369 microphone. A young engineer at the school named Peter Mauzey (b. 1930), who provided the composers with technical help, also built a circuit for creating reverberation.

Luening and Ussachevsky began a long-standing partnership as collaborators and caretakers of what was initially called the Columbia Tape Music Center (in 1958 it became the *Columbia–Princeton Electronic Music Center*). There was no permanent studio at first; the two men moved the portable equipment from one location to another in the trunk of Ussachevsky's car. There had been enough interest in their experiments

to generate several commissions during 1952 and 1953 and, during August of 1952, the composers set up shop in the corner of a renovated carriage barn at Bennington College in Vermont. That fall, they moved for two weeks into composer Henry Cowell's cottage in Shady, New York, and completed several short works for a Leopold Stokowski concert to be held at the Museum of Modern Art (MoMA) in Manhattan. From there the portable studio landed for a short time in the Ussachevsky living room in New York and then the sound studio in the basement of conductor Arturo Toscanini's posh Riverdale home. Luening mixed his piece *Invention in Twelve Tones* (1952) using the far superior collection of tape recorders at the Union Theological Seminary in New York.[26] Finally, after many months of nomadic existence, the Tape Center landed in a room at the Columbia music department.

Luening's and Ussachevsky's earliest experiments, like those of the Paris studio, did not make use of any electronically produced sounds. They had no oscillators or other signal-generating equipment. Instead, the two composers turned to the manipulation of recorded instrumental sounds. This was an important decision for them to make. Explained Luening:

> We had a choice of working with natural and "non-musical" sounds like subway noise and sneezes and coughs, or widening the sound spectrum of existing instruments and bringing out new resonances from the existing world of instruments and voices. We chose the latter.[27]

Luening and Ussachevsky composed their first pieces using only tape manipulations (speed changes, reverse sounds, splicing) and reverb using Mauzey's black box. Luening first worked with flute sounds and Ussachevsky the sounds of the piano.

The first public recital of their tape music took place at a Composers Forum recital organized by Ussachevsky on May 9, 1952.[28] Among the works premiered was Ussachevsky's *Sonic Contours*, featuring the electronically modified sounds of the piano. This raised some eyebrows and the word began to spread about tape music being created at Columbia University.

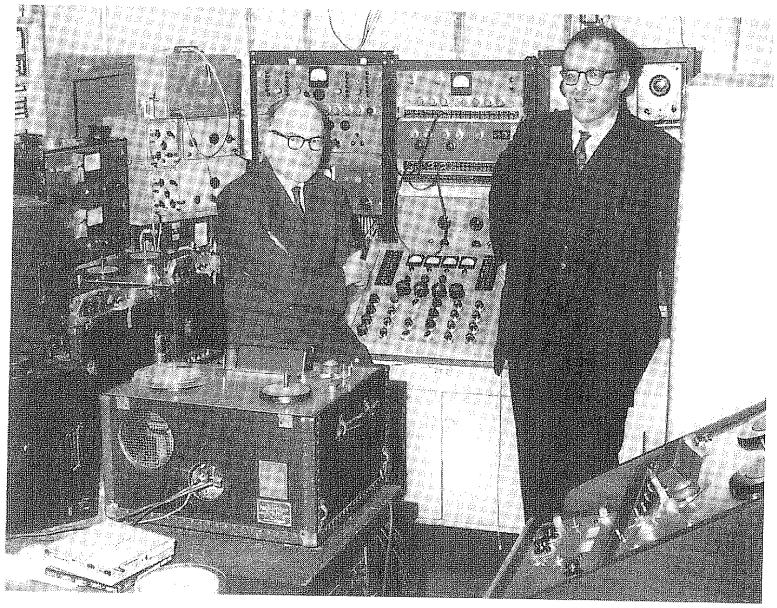


Figure 3.6
Otto Luening and Vladimir Ussachevsky in the Columbia–Princeton Electronic Music Center, *c.* 1960. (Columbia University Computer Music Center)