Construction and working methods of the Utrecht University Studio

History

Electronic music began in the Netherlands in 1954 when a few composers started working occasionally in an improvised studio of the Dutch Radio Union. In 1956 the Contact Organ for Electronic Music was founded, a joint publication of various institutions interested in electronic music: universities, radio, television, film, the composers union, the Gaudeamus Foundation, the firm of Philips, etc. One year later a studio was set up at the Technical College at Delft; by 1958 ten composers and fifteen students were working there, and Edgar Varèse had realized his Poème électronique for the World Exhibition at Brussels in the Philips studio at Eindhoven, which had been in existence since 1956. In 1959 Philips and the University of Utrecht agreed to set up together at Utrecht. This plan was realized a year later; the studio at Delft closed down at the same time. Philips engineer R. Vermeulen became director of the Utrecht studio. In 1961 the Contact Organ opened its own studio at Bilthoven, just outside Utrecht. Its chief function was to provide tuition in the form of courses. These courses started in the fall of 1962, led by the author. From the fall of 1964 the Bilthoven studio was rented by the University, which at the same time functioned as organizer of the courses. In the summer of 1967, the University set up its own teaching studio, where the courses have been held ever since. The author succeeded Henk Badings in 1964 as artistic director of the University studio, a position which the latter had held since 1962. Drs. F. de Vries assumed the administrative responsibility. In 1965 extensive reconstruction of the studio commenced, lasting two years.

Construction

The studio on the Plompetorengracht in Utrecht consists at present of five studio rooms, a central switchboard, a large workshop and several offices. The staff consists apart from the two directors and a secretary, of a physicist, two technicians, a technical engineer, three production assistants and a programmer. As well as these, a composer can be employed as a member of the scientific staff.

With regard to matters of technical administration the studio answers directly to the Curators of the University. Instead of a faculty, there is a committee consisting of professorts from various faculties. As electronic music has up to now not been a 'subject' at the University of Utrecht, tuition takes the form of a nine-month course which is repeated annually. It is open to qualified composers and other interested persons of a nationalities.

Scientific work in the studio at present focuses on three subjects: the development of studio apparatus, composition theory and timbre research. For the latter a group has been formed comprising a physicist, an audiologist, a perception researcher, a psychologist and a composer. For composition theory and timbre research a computer, the *Electrologica X8* , can be used.

Composers

The composers working in the studio may be paced in four categories. The first category consists of composers who have been invited to work there since their work is esteemed to be of value to the studio; they are employed as members of the scientific staff for the duration of their work and receive a monthly salary. In the second category are composers who have applied to work in the studio. They do not earn a salary, but may use studio facilities free of charge. The third category consists of composers, who wish to use electronic sounds for commercial purposes. These composers pay daily studio rent according to the number of studio staff required. The fourth category, finally, is formed by the participants of the course, who pay a small fee in return for the facilities of the teaching studio. They may also attend the theoretical lectures.

Studies

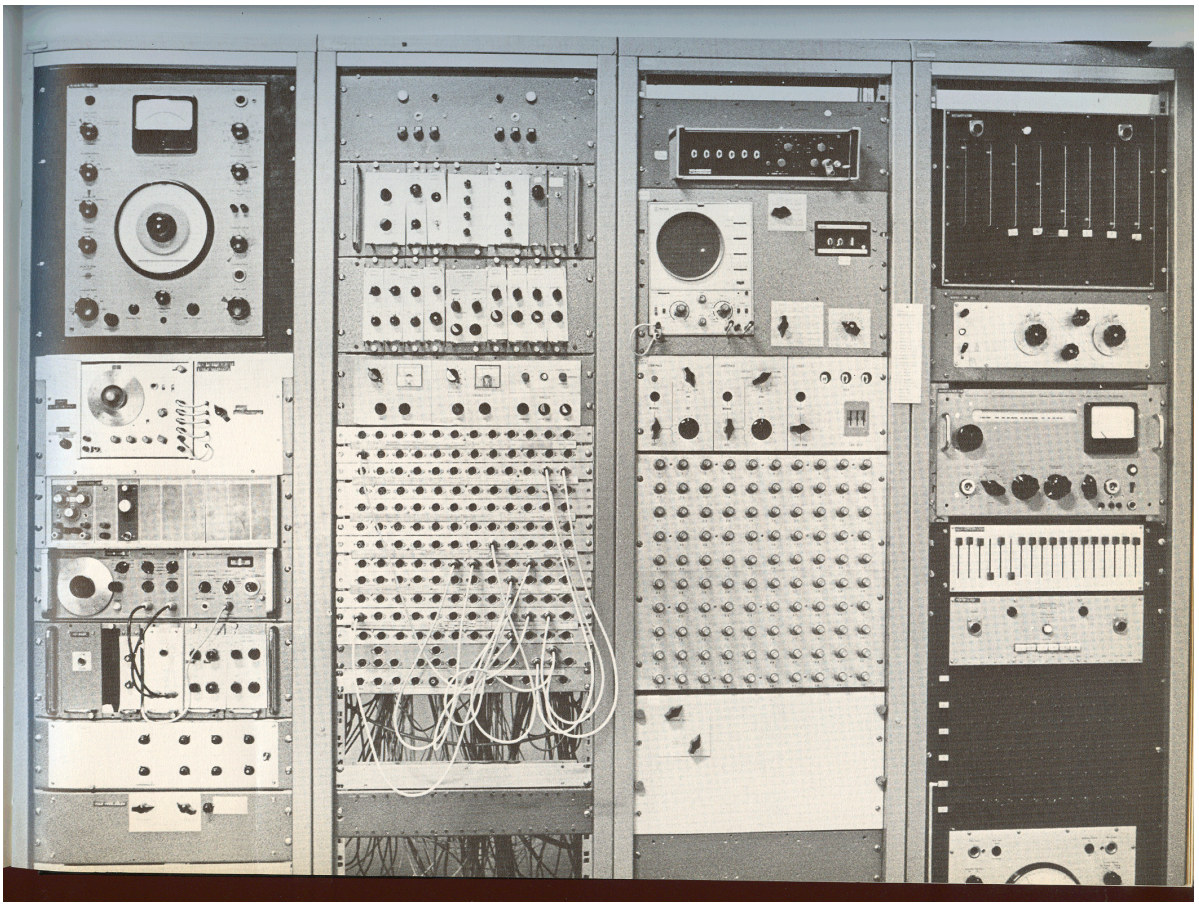
The annual nine-month course is open to composers and musicians, artists and film-makers, technicians, teachers and musicologists. The tuition program includes lectures and exercises in composition theory, electro-acoustics, aural physiology, computer composition and computer programming as well as information on production technique, notation, history and performance practises in electronic music, music and film, tape sessions and a series of colloquia. Sound production is taught in a studio where students can, during the first three months of the course, study the circuit techniques of the studio and the available equipment. During the remaining six months a choice may be made among experiments of a general nature, systematic examinations of equipment or sound phenomena, or the realization ofd a composition model.

Concerts

As well as the courses, the studio regularly organizes public concerts of electronic music and public lectures intended to provide interested listeners and music teachers with an insight into studio work. Similarly, there are lectures and demonstrations for students of other universities and for scholars. The studio's travelling equipment includes a four-track tape recorder, control panel and four loudspeakers. Between 1966 and 1968, twenty-seven electronic pieces were produced and fifty-five public concerts were given.

Technique

The technical equipment of the studio is in accordance with the production principles which have developed over the past fifteen years. The composer has at his disposal generators of various waveforms, various filters, ring and product modulators, tape recorders and control panels designed and constructed in the studio. Each control panel is equipped with remote control of all tape recorders in the entire studio complex, with an intercom, with a selector



switch for hearing and reading points in the circuit (tape recorder and amplifier outputs), and with free lines ending at the central switchboard. Each studio also has an electronic frequency counter and an oscilloscope.

Further equipment consists of

a reverberation plate (EMT), the reverberation time of which can in each studio be determined by remote control;

a portable transposition unit, made up of a generator and three-phase power amplifier, which can be connected to any tape recorder and permits continuous alteration of the tape speed in the ratio 1:10;

a portable four-channel variable envelope shaper.

Additional apparatus includes a variable function generator, a Philips echo tape recorder, a stereo gramophone and a four-track amplitude modulator. The variable function generator and four-track variable envelope shaper were designed and constructed in the studio by the physicist C.A.G.M. Tempelaars. The four-channel amplitude modulator, constructed by R. Vermeulen, is the predecessor of both new developments.

Voltage Control

The recently developed apparatus, especially the variable function generator, has not only extended the composer's range. Similarly the new machines are not only additional generators for producing sounds or envelopes: they permit the composer to relate various sound characteristics to one another or even to derive them from similar amplitude-time-patterns. Such a pattern – in the form of a programmed voltage curve – can only be used together with voltage-controlled apparatus. This was a reason for us to reconsider the possibilities of voltage control. As long as we had no voltage sources which could satisfy the composer's need for variability and programmability, there was no reason for the studio to acquire voltage-controlled equipment. The general voltage control to be introduced now is, firstly, adapted to the production of musical sounds, secondly, it is in keeping with the composer's working habits, and thirdly it establishes the connection with traditional audio technique. The practical applications cnn be placed under three headings.

Registration of manual actions

It can happen that the composer wants to provide a long sound sequence with one common envelope. Even if the sequence is based on a schematic form (such as crescendo/decrescondo), the composer will still desire to react to the characteristics of the as yet unenveloped sound, and to this end he will go on practising the necessary movement of his hand until the envelope has an optimal shape. Of course, it is impossible to write this interpretation in the score or to reproduce the envelope thus arrived at in case the recording is lost. The voltage-controlled amplitude modulator makes it possible to record the (frequency modulated) control voltage simultaneously with the modulated sound, and later (after demodulation) to use it to reproduce the envelope or to be drawn by a plotter. The same applies naturally to all the other parameters for which voltagte-controlled equipment exists.

Various parameters with common curves

The last paragraph shows the importance of being able to register control voltage. If they can also be programmed, further possibilities result. The composer can, for instance, fix certain curves and use them to control all parameters for which there is voltage-controlled equipment. He can moreover alter the programmed curve in detail and in such a way as to make it reproducible. This method could be called "indirect" because the composer no longer produces the sound itself and controls it by ear during production; he only produces inaudible voltage curves, whose effect on the various sound characteristics has yet to be heard. Composers accustomed to reacting and composing spontaneously will not be attracted by this production method. On the other hand, composers who desire to systematically define the sound characteristics and to link them with one another will find in this methid a long-awaited tool.

Transformation of control voltages

A control voltage which has been recorded on tape can be treated in a similar fashion to an audio signal. Theoretically this creates the possibility of composing and registering an entire piece of electronic music in the form of programmed and transformed control voltages. As soon as the recorded control voltages are synchronously played back and connected via the corresponding number of demodulators with the voltage-controlled studio equipment, the piece bcomes audible. This method is of course even more "indirect" than the other one, but could be fascinating to composers interested in the programming of musical structures and who have no computer at their disposal for sound production.

Computer

However, voltage control as outlined above is only a link between traditional sound production in the electronic music studio and sound programming with a computer as the sound source. In Utrecht, preliminary work in this direction has made a fair amount of progress. The computer is not, of course, to perform tasks which the traditional studio (with or without voltage control) can carry out, such as the production of stationary spectra. Electronic music was the first to give the term *Sound* a new meaning – that is one deviating from instrumental music – without being able to do justice to the implications. *Sound* is no longer simply a distinguishing mark in polyphonous instrumental music, but simple that which sounds. However, the traditional studio has developed few technical media capable of subjecting that which sounds to musical schemes of arrangement; in the electronic studio, too, the composer comes up against "instrumental" boundaries. The task is, therefore, to compose *The Sound*, instead of *With Sounds*. There is as yet little experience in this field, which is why sound-composition with a computer is till musical terra nova. Before the composer can compose *Sound* and program this composed sound, he must learn the extent to which his own musical knowledge, experience and desires are programmable. The programming of musical structures can be superseded by the programming of sounds. For this purpose, extensive composing programs have been written in the studio at the University of Utrecht, with which the composer can test models of compositional behaviour. Although such tests take place in macrotime (that is in the smallest musical units still in the range of rhythmic perception), they can later be transferred to microtime (the structure of the wave curve). This method of sound production is just as "indirect" as those described in the section of voltage control; but this indirect approach is inherent in programming. The extent will then become apparent to which composed alterations of the waveform affect auditory perception. Above all, the composer will be able to pursue the question as how great the extent to which formal processes are illustrated in the continuous sound, or, to put it another way, how well a continuously altering sound can be comprehended as a formal process. Here the traditional difference between from and sound disappears; a single sound will be heard as a "formed" one: form will sound.