**Electric/Electronic/Electroacoustic and Experimental Music Timeline**

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1897 Telharmonium (massive electric organ/additive synthesizer) designed. Completed 1902, early experiment in electronic music production and transmission (over telephone lines).

1913 Luigi Russolo - *The Art of Noises* - manifesto about broadening sonic palette of music to include the noises which were becoming so prevalent in industrial life.

1919 The theremin invented. Portable electronic instrument capable of expressive control; musician waved hands over two aerials (one for frequency, one for amplitude). The theremin was later incorporated into orchestral/ensemble composition or, later used for B-movie music and special effects. Edgard Varèse composed *Equatorial* (1934) for an ensemble including theremins.

1935 AEG Magnetophon: first tape recorder. Alterations and editing of sound materials now greatly facilitated.

1939 **KEY MUSICAL WORK:** John Cage - *Imaginary Landscape* No. 1 - utilises variable-speed turntables playing test tones, in combination with a muted piano and cymbal. First composition to integrate electronic sources (the test tones) and acoustic instruments. Paved the way for Cage’s increasing focus on the ‘liberation’ of sound materials.

1948 **KEY MUSICAL WORK:** Pierre Schaeffer, *Etude aux chemins de fer*, first piece of musique concrète (“concrete music”) composed using sampled environmental/industrial sound. Schaeffer’s early experiments and first studio were based at Radio France. Pieces composed at the Paris studio used recorded sounds and eschewed electronically-generated ones.

1950 Milan electronic music studio founded by Luciano Berio at RAI. This studio favoured both recorded (*a la musique concrète*) and electronically-generated (synthesised) sonic materials. The famous electroacoustic composition *Thema* (*Ommaggio a Joyce*) would later be composed there (in 1958).

1951 Studio for electronic music (*Elektronische Musik*), founded at Nordwestdeutscher Rundfunk (WDR) in Cologne. In line with the strictly parametric (numerically-controlled/described) compositional practices of serialism dominant in West Germany at the time, the only acceptable sonic materials were synthesised, whose timbral parameters could be carefully specified. Karlheinz Stockhausen was one of the most prolific composers at the studio.
1955/6 **KEY MUSICAL WORK:**

Stockhausen composes *Gesang der Junglinge*, which utilises both electronic and recorded materials (a boy’s singing voice). This is the first time that such materials were used at the Cologne studio and brought about something of a reconciliation between the French (*musique concrète*) and German (*Elektronische Musik*) approaches.

1957(a) RCA Music Synthesizer at Columbia-Princeton Electronic Music Centre in New York. ‘Programmable’ synthesiser with analogue sound generation: programmable refers mostly to the ability to ‘sequence’ notes and specify sounds...but the synthesizer was not a computer as such. Used by composers interested in music of rhythmic and melodic complexity.

1957(b) Computer music born, Bell Labs, NJ. In common with other areas of digital audio, many developments in computer music were spurred on by work on telecommunications engineering. Some staff at Bell Labs, including Max Matthews began to experiment with computer programs for sound synthesis and sequencing. This resulted in a family of music synthesis languages known as *Music N* - text-based files would control the synthesis (orchestra files) and sequences of notes to be generated (score files). Would develop into *Csound* (Vercoe, 1986), which is still in widespread usage.

1958 **KEY MUSICAL WORK:**

Edgard Varèse - *Poème Électronique* - composed as a piece of ‘tape music’ for the Philips Pavilion at the Brussels World fair. Varèse had been an early visionary polemecist in the quest for new (electronic) instruments and sound sources for composition and, with this piece, finally had the opportunity to work with some of the music technology whose development he had agitated for in the 1930s. The piece was a mixed-media one, featuring a building designed by Le Corbusier and Iannis Xenakis (who would later become an influential composer of instrumental and electronic music) along with light and Varèse’s music. The result was spatialised - sent to 425 speakers around the space.

1958–60 **KEY MUSICAL WORK:**

Stockhausen’s *Kontakte* (‘Contacts’) composed. One of the most celebrated early electronic music compositions. Stockhausen explored connections between pitch, rhythm and timbre, famously experimenting with slowing down a musical note until it becomes a set of ‘clicks’ or ‘pulses’, before using a reverberation effect to combine the pulses back into tones again.

1964 Robert Moog’s voltage-controlled synthesizer demonstrated at the AES (Audio Engineering Society) Convention. This greatly facilitates the possibilities for control of a number of parameters simultaneously. However, the synthesis method (subtractive synthesis) only really allowed for a ‘broad brush’ approach and sometimes the pitch generators (oscillators) became unstable, drifting out of tune. Some educational institutions in the US began to install voltage-controlled synthesizers as a means of exploring electronic music (others allowed composers some time on their general-purpose mainframe computers, exploring digital synthesis with *Music N*).

“Something new has been added, a new art of sound. Am I wrong in still calling it music?”

Pierre Schaeffer

(in Holmes, 2012, p.63)

“...when new instruments will allow me to write music as I conceive it, taking the place of the linear counterpoint, the movement of sound-masses, of shifting planes, will be clearly perceived. When these sound-masses collide the phenomena of penetration or repulsion will seem to occur. There will no longer be the old conception of melody or interplay of melodies. The entire work will be a melodic totality. The entire work will flow as a river flows.”

Edgard Varèse

(*New Instruments and New Music*, 1936)
1965/6 **KEY MUSICAL WORK:**
Steve Reich's tape works *Come Out* (1965) and *It's Gonna Rain* (1966). These pieces used the process of allowing identical tape loops to fall out of synchronisation, resulting in new patterns emerging. Reich later termed this his *phasing* technique and applied this method to his instrumental pieces.

1969(a) **STEIM** (STudio for Electro Instrumental Music) founded in Amsterdam to research the development of new electronic musical instruments.

1969(b) **KEY MUSICAL WORK:**
*Mutations* by Jean-Claude Risset is an influential early piece of computer music, engaging with perceptual explorations and morphing between fused/unified timbres (‘single sound sources’) and chords (‘groups of distinct voices’) using different configurations of the same frequency materials.

1973 John Chowning discovers FM (frequency modulation) synthesis whilst experimenting with vibrato. This technique allows for complex sounds to be generated by much simpler means than had previously been the case - Chowning noted that by varying the frequency of one oscillator at a rapid rate with a signal produced by another oscillator, he could produce effects which were similar to the output of around 20 oscillators in parallel. This technique was patented in 1975 and licensed to Yamaha, later providing one of the defining sonic characteristics of 1980s pop music.

1974 **KEY MUSICAL WORK:**
*Pentes* (‘Slopes’) by Denis Smalley was completed at Groupe de Recherches Musicales (GRM), the successor of Pierre Schaeffer’s Radio France studio. The piece was based on using processing to explore an interplay between short transient (perceptive) sounds and extended drones and glissandi (pitch-glides) using digital processing. The source samples were taken from Northumbrian pipes.

1975 Brian Eno coins term ‘ambient music’, which is similar in concept to Satie’s ‘furniture music’ (1917)... music as part of environmental sound or as defining ‘container’ for environmental sound materials/structures.

1978 **KEY MUSICAL WORK:**
*Trevor Wishart, Red Bird: A Political Prisoner’s Dream* (electroacoustic music), which uses a combination of extended vocal techniques (performed by the composer) and electronic processing to morph these elements with environmental sounds.

1983 **MIDI** – Musical Instrument Digital Interface – allows for reliable remote control signals to be sent digitally over a serial interface, standardising communications between a wide range of studio hardware. Facilitates the development of computer-based MIDI sequencing software for electronic music.

1984 The *Max* electronic music performance control language (by Miller Puckette) was first used at IRCAM (French Government research centre). This version was text-based, but later versions would become extremely popular due to their development into a graphic programming language structured around the manipulation of objects on-screen.

1986(a) **KEY MUSICAL WORK:**
*Riverrun* by Barry Truax saw the first implementation of real-time granular synthesis: building up a sound texture from combinations of grains (very short tones, with volume envelopes, of 1-50 milliseconds). The piece used granular synthesis techniques to render a stylised portrait of a river’s changing flow via its upper, middle and lower courses.

1986(b) **Csound**, a port of the *Music N* (1957) languages/environments written in the C programming language, released. *Csound* is highly ‘portable’ as a result and has been ported to a wide variety of computer platforms. (Current version: *Csound* 6, 2013).

1986(c) **Composers’ Desktop Project** (UK) gives composers access to computer-based sound processing on home computers, begun by consortium including Trevor Wishart. Initially based on Atari ST platform, later ported to Windows and Mac OS. It’s interface structure was based on the text-based *command-line interface*, but it didn’t require programming/scripting, as other synthesis environments (such as *Csound*) did.

1987 **G-lab Creator**, MIDI sequencer (no audio recording), ancestor of Apple’s Logic Pro/Studio. (Precursor of Cubase (Pro 24) also available at this time.)

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**Karlheinz Stockhausen**

Karlheinz Stockhausen (1928–2007) was ideally placed to heal the rift between the French *musique concrète* (based on manipulation of recorded sound) and German *Elektronische Musik* (based on sound synthesis, creating sounds by purely electronic means) schools of composition. He completed early exploratory compositions (etudes/studies) at both the Radio France (in 1952) and WDR (in 1953) electronic studios. He was unsatisfied with the results of his early *Elektronische Musik* pieces (*Studie I* and *Studie II*): his carefully-specified production of sound spectra by individual tone generators failed to produce convincingly blended timbres. As a result, he began to explore the combination of processed recordings and synthesis, with Gesang der Junglinge (1955–56) being credited as the first work which integrated the two approaches. Stockhausen engaged in extensive theorising about the new creative implications of electronic music.

“The ranges of perception are ranges of time...and since modern means have become available, to change the time of perception continuously, from one range to another, from a rhythm into a pitch, or a tone or noise into a formal structure, the composer can now work within a unified time domain.”

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**Karlheinz Stockhausen:** German composer who was influential in integrating the (previously distinct) streams of sampling and synthesis-based composition.
Post–digital music: experimentation beyond academia?

“Computers have become the primary tools for creating and performing electronic music...Our current sonic backgrounds have dramatically changed since ‘4’33’’ was first performed—and thus the means for navigating our surroundings as well. “In response to the radical alteration of our hearing by the tools and technologies developed in academic computer music centers—and a distribution medium capable of shuttling tools, ideas, and music between like-minded composers and engineers—the resultant glitch movement can be seen as a natural progression in electronic music. In this new music, the tools themselves have become the instruments, and the resulting sound is born of their use in ways unintended by their designers.”

A number of different ‘streams’ or ‘schools’ can be considered to be the antecedents of today’s technologically-mediated music and sonic arts:

- **Futurists** c.1900s-1930s (Italy, Russia)
- **John Cage and Conceptualism** (USA) c. 1940s-1970s
- **Musique Concrète** (France) c.1940/50s
- **Elektronische Musik** (Germany) c.1940/50s
- **Computer music** (USA) late 1950s

**Futurists:** music and musical life to imitate/celebrate new technology

**John Cage:** liberation of noise and introduction of ‘non-musical structures’ into music

**Musique Concrète:** liberation of noise/everyday sounds helping to provide an alternative to Western Classical music’s ‘abstract music’ project

**Elektronische Musik:** analogue technology for extension of Western Classical music’s ‘abstract music’ project...synthesis and parametric control over tonal materials

**Computer music:** digital technology for extension of Western Classical music’s ‘abstract music’ project...synthesis and enhanced parametric control over tonal materials...integrating compositional and textural control
Music Technology as Meme early 21st C
Electroacoustic Music and Sonic Arts

Electroacoustic composition is the confluence of a number of streams: musique concrète, Elektronische Musik, computer music, soundscape work, etc. It is sometimes known as acousmatic music, after the legendary practices of the Pythagoreans of listening to lectures from behind screens, without visual reference-points.

More generally, it is a contemporary approach to composition which owes much to the sonic and conceptual explorations of John Cage in its investigation of broader ranges of environmentally-derived (and culturally-derived) sound materials and experiences through technology.

Its defining characteristics are the use of extensive exploratory sound processing (timbre is the key structural domain of this music) or carefully-specified sound synthesis, the presentation of ‘pre-sculpted’ fixed media works in ‘tape music’ concerts, the presentation over multiple loudspeakers (spatial arrays or ‘loudspeaker orchestras’) where possible.

Its materials and means may, however, cross over to other related areas of artistic practice: sound art and sound installations, digital/media arts, popular electronic musics (EDM, glitch, ambient) and live electronic music performance, and composition for acoustic instruments and electronics.
Select Further Reading


Select Listening


...See also my Spotify playlist: MUS302 Lecture 1

Theoretically, a continuum between popular and high genres may be possible, but few works occupy the central part of this continuum.”

Natasha Barrett (in d'Escrivan and Collins, 2007)

I'm happy for others to use these notes as supplementary materials for their classes/lecture courses. If you find them useful or have any feedback on their content, please get in touch! (This is version 1.0.)

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