fpa 147

Week 4

Up until the post war (WWII) period, electronic music tends to emerge as the technology to enable it does.

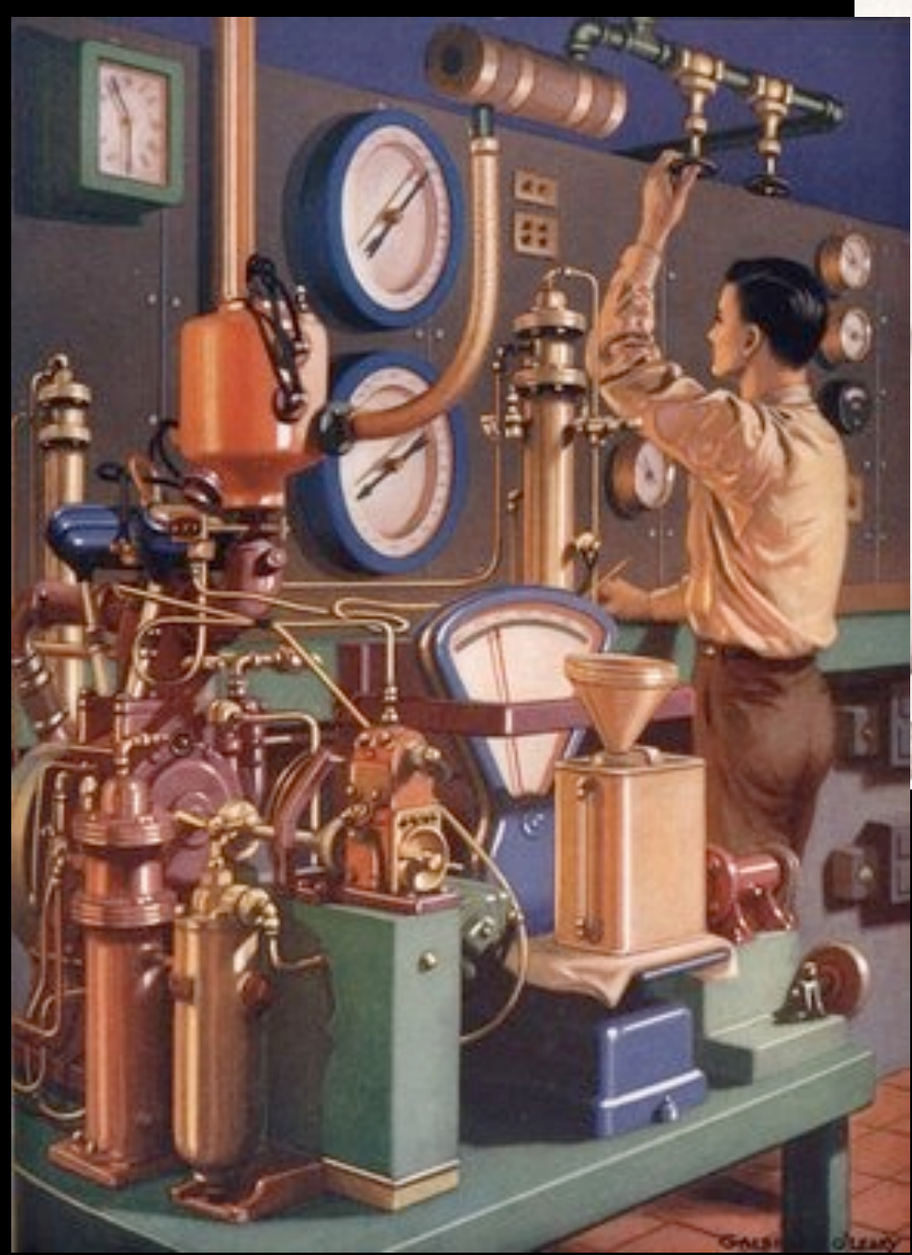
Three Motivations:

- *control, no mediation*
- *new frontiers of sound*
- *no constraints*

Possibility of complete creation & performance of a final musical event as complex as imaginable - all by a single individual without the mediation of performers.(or in other words: Exertion of a degree of control over the fundamental musical dimensions of timbre, pitch and rhythm which is greater than that of traditional systems.

The extension of the limits of frequency range, amplitude (dynamic range) and time which mechanical devices must obey: Loud very high frequency sounds, sudden, instantaneous shifts in timbre, frequency or amplitude, new timbres, new behaviours (ie the sounds of instruments played backwards, transposed in pitch and in time (rate-changing), etc.

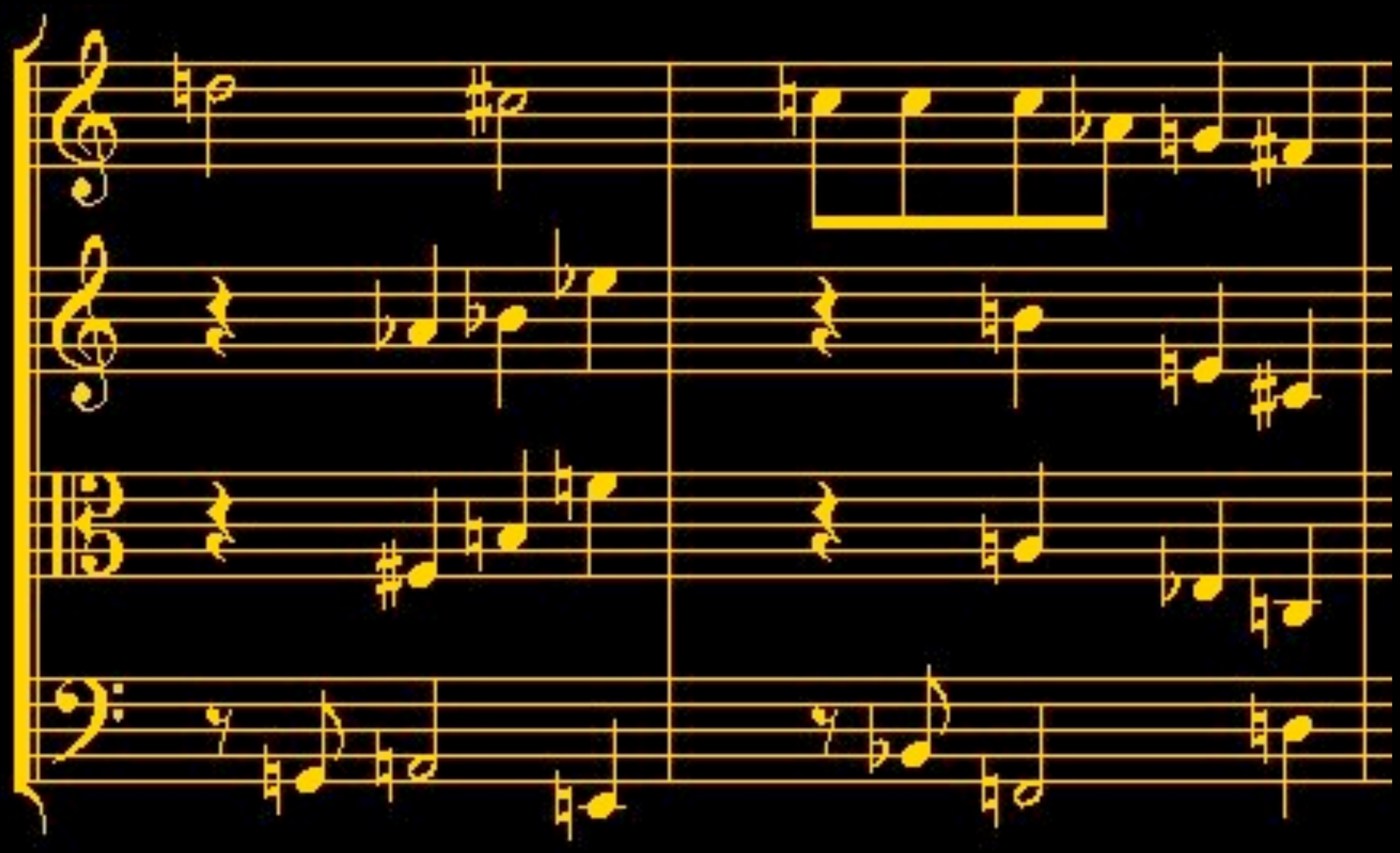
Possibility of meaningful, expressive interaction with music by virtually anyone with the requisite desire and inclination.Suddenly visual artists, animators, scientists, etc are making music.



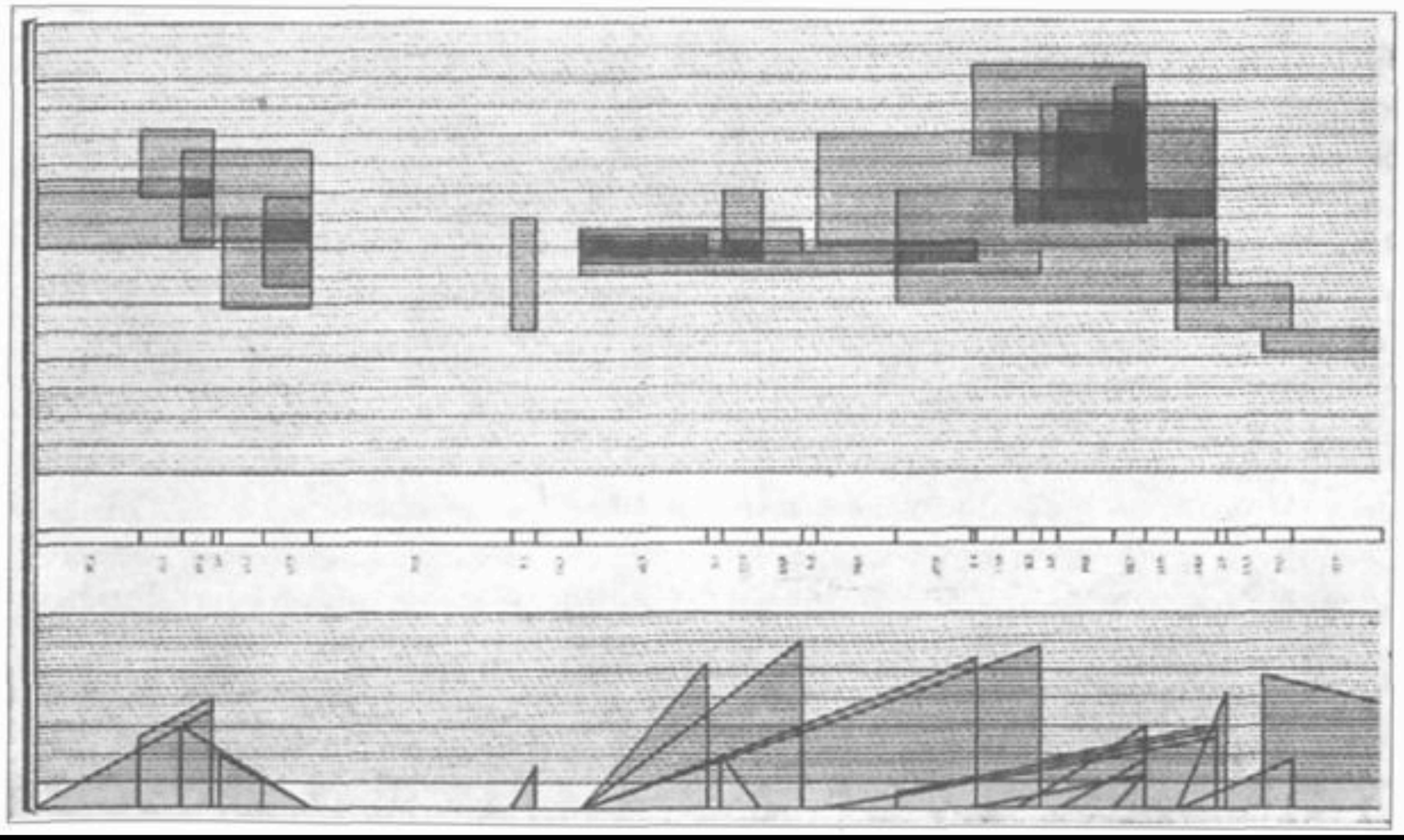
There is a myth of Western music, like our economies and technology/science, is always striving for new means of expression. This is predominantly a male model of new vistas to conquer. This model does not include the social function of music, but it is rather a utopian idea of creating the perfectly made object by the genius using the perfect machine. Electroacoustic music, unlike most other forms of art is acritical and relies greatly on the the mythification of technology.

Science (in the form of the atomic bomb) ended the World War II. Therefore electroacoustic music in the 50's can be seen as a celebration of this triumph of science. The human performer is removed because the human is fallible (the myth of control) and cannot therefore perform the perfect musical object. There is the idea that the listener is not an integral part of the work. Interpretation is not part of the work.

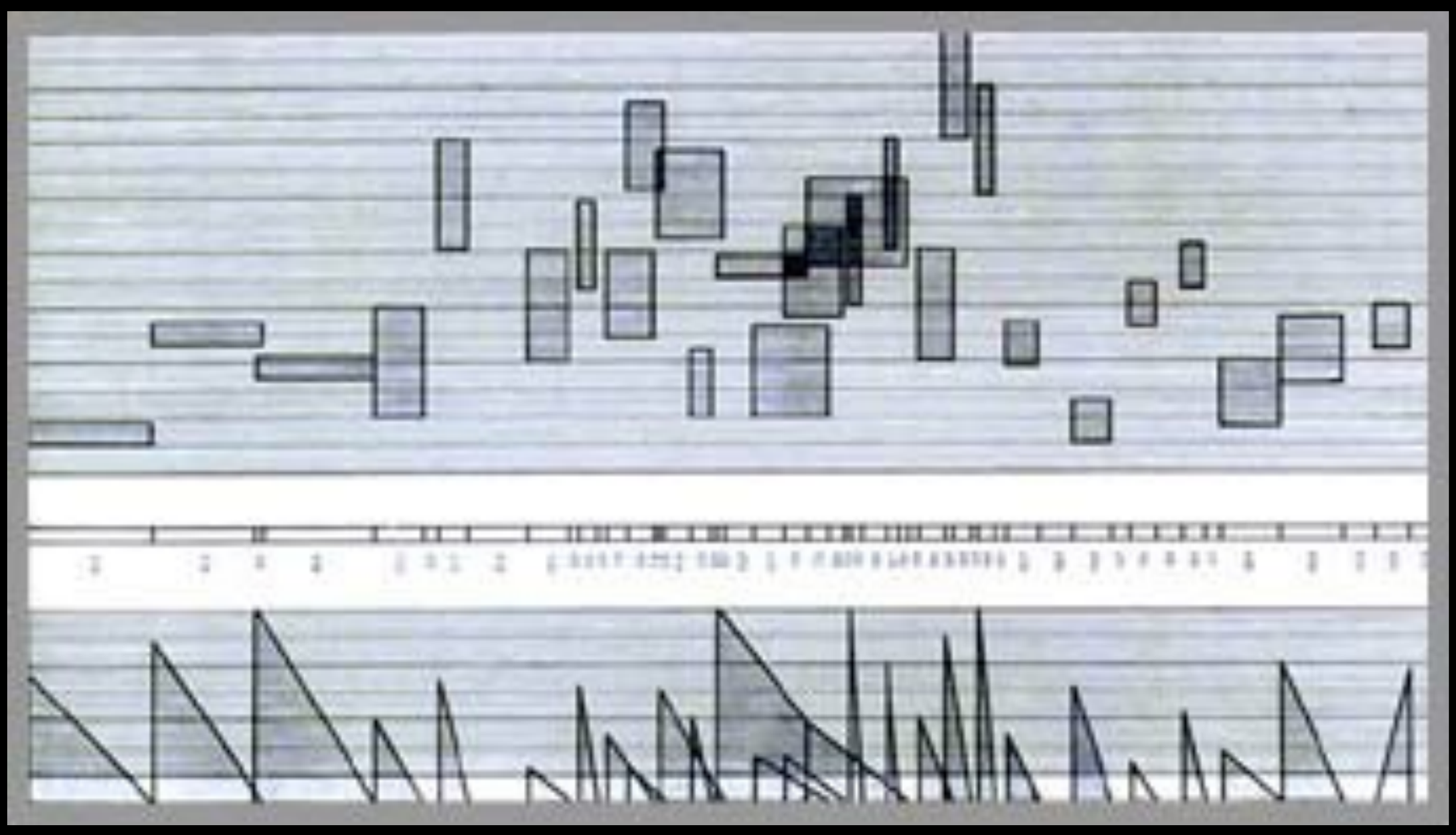
The First Electronic Music Studio The first studio designed to produce music entirely by electronic means was founded in 1952 by the German composer Herbert Eimert (1897-72), at the West German Radio in Cologne. One anecdote about the Cologne studio suggests that Eimert, in an effort to avoid the creation of French musique concrète style music, forbid microphones from the studio. This German music was the first pure electronic music, and is often referenced by its German name, *electronische musik* to distinguish it from later, more international, electronic music.



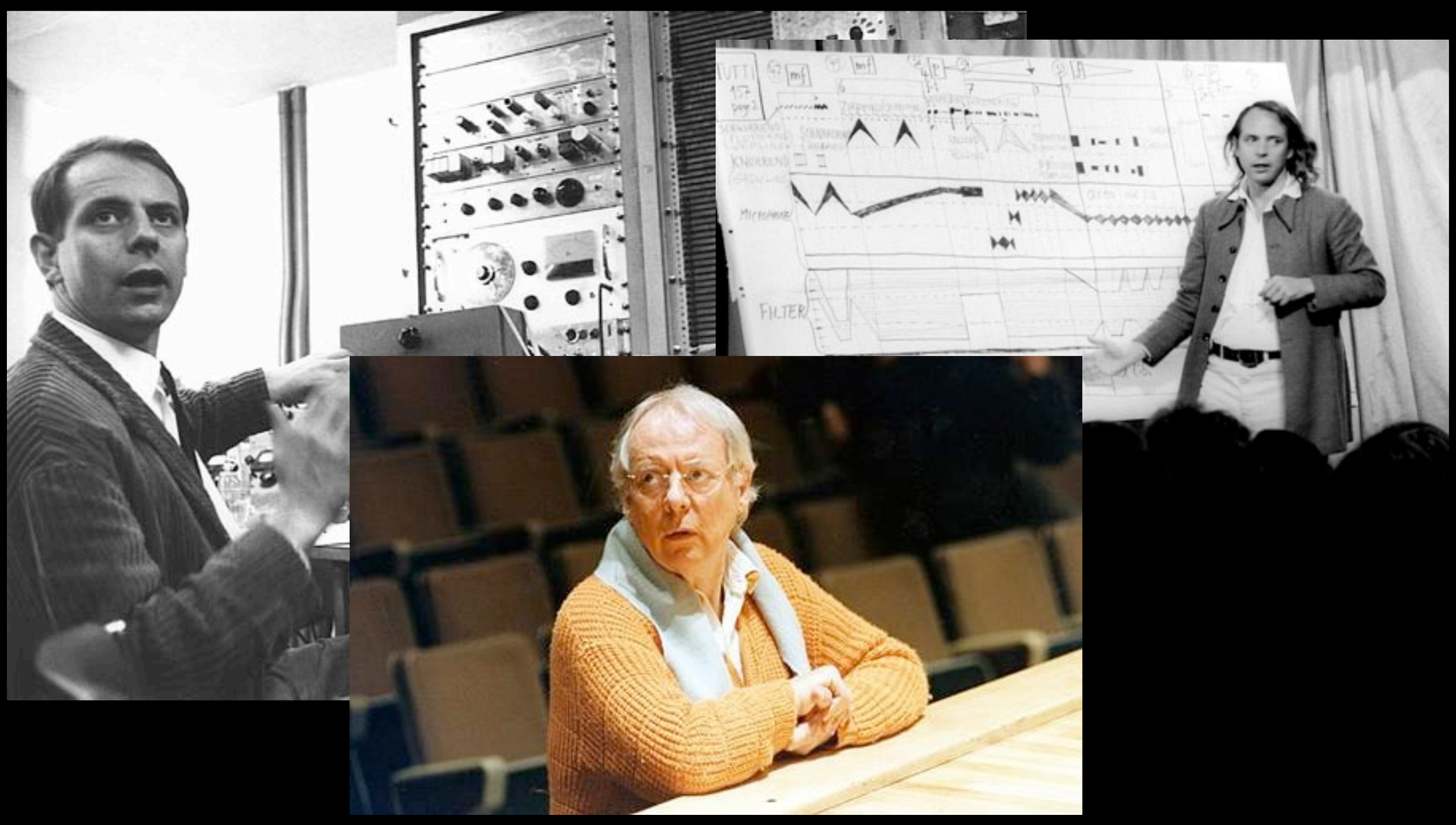
In music, **serialism** is a method or technique of composition that uses a series of values to manipulate differentmusical elements. Serialism began primarily with Arnold Schoenberg'stwelve-tone technique, though his contemporaries were also working to establish serialism as one example of post-tonal thinking. Twelve-tone technique orders the 12 notes of the chromatic scale, forming a row or series and providing a unifying basis for a composition's melody, harmony, structural progressions, and variations. Other types of serialism also work with sets, collections of objects, but not necessarily with fixed-order series, and extend the technique to other musical dimensions (often called "parameters"), such as duration, dynamics, and timbre. The idea of serialism is also applied in various ways in the visual arts, design, and architecture. Serialism first appeared in the 1920s, with antecedents predating that year. Schoenberg was the composer most decisively involved in devising and demonstrating the fundamentals of twelve-tone serialism, though it is clear it is not the work of just one musician. The serialization of rhythm, dynamics, and other elements of music was partly fostered by the work of Olivier Messiaen and his analysis students, including Karel Goeyvaerts and Boulez, in post-war Paris.



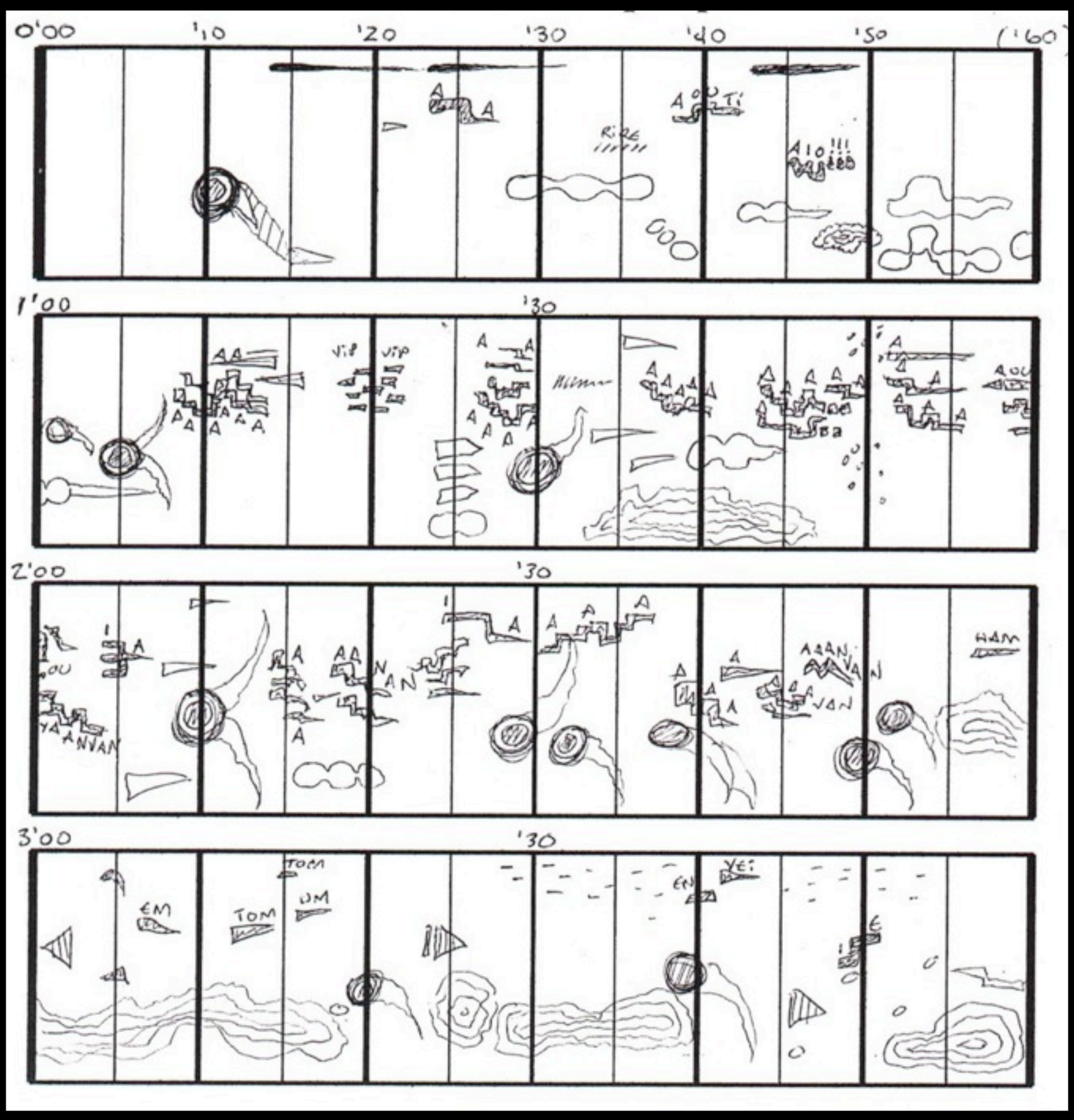
The Electronic Music Studio at Cologne in 1952. In addition to variable-speed tape recorders and the filters, echo chambers, and amplifiers found in the musique concrète studios, Eimert's studio also contained electronic sound producing devices: oscillators and noise generators. With these, composers could construct their own material "from the ground up", rather than relying upon natural sounds with predetermined timbral characteristics that, even when modified, could not be completely removed. In other words, in the musique concréte compositions you listened to, the sounds were still very much recognizable, despite the transformations. To composers of **serial music** exploring electroacoustics, this was a critical distinction, for they saw in electronic music a means for controlling, not only pitches and durations, but also the sonic materials themselves. Besides generating the music's structure from a single integrated compositional plan, its **timbre** could be so derived as well. Furthermore, it was a continuation of the tradition of **absolute music**, which dominated German concert music since the late 18th century - a music free of non-musical associations. Remember that in the 1950s, European concert music was very much dominated by serial composers, artists who were primarily concerned with order and organization. Thus, applying serial methods to electroacoustic materials, including the construction of timbre itself, seemed natural.



One obvious difference between *elektronische musik* and *musique concrète* was the sound materials themselves: the natural, concrete sounds of the latter were much more spectrally complex than the simple constructions of the former. Composers of early electronic music, in Germany and later in other countries, had to satisfy themselves with the knowledge that they were creating sounds completely from scratch, timbres perhaps never before heard. It quickly became obvious that their new timbres were no competition for the traditional timbres of orchestral instruments.

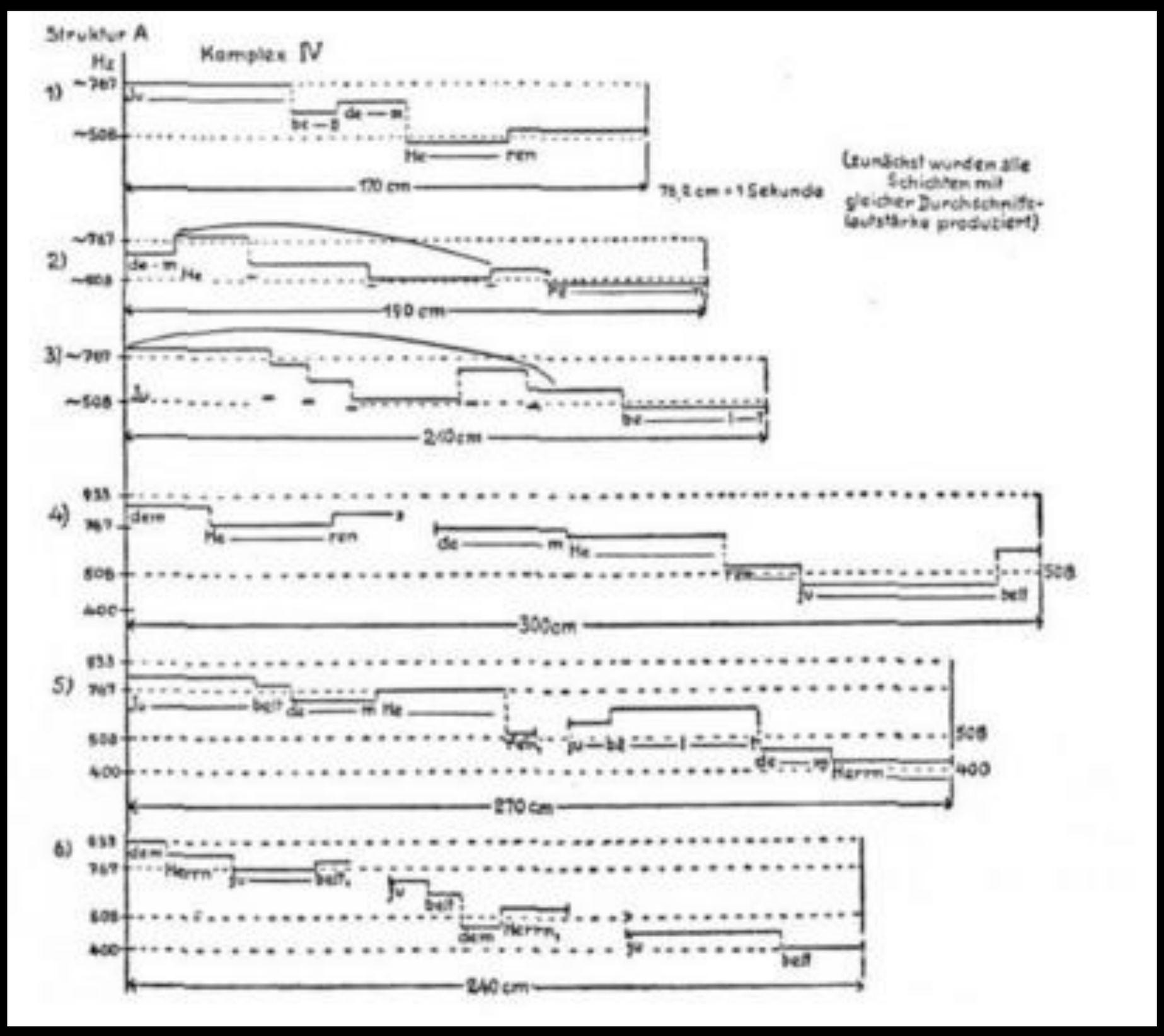


Karlheinz Stockhausen, a leading young German composer of acoustic serial music, began to work in the Cologne study, and his earliest compositions there, *Study I* (1953) and *Study II* (1954) were the first examples of pure electronic music. They systematically explored one of the basic techniques of early electronic sound construction, additive synthesis. The theoretical basis for Stockhausen's additive synthesis came from **Helmholtz** and **Fourier**, who demonstrated that any instrumental timbre could be analysed in terms of its component frequencies. Stockhausen had observed in Paris that timbre can be defined by an analysis of component frequencies (which had been scientifically known for some time). He had analysed the harmonic spectrum of hundreds of vocal and instrumental sounds and it seemed logical to assume that the process could be reversed. Entirely new timbres could be constructed by sine tone synthesis. It would therefore be possible, he surmised, to create a repertory of synthetic timbres which are mathematically related and therefore amenable to serial composition. In his *Studie #1*, sounds were created by combining sine waves in order to create artificial overtone structures, and thus new timbres. A serial system (ordering) was created for frequency, duration, amplitude, and timbre (number of sine tones in a pitch). The piece also used an echo chamber, in which pre-recorded material was played into a room via a speaker, and rerecorded by a microphone in the ambient space.

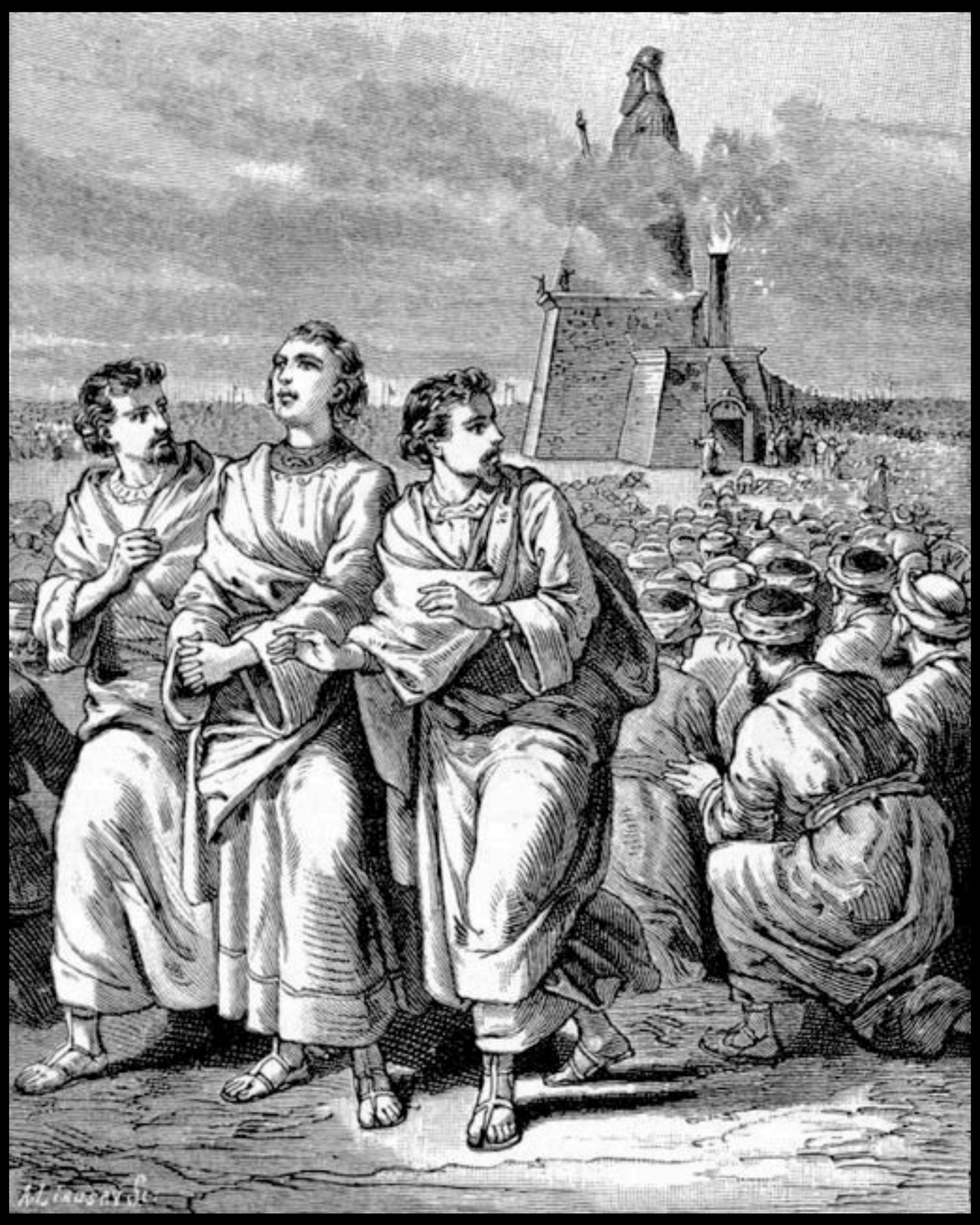


Stockhausen described the final synthesis in this manner: So serial thinking is something that's come into our consciousness and will be there forever: it's relativity and nothing else. It just says: Use all the components of any given number of elements, don't leave out individual elements, use them all with equal importance and try to find an equidistant scale so that certain steps are no larger than others. It's a spiritual and democratic attitude toward the world. The stars are organized in a serial way. Whenever you look at a certain star sign you find a limited number of elements with different intervals. If we more thoroughly studied the distances and proportions of the stars we'd probably find certain relationships of multiples based on some logarithmic scale or whatever the scale may be.

After his early studies, Stockhausen created one of the most important works of the repertoire: *"Gesang der Jünglinge."* Realizing that synthetic sounds were much simpler than *concrète* sounds, and recognizing the difficulty in creating complexity with synthesis alone, he incorporated *concrète* elements into this new work. These *concrète* sounds, based on a recording of a boy singing, were combined with purely electronic sounds, and using principles of serialism they were systematically organized within the work. The electronic sounds now included not only simple sine tones, both individually and in combination, but also filtered noise. This method initiated a second basic technique of early electronic music: **subtractive synthesis.** Here, the components of a complex sound (and what can be more complex than noise, which contains all frequencies) are filtered out in order to produce new timbres. **Subtractive synthesis** = partial removal of the spectrum of a complex source. *Gesang* deals with a much greater variety of sonic material than did any of the earlier studies created at the Cologne studio. It is further enhanced by its elaborate use of reverberation and spatial motion, produced by routing the sound through five independent loudspeakers placed in a circle around the listening space.

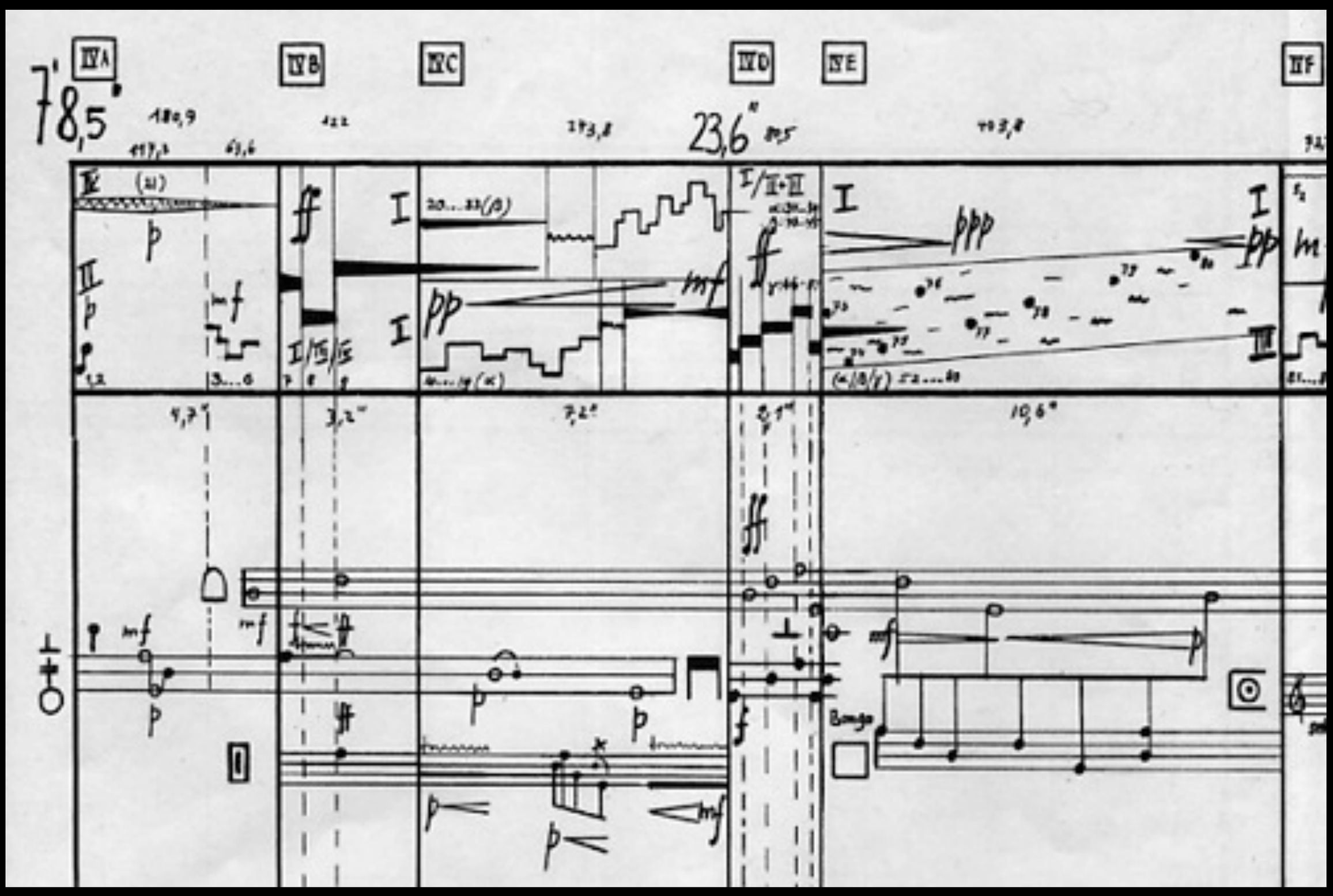


In Stockhausen's typically systematic way, all the materials are meticulously organized in a precompositional structure. For example, he formulated two scales, one electronic and one ***concrète.*** The electronic scale includes such elements as sine tones, modulated sine tones, white noise, and clicks. The*concrète* scale draws analogies between the electronic sounds and vowels (complex tones), consonants (noise elements), and sung tones (pure tones). The young boy singer imitated the pitches of prerecorded tones to integrate the electronic material even further. The work was constructed on series (ordering) based on timbre, pitch, duration, and dynamics for each of the sequences noted above, as well as on sequences based on dividing the material into various continuums—comprehensible to incomprehensible. The resulting work was a milestone in electronic music, both as the genre's first masterpiece and as the first composition to combine electronic and*concrète* elements. Furthermore, it legitimized electroacoustic music for many acoustic composers, because it demonstrated that the same meticulous organizational principles many of these composers were investigating in their acoustic music—namely serialism—could be applied effectively in electroacoustic music to create a highly complex and structured piece.



Two scales are formulated: one electronic and one concrete. This is an extension of the serial idea of klangfarbenmelodie:Electronic scale: Sine tones/FM sine, periodically mod/FM sine, randomly mod/AM sine, periodically mod/AM sine, randomly mod/Periodic combinations of the above/Random combinations of the above/White noise/White noise with random density/Periodic clicks/Random clicks

Concrete: All from a boy's voice using analogies between the electronic sounds and vowels (tones), consonants (noise elements), and sung tones (pure tones). (Interesting to note that some sounds modified using a "rate changer") The young boy imitated the pitch of prerecorded tones to further integrate the electronic material. The work was constructed on rows based on timbre, pitch, duration, dynamics, for each of the above sequences as well as sequences based on dividing the material into various continuums: comprehensible to incomprehensible, Note the use of stereo. The text is based on the third chapter of the Book of Daniel: Shadrack, Meshack and Abednego are thrown into the fiery furnace by King Nebuchadnezzar. The analogy to post war Germany is obvious...



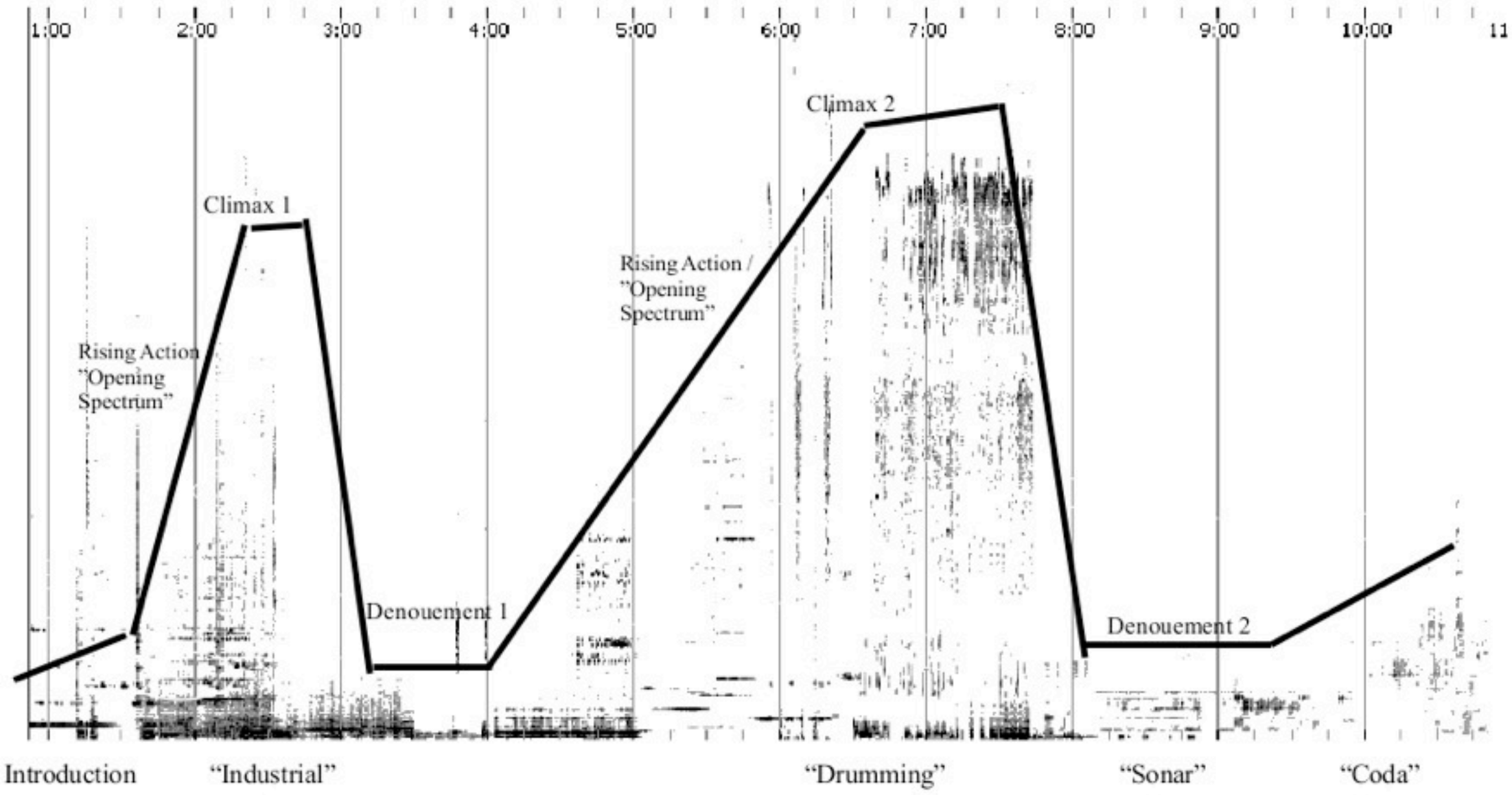
Stockhausen composed *Kontakte*(1959-60) immediately after he completed *Gesang*.In it, he continued to experiment with multiple-channel sound diffusion by using a rotating speaker system. Like all of Stockhausen's work, it is highly organized. The scale of electronically produced timbres contains familiar tones, sound, and noises (metal, skin or wood, etc.) and mediates among them. It facilitates the transformation of sound from each one of these categories into every other one, and the mutations of sound into completely new, previously unknown sound events. (Stockhausen; program notes from the original record album.) *Kontakte* is conceived for live performance involving a prerecorded four-track tape as well as a live percussionist and pianist. There is no live sound modification, and the performers play notated music to an accompanying tape. However, Stockhausen did not envision this relationship as soloists with accompaniment. Instead, the performers create a parallel and simultaneous performance to the tape. Their actions are, at times, synchronized and related to the tape, but the live element is seen as extending the tape into the concert hall.Stockhausen was a forerunner in creating live electronic works, and he mixed electroacoustic works such as this one. The concept of live electroacoustic music will be explored in detail in Unit Twelve.

Iannis Xenakis

Iannis Xenakis (May 29, 1922 – February 4, 2001) was a Romanian-born Greek ethnic, naturalized French composer, music theorist, and architect-engineer. He is commonly recognized as one of the most important post-war avant-garde composers. Xenakis pioneered the use of mathematical models in music such as applications of set theory, stochastic processes and game theory and was also an important influence on the development of electronic music.

Among his most important works are *Metastaseis* (1953–4) for orchestra, which introduced independent parts for every musician of the orchestra; percussion works such as *Psappha* (1975) and *Pléïades* (1979); compositions that introduced spatialization by dispersing musicians among the audience, such as *Terretektorh* (1966); electronic works created using Xenakis's UPIC system; and the massive multimedia performances Xenakis called *polytopes*. Among the numerous theoretical writings he authored, the book *Formalized Music: Thought and Mathematics in Composition* (1971) is regarded as one of his most important. As an architect, Xenakis is primarily known for his early work under Le Corbusier: the Sainte Marie de La Tourette, on which the two architects collaborated, and the Philips Pavilion at Expo 58, which Xenakis designed alone.

Figure 1: Dramatic form and Spectrum in *Orient-Occident*

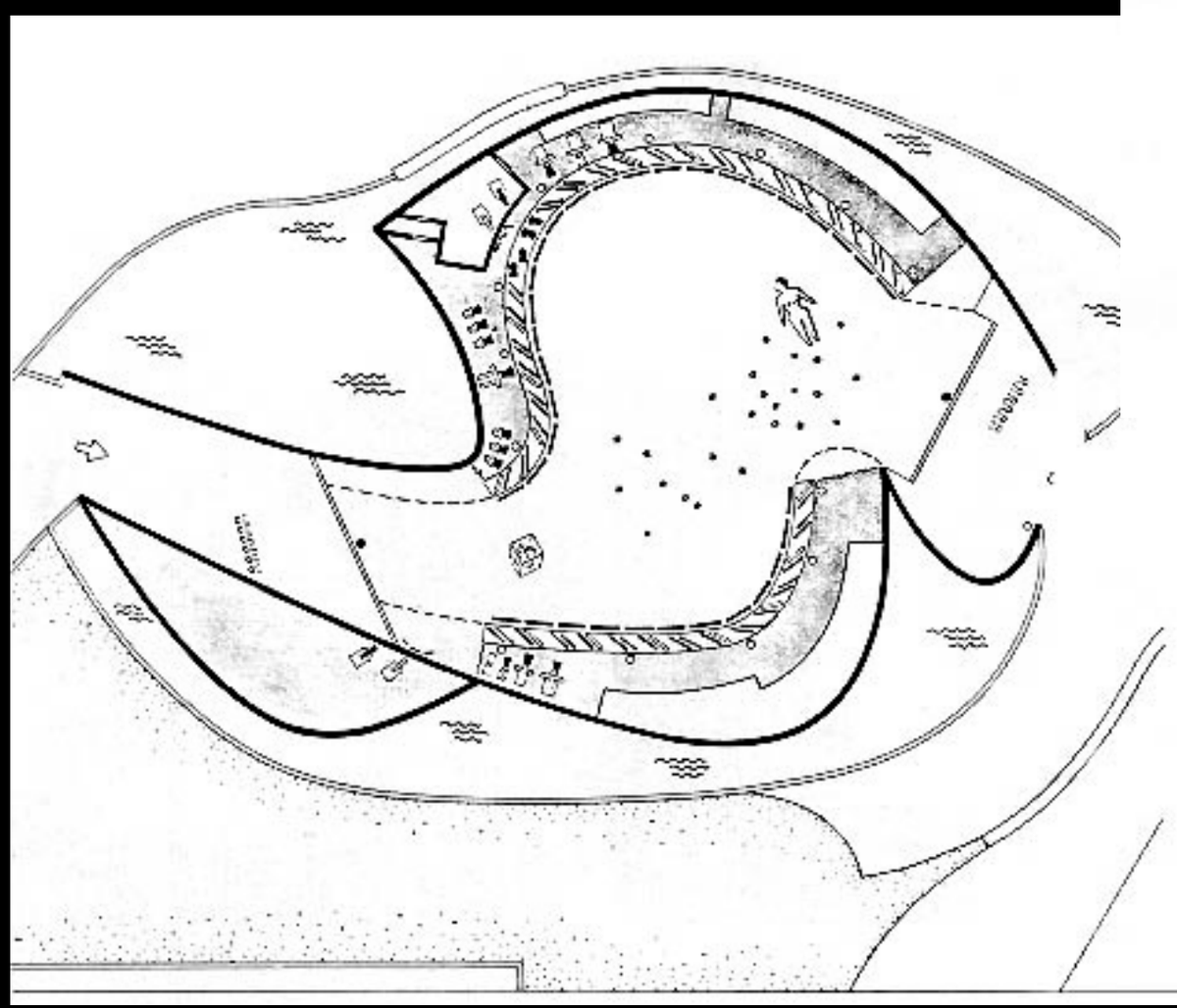


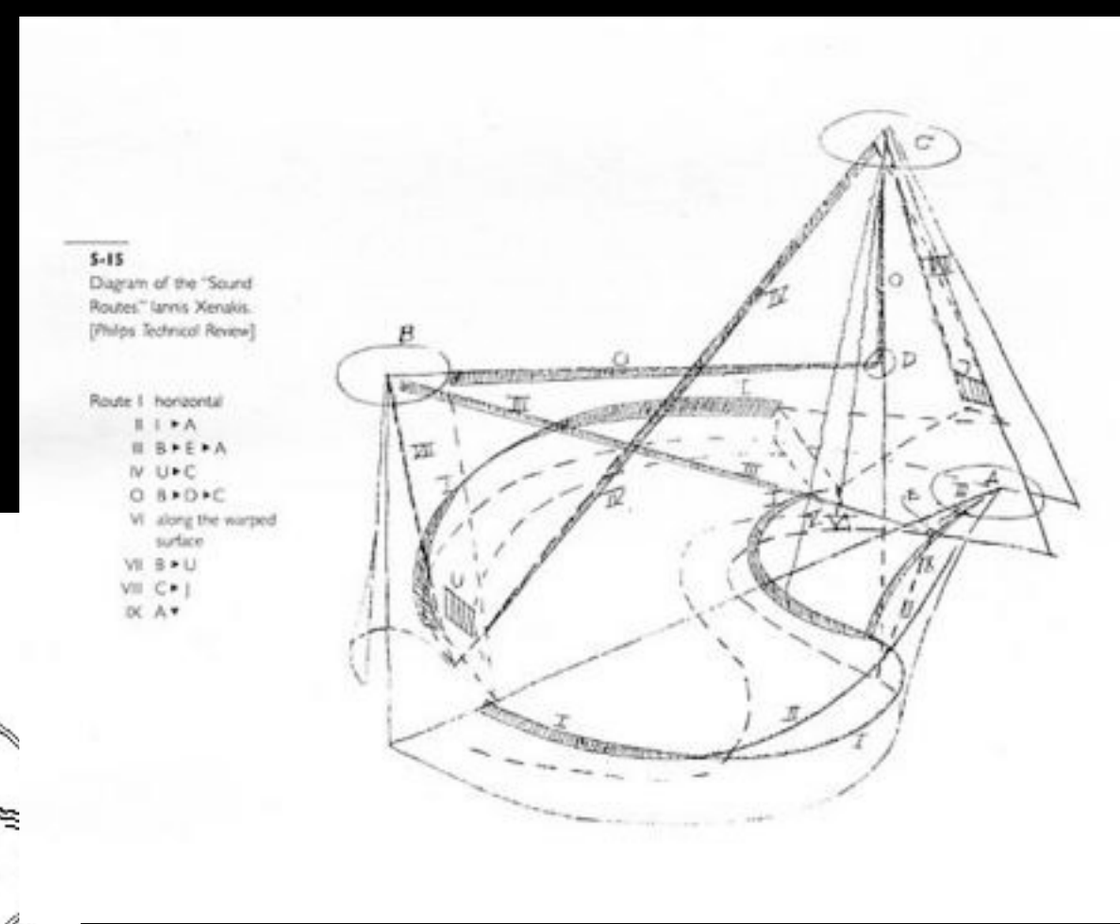
http://asymmetrymusicmagazine.com/editorials/intuition-and-order-in-xenakiss-orient-occident/

The real importance of Edgar Varese lies with his dealing with sound directly, as a raw phenomenon, with meticulous attention to spacing, sonority and a precisely calculated feeling for timbre and intensity; timbre is no longer 'incidental, anecdotal, sensual or pictaresque' but becomes 'an agent of delineation'. His music was the first that is impossible to transfer to any other medium - unlike say Stravinsky's The Rite of Spring the two piano arrangement of which successfully perserves the musical content , its 'idea structure'.

As a child he was not interested in learning his scales since they all sounded the same, and in his mature work 'notes' do not have the function they do in Shoenberg or Webern. A specific pitch, in a specific and carefully considered part of an instrument's range and produced with a sharply defined articulation becomes part not of a chord but of a chordal aggregate, a density of what happen to be pitched notes. His structuring methods - which he likened to crystal formation - consist of laying side by side these densities, which may differ one from the other only in emphasis, duration and note alignment. Again form is a resultant - an accumulation of what happened in the piece - emphasis is on experience rather than structure. The analogies he makes are geometric, gravitational, alchemical, natural: he speakes of'sound masses, of shifting planes.. taking the place of linear counterpoint... There will be no longer the old counterpoint of melody or interplay of melodies. The entire work will be a melodic totality, the entire work will flow as a river flows.'

A landmark in electroacoustic music and in 'total theatre' was the collaboration between Le Corbusier, Iannis Xenakis and Edgar Varese resulting in the Philips Pavilion at the 1958 Brussels World's Fair. Through an installation of over 400 loudspeakers, V's Poeme Electronique swept repeatedly across the building's high, angular spaces with projected images illuminating the walls. this work established a number of important ideas: - that such an event could proceed continuously, with no beginning or end - that it could involve vast spatial dimensions - that the listener/viewer could walk in, out, around etc., regulating or modifying the experience by choice. This work introduced many people to electronic music. In denying that his pieces were experimental 'I offer the finished product.. it is for the audience to make the experiment of confronting a new work'

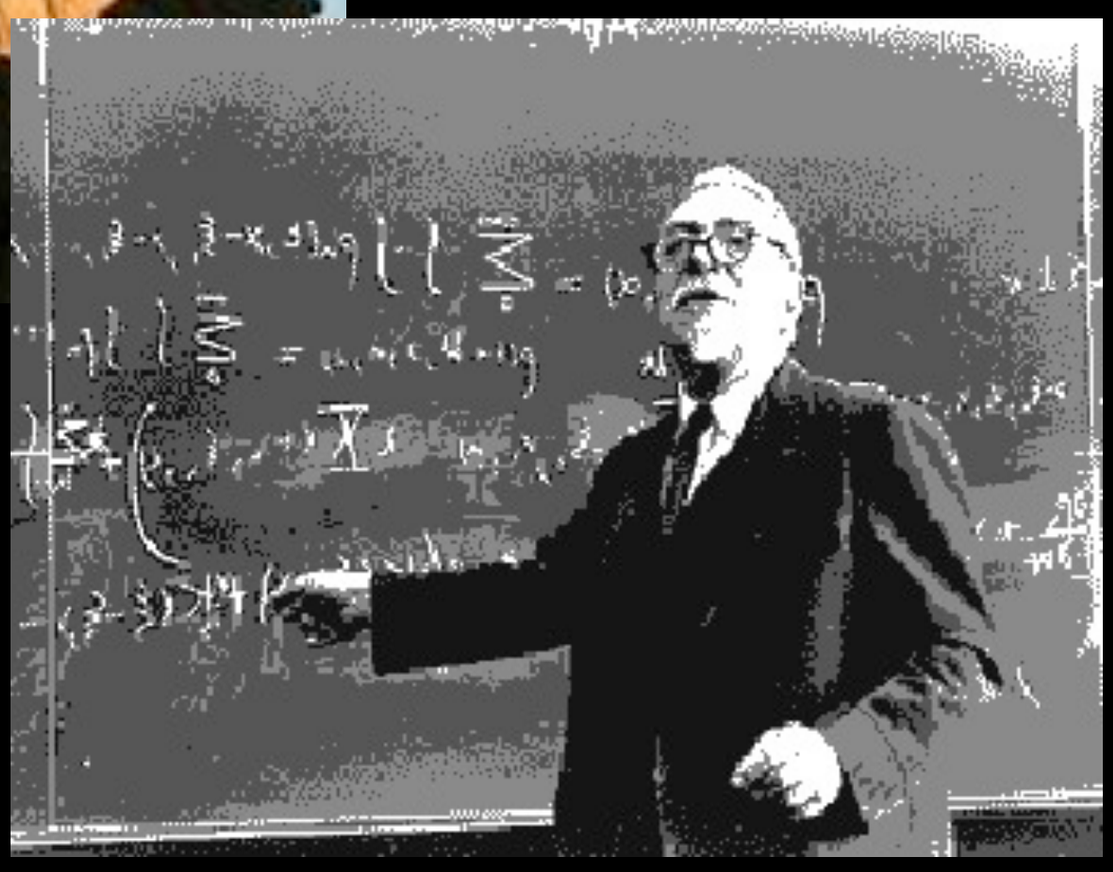




The pavilion was shaped like a stomach, with a narrow entrance and exit on either side of a large central space. As the audience entered and exited the pavilion, Iannis Xenakis' composition *Concrèt PH* was heard. *Poème électronique* was synchronized to a film of black and white photographs selected by Corbusier which touched on vague themes of human existence. Corbusier's original concept called for a pause in the film while his voice was heard, speaking directly to the audience. However, Varèse objected to the idea that Corbusier's voice would be played over his composition, and the idea was abandoned. The interior of the pavilion was also lit by a constantly changing pattern of colored lights, and in addition to the film, three separate projectors showed additional still photos on the walls. Varèse designed a very complex spatialization scheme which was synchronized to the film. Prefiguring the acousmonium style of sound projection, hundreds of speakers were controlled by sound projectionists with a series of rotary telephone dials. Each dial could turn on five speakers at a time out of a bank of 12. Many estimates of the pavilion's sound system go as high as 450 speakers, but based on the limitations of the switching system and the number of projectionists used, an estimate of 350 seems more reasonable. The speakers were fixed to the interior walls of the pavilion, which were then coated in asbestos. The resulting appearance was of a series of bumps. The asbestos hardened the walls, creating a cavernous acoustic space.

Bebe Barron (16 June 1925 – 20 April 2008) and **Louis Barron** (23 April 1920 – 1 November 1989) were two American pioneers in the field of electronic music. They are credited with writing the first electronic music for magnetic tape, and the first entirely electronic film score for the MGM movie *Forbidden Planet* (1956).

The couple married in 1947 and moved to New York City. Louis' cousin, who was an executive at the Minnesota Mining and Manufacturing Company (3M), gave the newlyweds their first tape recorder as a wedding gift.[5][1] Using their newly acquired equipment, the couple delved into the study of musique concrète. The first electronic music for magnetic tape composed in America was completed by Louis and Bebe in 1950 and was titled *Heavenly Menagerie*. Electronic music composition and production were one and the same, and were slow and laborious. Tape had to be physically cut and pasted together to edit finished sounds and compositions.

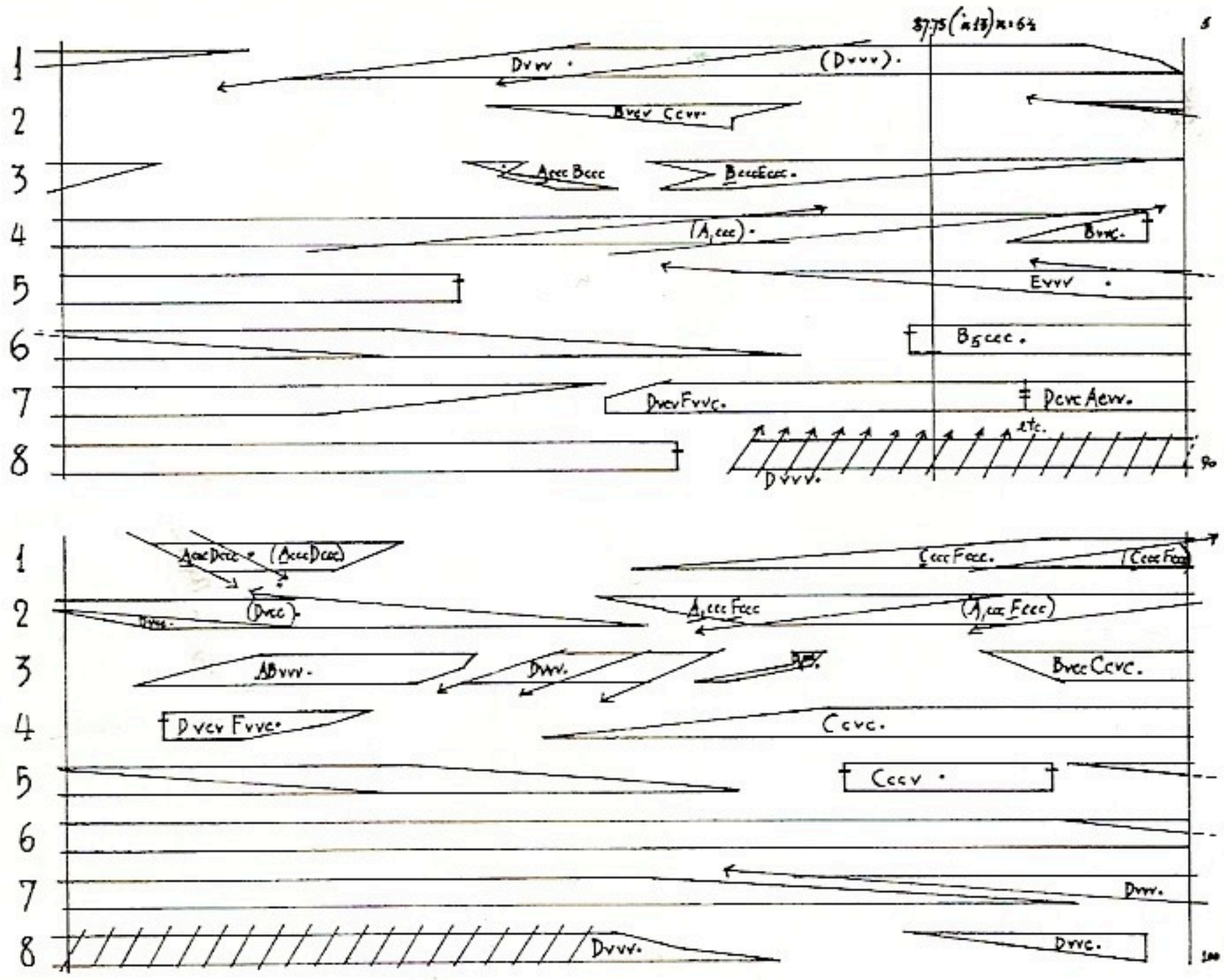


By following the equations presented in the book,*Cybernetics: Or, Control and Communication in the Animal and the Machine*, by mathematician Norbert Wiener (1948) Louis was able to build electronic circuits which he manipulated to generate sounds. [5] Most of the tonalities were generated with a circuit called a ring modulator. The sounds and patterns that came out of the circuits were unique and unpredictable because they were actually overloading the circuits until they burned out to create the sounds. The Barrons could never recreate the same sounds again, though they later tried very hard to recreate their signature sound from*Forbidden Planet*. Because of the unforeseen life span of the circuitry, the Barrons made a habit of recording everything.

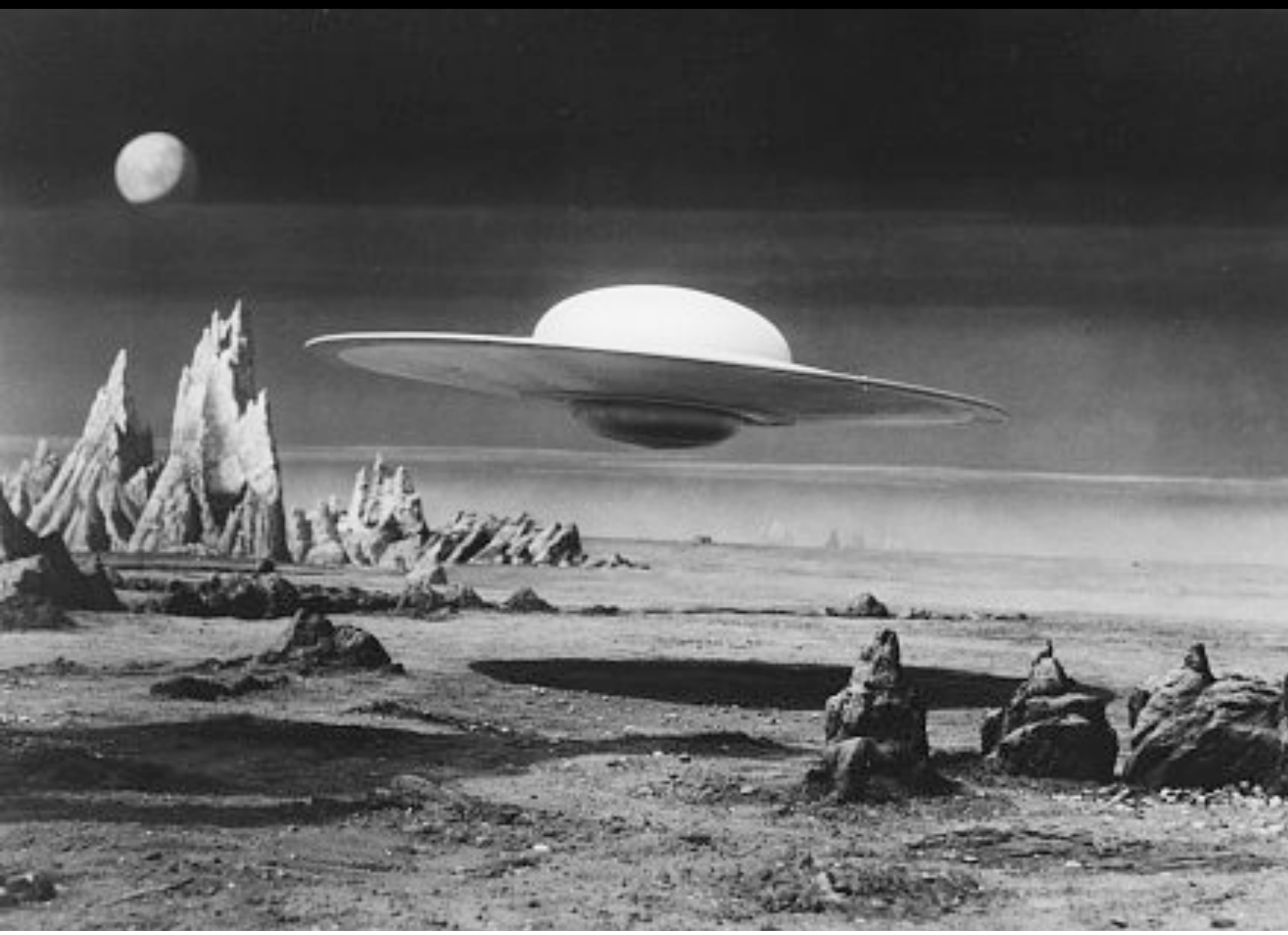
Most of the production was not scripted or notated in any way. The Barrons didn't even consider the process as music composition themselves. The circuit generated sound was not treated as notes, but instead as 'actors'. In future soundtrack composition, each circuit would be manipulated according to actions of the underlying character in the film.

After recording the sounds, the couple manipulated the material by adding effects, such as reverb and tape delay. They also reversed and changed the speed of certain sounds. The mixdown of multiple sounds was performed with at least three tape recorders. The outputs of two machines would be manually synchronized, and fed into an input of a third one, recording two separate sources simultaneously. The synchronization of future film work was accomplished by two 16 mm projectors that were tied into a 16 mm tape recorder, and thus ran at the same speed.

While Louis spent most of his time building the circuits and was responsible for all of the recording, Bebe did the composing. She had to sort through many hours of tape. She described it, "it just sounded like dirty noise". Over time, she developed the ability to determine which sounds could become something of interest. They may also have invented the tape loop. The tape loop gave the Barrons' sounds rhythm. They mixed the sounds to create the otherworldly and strange electronic soundscapes required by *Forbidden Planet*.



The Barrons' music was noticed by the avant-garde scene. During 1952–53 the studio was used by John Cage for his very first tape work *Williams Mix*. The Barrons were hired by Cage to be the engineers. They recorded over 600 different sounds, and arranged them with Cage's directions in various ways by splicing the tape together. The four and a half minute piece took over a year to finish. Cage also worked in the Barrons' studio on his*Music for Magnetic Tape* with other notable composers, including Morton Feldman, Earle Brown, and David Tudor. It was Cage who first encouraged the Barrons to consider their creations "music".



Forbidden Planet is a 1956 science fiction film directed by Fred M. Wilcox, with a screenplay by Cyril Hume. It starsLeslie Nielsen, Walter Pidgeon, and Anne Francis. The characters and its setting have been compared to those in William Shakespeare's *The Tempest*, and its plot contains certain story analogs.*Forbidden Planet* was the first science fiction film that was set entirely on another planet in deep space, away from the planet Earth.[5] It is considered one of the great science fiction films of the 1950s, a precursor of what was to come for the science fiction film genre in the decades that followed.

Forbidden Planet's innovative electronic music score, credited as "electronic tonalities" – partly to avoid having to pay any of the film industry music guild fees – was composed byLouis and Bebe Barron. MGM producer Dore Schary discovered the couple quite by chance at a beatnik nightclub in Greenwich Village while on a family Christmas visit toNew York City; Schary hired them on the spot to compose his film's musical score. While the theremin (which was not used in Forbidden Planet) had been used on the soundtrack of Alfred Hitchcock's 1945 film *Spellbound*, the Barrons' electronic composition is credited with being the first completely electronic film score; their soundtrack preceded the invention of the Moog synthesizer by eight years (1964).