

Electronic Music

Electronic music is the great adventure of music from the beginning of the 20th century. Music has always embraced the latest technology, from drawn metal strings replacing gut strings, and the mechanical and manufacturing sophistication of the pianoforte replacing the harpsichord. The latest technology has always been used to extend and expand music's expressive possibilities, and that has included electronic music, where technology has been pressed into the service of music and many of the musical developments have been made possible by technological developments.

Today the term "electronic music" is sometimes synonymous with dance music and music which is all synthesized, but electronic music has a history which is about 100 years old and the term can have multiple meanings, although all of the meaning are based on a music which is produced by electronic means, usually without any standard instrument being involved.

Electronic instruments began to appear at about the turn of the 20th century, as techniques for harnessing electricity became more developed. The honour for the first electronic musical instrument often goes to Theadus Cahill's Teleharmonium, developed in 1897 and first publically performed in 1906, although Elisha Gray had the "Singing Telegraph" from 1876 predates it. The Singing Telegraph used solenoids tuned to vibrate at musical frequencies, which were activated by a piano-style keyboard. The Teleharmonium was a very large machine, taking several railway boxcars to transport, it was played via two piano-style keyboards and it transmitted signals over the telephone network to subscribers.

The most significant early electronic musical instrument was the Theremin (1917) built by Leon Theremin, a Russian who also developed the first secret listening bug. Other instruments were developed, such as the Ondes Martenot, the Trautonium and so on. These instruments were all initially used to play standard repertoire and not used to develop musical expression.

There were some radical musical developments in the early 20th century, such as the Italian Futurists and there were other social changes post WWI and WWII that precipitated the later more adventurous developments in Electronic Music.

Other developments in Electronic Music during the first half of the 20th century include montage sound pieces made with film (with optical soundtrack recording) by such composers as Fritz Walter Bischoff, Arseny Mikhaylovich Avraamov and Yevgeny Sholpo (by drawing audio waveform on optical film), Walter Ruttmann, and Jack Ellit through to the early 1930s. Various composers also included recorded sound via gramophone playback with orchestra and other instruments.

John Cage, in 1937, prophetically published his *Future of Music: CREDO* text which states, in part, that music will continue to be made with more electronic and "noisy" sounds, such that in the future electronic music will be made where the points of opposition in music will not be between harmony and dissonance (as in the past) but between noise and non-noise sounds. In 1939 Cage performed *Imaginary Landscape No. 1*, which was the first piece to include live electronics in the form of a variable-speed turntables playing test-tones and muted percussion and piano.

While Halim El-Dabh made a montage piece (*Ta'abir al-Zaar*) with recorded sound on a wire recorder in 1944, the real start of electronic music was in Paris in 1948 with Pierre Schaeffer's first pieces of musique concrète; *Étude aux Chemins de Fer* (railway study), *Étude aux Piano (I & II)*, *Étude aux Tourniquets*, and *Étude aux Casseroles* (all for analog disk playback), presented in a radio concert in October of that year. These pieces were made using recordings (on disk) of everyday sounds, manipulated and edited into a montage. Schaeffer developed a complete theory around what he called sonic objects and concrete music made from these recordings.

Electronic music composers soon realized that without melody, harmony, and rhythm, which are traditionally used to express form in a piece of music, they needed to find other means. As electronic music uses sound itself as the fundamental element, *timbre* became the differentiating factor with which to express the form of a piece of electronic music. The earliest electronic music composers quickly adapted to this and developed the new language to suit their needs. To this day, electronic art music typically expresses its form through timbral changes.

The WDR (Westdeutscher Rundfunk - West German Radio) Studio für Elektronische Musik was founded by Herbert Eimert, Robert Beyer and Werner Meyer-Eppeler in 1951 in Köln, Germany. Karlheinz Stockhausen worked there and produced several significant works of electronic music in the early to mid 1950s. These works include *Studie I*, *Studie II* and *Gesang der Jünglinge*. In contrast to the French practice of making music from recordings of real sounds, the WDR philosophy was to make pure Elektronische Musik (electronic music) from fundamental sine waves, fully synthesizing all sounds. This was partly made possible by the proliferation of German tape recorder technology after WWII, which made overdubbing and re-recording possible, as well as finer and more sophisticated editing than was possible with disks.

There were many other developments in the 1950s that were highly significant. Electronic music studios were developed in America (Columbia University NY, University of Illinois, and Ann Arbor Michigan), Italy, The Netherlands, Poland, Japan, Canada, England and Chile. CSIRAC became the first computer to play music and Max Mathews at Bell Labs laid the foundations for computer music (see Computer Music). The possibilities of electronic music captured the imaginations of many composers and it featured in the Philips Pavilion at the 1958 Worlds Fair, as well as being used by Louis and Bebe Baron for the soundtrack to the film *Forbidden Planet*, the first film with an electronic music soundtrack. Many of the world's best composers embraced electronic music, such as Karlheinz Stockhausen, Iannis Xenakis, Edgard Varèse, Györgi Ligeti, John Cage, Luciano Berio, Gottfried Michael Koenig, Vladimir Ussachevsky, Luigi Nono and others. These developments were still based on the basics of analogue sound synthesis and tape editing of pre-recorded sounds to produce montage works.

Throughout the 1960s and 1970s, with advances in the miniaturization of electronics, tape recorders became less of a specialist item and commercial synthesizers were developed, particularly popular were the Moog, Buchla and EMS instruments. This took electronic music out of the universities and research departments and more into the mainstream. The research and art-music activity in electronic music continued, but also many popular music and jazz performers added synthesizers to their live performance instrumentation and tape editing techniques to popular record production, Kraftwerk, Brian Eno and Keith Emerson are major examples, as is Pink Floyd's

album *Dark Side of the Moon*. Also much of disco was based on electronic music and jazz and funk artists such as Herbie Hancock and Stevie Wonder also embraced electronic instruments. Popular exposure to electronic instruments, techniques and sounds was also ensured by the success of TV productions such as the BBC's *Doctor Who* and the film *Star Wars*.

At the end of the 1970s two digital electronic instruments heralded the beginning of the merging of analogue electronic music with computer music. The New England Digital Synclavier and the Fairlight CMI (Computer Musical Instrument) combined many of the features of analogue synthesizers and the editing ability of analogue tape. Commercial analogue synthesizers needed digital control to easily bring back "patches" and settings that would otherwise take several minutes to re-set. Manufacturers had been making modular analogue synthesizers such as separate keyboards, synthesis and sequencing parts. Users naturally wanted to mix-and-match components from different manufacturers, and with the industry embracing digital control of synthesizers, Sequential Circuits and Roland established the MIDI (musical instrument digital interface) specification in the early 1980s. This revolutionized both analogue and digital synthesis, and allowed computers to be easily integrated with synthesizers. The 1980s and 1990s saw an explosion in growth of electronic musical instruments and their use by musicians. The cost-effectiveness of synthesizers and digital samplers meant that musicians had access to more sounds and editing capabilities than ever before. Digital emulations of analogue equipment and processors meant that such processing was significantly cheaper and more reliable. The use of digital processing greatly expanded the sound manipulation options for electronic musicians, creating new sounds and composition paradigms such as spectral music.

In the mid 1980s with the separation of the control of synthesizers from the sound generation mechanism that MIDI enabled, alternative controllers started to be developed. These ranged from wind, drum and guitar controllers that mimicked traditional instruments tigering arbitrary sounds to specialised and often custom controllers such as the Buchla Thunder and the gesture-tracking sensor-based instruments from Michel Waisvisz and Laetitia Sonami. This activity has increased and in 2002 the first conference of New Interfaces for Musical Expression (NIME) took place. Commercial interest in this has continued and now there are many alternative controllers from grid-based button sequencers to add-ons for a player's wrists and body parts, the bows for string instruments and camera based controllers that track a performer's gestures visually.

Digital hardware was able to emulate less reliable analogue hardware by the 1990s, and software-based instruments started to be developed for general-purpose computers. Over the next ten years software synthesis systems gradually replaced dedicated hardware instruments, and these instruments often integrated with Digital Audio Workstation editing and production systems. Some of these software instruments accurately emulated older analogue synthesizers, others allowed for sample playback like hardware samplers, and various general-purpose synthesis and DSP (digital signal processing) languages were developed such as Pure Data, MaxMSP, Supercollider, Nyquist, Audulus, Csound, Impromptu, ChucK and others. These environments allow musicians to create custom synthesis and processing tools.

New Wave bands in the 1980s and Techno and House dance music (derived from disco) through the 1990s continued to expand electronic music's popularity in mainstream culture. The increasing availability of powerful commodity computing meant that electronic music was easier to produce and dance music became extremely popular in the 1990s with rave culture and DJs.

Today, electronic music is everywhere. Most popular music uses in some way tools based on the developments in electronic music, even if it is simply the use of samplers playing back pre-recorded sounds of standard acoustic instruments or now-standard synthesizer sounds. Some music, such as electronic dance music, is completely produced electronically and new practices have developed such as live coding, circuit bending and chipmusic. The classical experimental tradition also continues where musicians use electronic means to search for new sounds and new aesthetics.

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Some of the key works of Electronic Music:

- John Cage — *Imaginary Landscape No. 1* (1939)
- Pierre Schaeffer — *Cinq études de bruits* (includes *Étude aux Chemins de Fer*) (1948)
- John Cage — *Williams Mix* (1952)
- Karel Goeyvaerts — *Nummer 5 met zuivere tonen* (1953)
- Karlheinz Stockhausen — *Gesang der Jünglinge* (1955–56)
- Louis and Bebe Barron — *Forbidden Planet* (1956)
- Edgard Varèse — *Poème électronique* (1958)
- Iannis Xenakis — *Concrèt PH* (1958)
- Luciano Berio — *Thema (Omaggio a Joyce)* (1958–59)
- Karlheinz Stockhausen — *Kontakte* (1958–60)
- Luciano Berio — *Visage and Momenti* (1960)
- Pauline Oliveros — *Sonic Meditations, Teach Yourself to Fly* (1961)
- Milton Babbitt — *Philomel* (1964)
- Luigi Nono — *La fabbrica illuminata* (1964)
- Karlheinz Stockhausen — *Mikrophonie I & II* (1964 and 1965)
- Karlheinz Stockhausen — *Hymnen* (1966–67)
- Luigi Nono — *Contrappunto dialettico alla mente* (1968)

- Alvin Lucier — *I Am Sitting in a Room* (1969)
- James Tenney — *For Ann (rising)* (1969)
- Mario Davidovsky — *Synchronisms No. 6* (1970)
- Françoise Bayle — *L'Expérience Acoustique* (1972)
- Bernard Parmegiani — *De Natura Sonorum* (1975)
- Luc Ferrari — *Presque Rien N°2* (1977)
- Trevor Wishart — *Red Bird: A Political Prisoner's Dream* (1977)
- Iannis Xenakis — *La Legende d'Eer* (1977)
- Jean-Claude Risset — *Sud* (1985)
- Trevor Wishart — *Vox 5* (1986)

See also:

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Further reading:

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