

by Allen Forte

Composing with Electrons in Cologne

ELECTRONIC music shares somewhat the same condition as Mark Twain's weather: everybody talks about it, but hardly anyone has heard any of it. My wife, who knows even less about electronic music than the proverbial man in the street, and I are, however, among the fortunate few who have had an opportunity actually to see the electronic music studio of the WDR (West German Radio) at Cologne and to sample by ear some of its artistic yield. Our visit took place one morning when, having fortified ourselves for this contact with the music of the future by an ample Rhenish breakfast, we set forth for the radio station—a large building of typical postwar German modernistic design. (One of its more unusual features, I subsequently learned, is a floating foundation similar to the one designed by Frank Lloyd Wright for the Imperial Hotel in Tokyo.) It stands on Walrafplatz, one of the few rebuilt squares in Cologne, in the shadow of the magnificent old cathedral, which—surrounded by ruins—now dominates the city much as it must have done in the Middle Ages.

We were told by the receptionist that we would find Herr Gottfried Michael Koenig, to whom we had an introduction, on the fifth floor. After several false starts, we finally managed to board one of the small, doorless compartments that move up and down in a continuous flow, like an endless succession of dumbwaiters, and which serve in many German buildings as a combination escalator and elevator (dubbed the "paternoster" by the building's inhabitants). We discovered Herr Koenig, a pale, thin young man with sand-colored hair, hunched over a maze of equipment in a room marked Studio 8. His formal, old-fashioned manner as he greeted us offered a curious contrast to the surroundings. We shook hands all around and then came the inevitable question: "Do you speak English?" Herr Koenig's reply, "*Leider nicht*," only momentarily stopped the proceedings, for my wife speaks fluent Viennese (understood by most Germans) and I speak a fumbling but adequate *Schuldeutsch*. We were, surprised, however, when Herr Koenig informed us that we were not yet in the electronic music studio. He proceeded forthwith to

lead us down to it, explaining on the way that the studio has been in operation since early 1953, when it was equipped by the station's technical department, and that all current operating expenses (including the building of new equipment) are met by the station.

Koenig ushered us into what appeared to be the control room of a recording studio, and I was taken aback to learn that this was the complete "studio," forgetting that no space was required for large groups of instrumentalists or singers. I am always conscious of German thoroughness and efficiency, but confronted with all the forbidding apparatus I was particularly grateful when Koenig outlined a systematic plan of attack. He proposed first to explain something about the equipment and then to let us hear some electronic compositions made in the studio. The equipment, he pointed out, was of three types: (1) electronic sound producing sources, (2) electro-acoustical de-

Studio director Herbert Eimert watches composer Karlheinz Stockhausen assemble a composition from the control board.



vices for manipulating the sound produced, and (3) sound recording means.

He then showed us the main instruments (or "sound sources" as the group prefers to call them). Most reassuringly familiar-looking was the Bode-Melochord, an electronic instrument of rich tone quality operated by means of two organlike keyboards. Koenig next introduced us to the Monochord, invented by Friedrich Trautwein, an instrument which strongly resembles a common household clothes wringer. It, like the Melochord, can produce two tones at once, but it has additional special devices which permit the continuous variation of frequency and also provide a wide range of tone color. Both the Melochord and the Monochord are fully electronic; that is, they use only electronic components for the production of oscillations. This distinguishes them from instruments which use such mechanical parts as strings, tongues, membranes, or rotating elements in conjunction with electronic components. An example of this latter type of instrument is the well-known electric organ, familiar to aging movie-goers and to habitués of cut-rate night clubs. (I quickly learned that any reference to this instrument is considered a major social indiscretion at Cologne.) Both the Melochord and the predecessor of the Monochord, the Trautonium, were used to provide background music for productions of the German Radio in the late Thirties.

The other sound sources are less picturesque. They include the *Rauschgenerator* (noise generator), the *Schwebungssummer* (buzzer), and the *Tongenerator* (frequency generator), all electronic devices operated from a control panel. Judging from Koenig's remarks,

I think that these are favored by the Cologne composers over the more elaborate instruments. These simpler devices are not "played" like conventional instruments or even electronic instruments such as the Martenot or Theremin, but are used to produce simple sounds which are used as musical building blocks. A composition is assembled gradually, sound by sound, and simultaneously stored on magnetic tape.

At this point we were joined by Heinz Schütz, one of the technicians responsible for the building of the studio and the official studio technician at present. Herr Schütz began to discourse volubly in my wife's direction upon the intricacies and virtues of electronic equipment (she is utterly innocent of technical knowledge), leaving me to reflect upon the simple beauty and clarity of the English language. Koenig finally came to the rescue by suggesting that we hear some tapes, beginning with a

composition for conventional instruments by Karlheinz Stockhausen called *Kontra-punkte*, to be followed by an electronic composition of the same composer. The first composition, he felt, would provide us with a basis of comparison for the second and thus help to orient us to the new sounds. Although I had not expected Victor Herbert, I was not quite prepared for *Kontra-punkte*, which turned out to be a twelve-tone composition for chamber orchestra written in a style similar to that of Anton Webern, the avant-garde Austrian who has had considerable influence on experimentally inclined contemporary composers. Stockhausen's electronic work that followed, *Studie I*, was of approximately nine minutes duration and shared many of the characteristics of the "conventional" work,



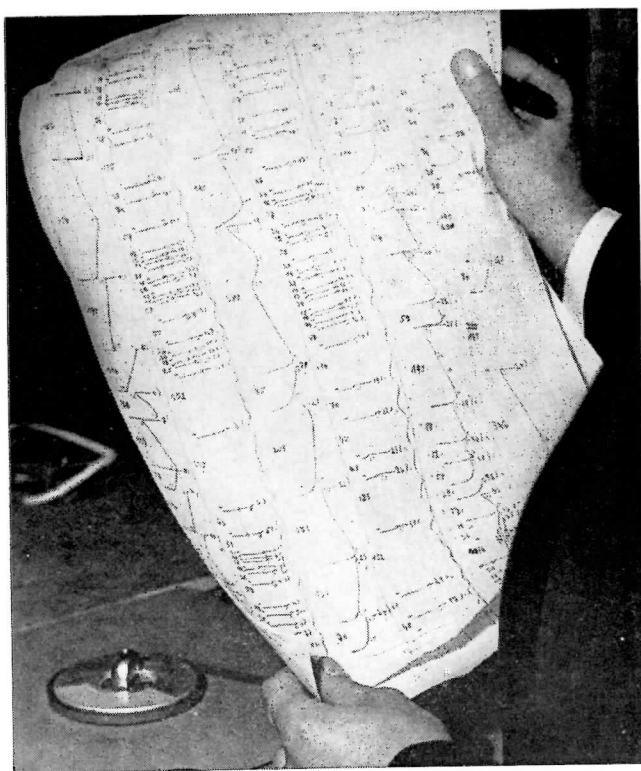
Technician, reading score above oscilloscope, mixes and tapes his sonic ingredients.

Kontra-punkte. Mass effects were sparingly employed, in favor of the opposition and juxtaposition of single tone qualities. Both works were rhythmically complex and "unsquare"; neither had any singable tunes. *Studie I*, the electronic composition, had, however, a flexibility which would have been impossible to obtain with human performers, and this flexibility—which involved rapid changes in amplitude, frequency, and speed—also provided the work with a certain intensity not heard in the conventional composition. I confess to having had considerable difficulty hearing the composition as a unity, despite such unifying elements as the recurrent motive of a descending minor third. Nonetheless, I found it to be extremely vital and compelling.

The second electronic composition we heard was by Koenig, *Klangfiguren* 1955, described by the composer as "a constellation of amplitudes and intensities." This

also owed much to the style of Webern. Like the Stockhausen work it was polyphonic and contained extremes of tonal and rhythmic activity which resulted in great variation in tension. But again I found it difficult to hear the composition as a continuum. To a certain extent this may have been due to the quality of sound, which, frankly, I found distracting. There was often that peculiar flatness which, associated with abruptness of attack and unexpected stability, is the identifying characteristic of electrically produced sound. I did not find the sounds ludicrous or thin, although I must admit that some of the effects were occasionally funny. For instance, a certain rapid succession of high frequencies kept reminding me of the sound made by running the thumb rapidly across the teeth of a comb.

But probably the main reason the sound quality is somewhat disturbing is that the new electronic sound elements differ radically from sounds produced by conventional instruments. There is even a new terminology and a new scheme of classification for the different sound events. I shall attempt to describe these:



Page of a score, ready for taping from electronic sources.

1. Sine-tones (*Sinustöne*). These are known in classical acoustic theory as "simple harmonic tones" or "sinusoidal oscillations," that is, pure, indivisible tones which cannot be analyzed out as composites of fundamentals and harmonics. To the Cologne group the sine-tone is *the* tone. What we have in the past called a tone falls into another category (No. 3 below).

2. Tone-mixtures (*Tongemisch*). These are combinations of sine-tones which result in sounds containing non-harmonic elements. Tone-mixtures are not chords, by the traditional definition, but are more akin to sonorities (see No. 3 below), or what we conventionally call tones. Tone-mixtures occur in conventional bells, cymbals, and the

like, where they are especially perceptible in phases of attack and decay. The difference between these latter semi-accidental events and the tone-mixtures used by the Cologne group is that with the equipment in their studio the Cologne composers can produce tone-mixtures with absolutely stable characteristics, thus making them available to the composer as predictable sound material. Tones (sine-tones) and tone-mixtures are the unique contributions of the Cologne group to composers working in electronic music.

3. Sonorities (*Klang*). These are the traditional tones of yesteryear, sounds which are actually combinations of a fundamental tone and its harmonics, and are not discrete, indivisible entities as the old term—tone—implied. Included in the concept of sonority are the notions of both pitch and timbre, in contradistinction to the sine-tone, which is without timbre, relatively speaking. A tremendous range of sonorities is now at the disposal of the composer. He is no longer restricted to the limited number of tone qualities and pitches afforded by traditional instruments, but can construct sonorities as he desires.

4. Aggregates (*Zusammenklang*). Two or more different sonorities sounded simultaneously constitute an aggregate. These are subject to the same accurate determination as sonorities.

5. Noises (*Geräusche*). In this category are sounds of unpredictable character and of irregular and unstable structure.

All of these sound elements can be further varied by means of the sound manipulating devices, the second type of equipment in the Cologne studio. These devices carry the original sounds through processes which modify their characteristics. At the present the most important of these processes are: modulation, expansion and contraction of the frequency band, cutting of the band, rhythmicization, adjustment of dynamics (relative amplitude), and various applications of reverberation.

The third type of equipment and the easiest to describe is the sound storage equipment. It consists simply of two tape recorders with synchronized drive motors. These permit the superposition and integration of sounds and have led to the development of fairly complicated editing techniques.

This, then, is the technical equipment used by the Cologne composers. It is complex, and to become familiar with it is difficult. Does this mean that the electronic composer must be a trained technician? Emphatically no. Certainly he must be conversant with basic technical notions, but his problems are musical, not technical. As Herbert Eimert, musical director of the West German Radio has said, "... electronic music has more to do with counterpoint than with electricity."

It is in the working out of a composition that this musical-technical dualism is most evident, because here the co-operation of both composer and technician is required. The Cologne group seems to have avoided any difficulties in this situation, perhaps because the composer is accorded the superior position in the so-called realization procedure. Both Koenig and Schütz explained at some length this notion of "realization," the term used at Cologne to in-

dicating the bringing to life of a musical composition and its step-by-step storage on tape. Implicit in the term is the hard fact that no performers are required for the projection of electronic music. The composer, working with technicians, simply guides his musical idea from its genesis in his own brain, through the production of the individual sounds and the manipulation of those sounds to the completed version on tape. In exchange for fallible performers the composer gains predictability, a goal that has attracted many composers, including Haydn, Mozart, and Beethoven, who all wrote for the mechanical instruments of their time.

By the time we had absorbed all this information, mental exhaustion had set in and lunchtime had conveniently arrived. We agreed to continue our examination of electronic music over some good Kölnisch food, whereupon we repaired to a nearby outdoor restaurant overlooking the Cathedral square. A bottle of superb Moselle provided the perfect background for a discussion of certain difficult aesthetic points and also gave me an opportunity to find out more about the people connected with the studio.

First of all, there are two persons who were instrumental in getting the studio under way: Herbert Eimert and Werner Meyer-Eppler. Eimert, a music critic and writer as well as a composer, made the first experiments with electronic music in late 1952 and early 1953 at the instigation of Werner Meyer-Eppler, to whom the Cologne group is greatly indebted for its intellectual basis. Meyer-Eppler not only knows music, but is also Director of the Institute for Phonetics and Research in Communication at Bonn University, where he has been doing original work of considerable interest.

Most of the composers who have at one time or another composed at the studio are in their late twenties or early thirties. I include in this group Paul Gredinger, who is also an architect and now teaches at the Industrial Arts School in Zurich; Henri Pousseur, teacher of music at the Gymnasium in Eupen, Belgium; Karel Goeyvaerts, teacher of music history in Antwerp; Bengt Hambraeus, who is associated with the Institute for Music History at Upsala University (Sweden), and Giselher Klebe, of Berlin. The two composers retained by the studio (in addition to Eimert, of course) are Gottfried Michael Koenig, who has been a regular employee since 1954 in the capacity of Assistant, and his colleague, Karlheinz Stockhausen, both still in their twenties. Stockhausen studied music in Cologne and in Paris, working in the latter city with Olivier Messiaen and at the same time was involved with the *musique concrète* studio there.

Stockhausen enjoys the distinction of having composed the first work for sine-tones, his *Komposition 1953, Nr. 2*. The overtone-free sine-tone, in fact, aptly symbolizes the philosophic attitude of the Cologne group, for they are purists, intolerant of extraneous or unpredictable elements in music. The group sees the sine-tone as a microcosmic pattern for compositional procedures of which order and predictability are the watchwords. Therefore, is it not surprising that mathematics has a definite place in the musical thinking of a group. Nor is it surprising that most of these young composers who are interested in the new

media also have composed works in the twelve-tone system.

Another prominent aspect of the Cologne group's attitude is their awareness of their historical position. They feel strongly that they are doing the most important work being done today for the future's music. This is not to say that they are arrogant or that they disparage other departures from traditional means and media. They do try, however, to keep the record straight with regard to what constitutes "electronic" and what constitutes "music" — not an easy job. There is, for example, some disagreement as to whether "*la musique concrète*" (of Pierre Schaeffer and his associates at the Paris Radio) is genuinely electronic. Werner Meyer-Eppler and Herbert Eimert have both been quite explicit about "*konkreten musik*," as they call it. According to them, electronic music is built of electronically *generated* sound, electronically manipulated, electronically stored. Therefore, in their view, both the French group and its American counterpart, the so-called "music for tape" group (of which Vladimir Ussachevsky and Otto Luening are the most prominent members), are not turning out genuinely electronic music since they use natural or "concrete" sounds (from brake drums and drops



Staff-composer Stockhausen, pioneer of the sine-tone poem.

of water, for example) as well as electronically originated sound and sounds made by conventional instruments. But the situation here is further complicated by the fact that one cannot lump all the tape composers together. They have different procedures and different compositional aims. For instance, Luening's *Theater Piece No. 2*, a relatively conventional and serious work, is a far cry (no pun intended) from certain of the early "concrete" sound effects — and they were only sound effects, not music. The Luening composition, which received its first performance at the Juilliard School of Music

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on April 20, 1956, was intended to accompany dance, but seemed to me to be quite self-contained. It alternates and in some sections combines tape and chamber orchestra. The use of tape appears to be justified by its ability to present frequency-tone quality combinations not available from conventional instruments; for example, flute in contrabass register and piano played at high speed to correlate with orchestra. The orchestra, on the other hand, provides a variety and abundance of tone color not easily synthesized on tape. And what at first appear to be "concrete" sound effects, such as a voice which intones "testing, testing, testing," are actually used as musical elements (in this case rhythmic elements) and relate directly to the composition.

The Edgar Varèse composition *Deserts*, also for tape and chamber orchestra, is entirely different from the compositions of Ussachevsky and Luening. It employs taped sound effects found in nature. These alternate with sounds produced by conventional musical instruments. The outstanding feature of this work is that the natural sounds are reflected by the instrumental sounds—that is, similarities between the two are exploited, and to quite amazing effect. In fact, it is often difficult to determine precisely where the one leaves off and the other begins.

I have not yet had an opportunity to hear the compositions by John Cage, Morton Feldman, and Earle Brown written for eight tape recorders, which according to a recent newspaper announcement were to be presented soon if the necessary equipment could be made available. In the event that it were not available, Mr. Cage, never at a loss for something to do, was to present his work for eight radios. This leads me to believe that Mr. Cage is becoming more conservative. The last composition of his that I heard was for *thirteen* radios. On the other hand, he may have sold some of the radios in order to buy tape recorders, a dramatic demonstration of the plight of the contemporary composer.

Another development in the field of electronic music is the RCA Electronic Music Synthesizer. Its designers claim that it has an unlimited capacity for duplicating familiar sounds, in-



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cluding speech, and for creating new sounds to order. This device is not taken very seriously by the Cologne group.

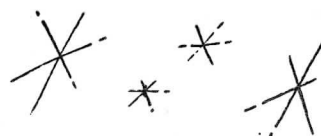
More and more composers are being attracted to the Cologne studio, due to the fact that it has taken the lead in developing compositional procedures for the new media. Many prominent European musicians and critics are watching the studio with interest, even established composers of the older generation. Ernst Krenek, for instance, had a work presented at the second program of electronic music given on May 30, 1955 at the WDR Auditorium. (The first concert of electronic music was given on October 19, 1954.) Other composers whose compositions were heard at the same concert are Herbert Eimert, Bengt Hambraeus, Karlheinz Stockhausen, Giseler Klebe, Gottfried Michael Koenig, and Hermann Heiss.

This brings up the question of how one can hear electronic music without traveling to Cologne. Universal Edition, a well-known music publishing house in Vienna, has already provided an answer. It plans to issue recordings of two works by Karlheinz Stockhausen, *Studie I* and *Studie II*, and two works by Herbert Eimert, *Glockenspiel* and *Etüde über Tongemische*. These were scheduled to be released in Europe in July of this year.

In speculating upon the future of electronic music it seems to me that two considerations are basic: the effect of electronic music upon music as an art and the effect of electronic music upon musicians. As for the latter, it is quite obvious that with the expansion of electronic music fewer performers will be needed than at present. The live performance of music will be confined more and more to the amateur musician in his own home, which of course is the trend even now. On the other side of the ledger, there may be greater opportunity for gifted composers to write music and have it heard. Here it should be pointed out, however, that the electronic music composer's job is more, not less, difficult than that of his predecessor. As electronic music achieves more and more importance, the training of composers will undoubtedly have to undergo some revision during the next twenty-five years.

The effect of electronic music upon music listeners is, of course, another

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Continued from preceding page

matter. It will certainly be many years
before serious electronic music gains
acceptance or is even widely heard. But
then this has been the situation for
years now even with "conventional"
contemporary music. For example,
first-rate compositions such as Web-
ern's *Six Bagatelles*, for String Quartet,
Op. 9 (composed in 1913), still shock
the average listener.

It is my own opinion that electronic
media, properly used, can open the
way to the further development of
music as an art of a high order. Twenty
years hence, electronic media may well
be seen as the salvation of a music al-
most moribund under the weight of tra-
ditionalism. In any case, electronic mu-
sic, viewed historically, seems a possible
meeting point for some of this half-
century's divergent musical trends. Per-
haps the most significant of these trends
was that toward greater complexity, a
trend which led music to the extreme
limits of playability by human perform-
ers. These limits were reached about
twenty-five years ago at the apex of the
prewar European avant-garde movement,
notably in the works of Schoenberg and
Webern. The war delayed the advent of
electronic music, which otherwise might
have been seized upon earlier.

In the near future there is bound to
be a certain amount of confusion regard-
ing the role of instruments in creating
electronic music, and we will hear the
question: which will dominate, the new
electronic tools, or the people who use
them? A hint at the answer is provided
by the camera, which threatened to
supersede the artist and make visual
representation available to anyone who
could push the right button at the right
time. But the fact remains that the pro-
fessional photographer today, with all of
his equipment, requires basic talents of
perception very similar to those of the
artist who wields brush or pen. And just
as camera designers or manufacturers do
not themselves necessarily turn out any-
thing more than snapshots for the family
album, so musical instrument manufactur-
ers and designers may have only vague
ideas concerning good music. But this is
probably as it should be, for—as in the
music of the past—the problems of elec-
tronic music do not reside in the instru-
ments but rather in the



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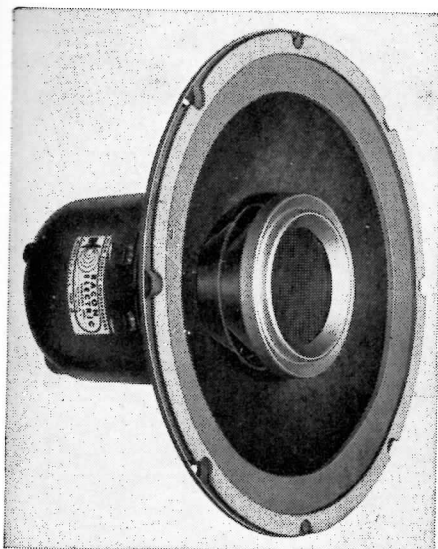
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people who create music and in the people who listen to it. And, as always, the main burden falls upon the composer, whose efforts are essential to the furtherance of music as a living art.

This does not mean that we have to accept all electronic music, nor does it mean that everyone has to like it or else be condemned as a dull-witted reactionary. Nevertheless, I want to register a plea for open-mindedness with regard to the new developments. The new need not *threaten* the old; the process is addition not replacement. In my own case I see no conflict between my fondness for Scarlatti and my predilection for Brahms. And, some two weeks after my visit to the electronic music studio at Cologne, it gave me great pleasure to buy a delightful little harpsichord in Passau. Being by nature a purist, I play nothing on it but authentic harpsichord music.

ART OF BAFFLING

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adjusting the enclosure to a particular type of speaker. Much of this can be done in the original planning and computation, but much of it must be arrived at through empirical testing and analytical listening.

As an aid in this listening, the author often takes a speaker enclosure outdoors, under substantially free-field conditions, and alternately listens to it and to a good pair of earphones. Under this treatment, many an enclosure has shown off its shortcomings, and a few have demonstrated "tone quality" that positively enhanced the musical quality of the program.

Far too much emphasis has been placed upon quantitative values in reproducer performance and not enough upon the qualitative aspects. We measure the range of the response curve, its degree of deviation from a norm at several frequencies, its polar pattern. We measure efficiency. In short, we seem to be interested principally in how much sound we are getting instead of what kind of sound — again on the pseudological premise that the "degree" should determine the "kind," since the "kind" already has been established by the original program. But although such studies are fundamental to good design, they are

Continued on next page

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