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THE DEVELOPMENT AND TESTING OF A BASIC SELF-INSTRUCTIONAL PROGRAM FOR THE ARP 2600 PORTABLE ELECTRONIC SYNTHESIZER AND EFFECTS ON ATTITUDES TOWARD ELECTRONIC MUSIC

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By

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ABSTRACT

THE DEVELOPMENT AND TESTING OF A BASIC SELF-INSTRUCTIONAL PROGRAM FOR THE ARP 2600 PORTABLE ELECTRONIC SYNTHESIZER AND EFFECTS ON ATTITUDES TOWARD ELECTRONIC MUSIC

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This study had two concerns. They were 1) development and trial use of a programmed learning method for the Arp 2600 Portable Synthesizer and 2) to examine the difference in attitude toward electronic music that existed between two groups of students exposed to the method as opposed to students taught electronic music by group instruction.

This study was limited to only the initial aspects of synthesizer music production. No attempt was made to develop complete understanding of all aspects of electronic music. No references were made to electronic functions within the Internal Clock and the Sample/Hold Gate functions of the Arp 2600 Portable Electronic Synthesizer.

Procedure

A self-instructional program was designed, trial piloted, edited, and finally used experimentally with high school aged musicians.

A thirty-five item attitude inventory was administered to the groups as a pre and posttest. Group one, the control group, was taught electronic music by group instruction. Group two, the experimental group, was given the self-instructional program. Sixteen high school aged students were in the control group and sixteen were in the experimental group. A second experimental group of ten students was included for purposes of obtaining more data on the attitude inventory.

An analysis of the data supports the conclusion that no statistical differences in attitude existed among the groups involved in this study as a result of the programmed method as opposed to group instruction.

To the memory of my loving Mother,
Ruth W. Gardner, and Father, Willie
D. Gardner, Sr.

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The author wishes to thank the members of his guidance committee: Dr. James Niblock, Dr. Robert A. Harris, and Mr. Richard T. Klausli. A special thanks to Dr. Robert G. Sidnell, my Major Professor, for his invaluable professional assistance.

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CHAPTER I

OVERVIEW OF THE PROBLEM

Among the music developments in the twentieth century, the advent of electronic producing sound sources has to rank as one of the most revolutionary and challenging advancements in musical progress. As Machlis[1] has said:

> It is a truism that each stage of social evolution engenders its own artistic form. Thus, it was inevitable that the great scientific advances of the past century, specifically in the field of electronics and acoustics, would have a profound effect upon the course of music.

Techniques that generate, transform and manipulate sounds electronically form the basis of electronic music. Conventional instruments are usually limited to about eighty pitch levels and are confined by traditional dynamic levels. Electronic music enables the composer to free himself from these constraints by making available the entire range of frequencies audible to the human ear. Electronic music also places at the composer's disposal innumerable precisely-calculated dynamic levels and infinite numbers of rhythmic patterns based on durational values measured in centimeters on tape.

At about the turn of the twentieth century, there were indications that new conceptions were taking place in music that would demand resources beyond the capabilities of traditional instruments. Cahill in 1895, and Duddell in 1899 began construction of instruments which were, in principle, the forerunners of the Hammond electric organ.

In the first quarter of the twentieth century, some composers began expressing the need for an electronic instrument whose performance capability was beyond that of traditional instruments. Edgar Varese[2] stated in 1922:

> What we want is an instrument that will give us a continuous sound at any pitch. The composer and the electrician will have to labor to get it.

John Cage[3], as cited by Teitelbaum, also held views that were similar to Verese's when he stated:

> I believe that the use of noise to make music will continue and increase until we reach a music produced through the aid of electrical instruments that will make available for musical purposes any and all sounds that can be heard.

With the aid of such new electronic musical resources, composers have pursued two increasingly divergent interests. The first interest was toward invention and discovery of new sound qualities. The second was toward precise control over musical materials beyond the limits of the human performer. To facilitate such control, particularly over rhythmic problems, sophisticated programmable devices such as the RCA Music Synthesizer, Moog synthesizers, Buchla synthesizers, Syn-ket synthesizers, Arp synthesizers, and high-speed digital computers have been employed. Enabling the composer to specify precise values of frequency, amplitude, duration and succession of all sound events, these devices produce a completed tape composition requiring little or no editing.

To those composers whose demands had already exceeded the capabilities of most instrumentalists, the elimination of the performer was most welcome. To others more interested in chance and indeterminacy and the actions and interactions of human performers, the medium of fixed tape music seemed threatening. Thus, in the late 1950's, a number of musicians began experimenting with live electronic performances.

In an interview with Milton Babbitt, Charles Fowler[4] asked him to comment on the fear that the composer of electronic music would eventually eliminate the performer. Babbitt stated the following:

> I know of no serious electronic composer who ever asserts or would want to assert that we are supplanting any other form of music or any other form of musical activity. We are interested, not in supplanting, but in supplementing.

He further states that this is one of the annoying misapprehensions about the electronic composer's activity.

Most people of artistic taste share a distrust and dislike of machinery involved in the production of art. They argue that anything pretending to be art cannot come out of a machine. Art is a creative human product and electronic music, born of intricate circuits and the oscillations of electrical particles is a contradiction in terms. This attitude, the limited availability of synthesizers in music departments of secondary schools and colleges, and the complex technical language used in books written on the subject has made it difficult for the student to explore and appreciate electronic music by gaining practical experience with a synthesizer. According to Meyers[5]:

> One of the most complex tasks facing musicians interested in electronic music is the learning of specialized technical concepts and language used in that field. Unfortunately, most musicians have had little or no schooling in the sciences. Those who have taken the lead in electronic composition are undoubtedly exceptional in their propensity for mathematics and physics. The majority of musicians, however, find it extremely perplexing and inconvenient to search through scientific texts in order to extract that information necessary for an understanding of electronics as applied to music. This, plus a certain natural fear of

> the unfamiliar subject matter, has prevented many people from exploring the medium. It is evident that they have not been helped much by the literature on electronic music.

There are those who feel that musicians interested in electronic music do not have to be ingenious combinations of physicists, engineers, mathematicians and technicians in order to compose and understand electronic music. Babbitt[6] submits the following:

> I don't have to know how to build an oboe to write for it, and I don't have to know how to build a synthesizer to write for it. The educator doesn't need this technological information either. The educator has to be able to describe in very general but accurate terms how these media operate, just enough to arouse the child's interest and avoid misunderstanding.

Since we are dealing with music, the question of how much technical knowledge is needed can be limited to the amount ultimately related to the actual making of electronic sounds on a synthesizer.

Thus, it is hoped that by exposing the musician or non-musician to the fundamentals of composition in this medium through a self-instructional method, the student will develop the potential for exploration, discovery, and appreciation of electronic music.

Purpose of the Study

Certain attitudes prevail among students that may prevent the medium of electronic music from taking its place as an integral part of music education in secondary schools. One way of changing a student's attitude may be through exposure, learning, and success. If a student is successful with a self-instructional method in electronic music, one would hypothesize a positive attitude toward the medium. Thus, the purpose of this study is twofold: 1) to develop a self-instructional method for the Arp 2600 Portable Electronic Synthesizer and 2), to investigate the effects of learning by this method on attitude toward electronic music as opposed to the effects of exposure to group instruction on attitudes toward electronic music, between two groups of students.

Importance of the Study

The importance of this study is threefold. First, a review of methods of study for electronic synthesizers indicates that no emphasis has been placed upon the development of a self-instructional method for electronic synthesizers. While manufacturers do publish owners' manuals with different systems, these manuals do not teach one to progress from the simple to the complex through a structured sequence of events. A second reason for the importance of this study is that electronic music involves a great deal of manipulative and creative activity. Because of this, it possesses a high degree of motivational potential among today's youth. Self-instructional learning can also teach some music skills. Finally, a discovery of the degree to which this self-instructional method is successful may lay the foundation for the development of self-instructional methods for other types of synthesizers.

Generalizability

Indications are that the findings of this study would be generalizable only to the Arp 2600 Portable Electronic Synthesizer. Further, the subjects involved were high school aged students fifteen to eighteen years with an expressed interest in music. Therefore, it can be concluded that the findings will hold for a large proportion of musically interested youth.

Hypothesis

This study was designed to test the following hypothesis:

Hypothesis) There will be differences between the two groups in attitude toward electronic music.

Limitations of the Study

1) Because no two electronic synthesizers (of a different make) are alike beyond the basic function of voltage control, this study was limited to the Arp 2600 Portable Electronic Synthesizer.

2) This study of attitudes had the problem that all attitudinal studies possess. One must accept the information reported without being able to use any objective measures to verify the validity of respondent statements. The respondents may have concealed their real attitudes or may have provided answers that they thought would be most acceptable to the investigator.

3) This study was limited to students of high school age who had expressed an interest in music as performers in bands, orchestras and choirs.

4) This study was limited to only the initial aspects of synthesizer music production. No attempt was made to develop complete understanding of all aspects of electronic music. No references were made to electronic functions within the Internal Clock and the Sample/Hold Gate functions.

5) The basic synthesizer functions included in this method are functions of the oscillators, filters and envelope generators.

Definition of Important Terms

Electronic Music: Music produced by means of programmed electronic oscillations.

Frequency	The number of vibrations per second of a sound. (These vibrations usually determine pitch.)
Hertz (Hz)	A term used to describe the number of cycles (vibrations) per second, hence specific pitch.
Synthesizer	A set or group of electronic instruments used for the production and control of sound.
Arp 2600 Portable Electronic Synthesizer	A portable, integrated electronic musical instrument.
Timbre	The recognizable quality of sound partly distinguishing one instrument or voice from another.
Self-Instructional Method	A method that includes the presentation of instructional materials in a logical sequence of steps. The participant is required to respond actively to the materials. He receives immediate feedback to confirm his responses and works at his own pace.
Attitude	The degree of positive or negative affect associated with some psychological object. Psychological object is a generic term for any concept, issue, institution, ideal, person or group toward which individuals may have positive or negative feelings.[7]
Attitude Scale	A quantitative method for assessing an individual's relative position along a unimensional attitude continuum. The direction and intensity of the respondent's attitude is indicated by a single score which summarizes his responses to a series of items, each of which is rated to the single concept, object, or issue under study.[8]

Overview

Chapter I is comprised of a general overview of the problem, the purpose of the study, the importance of the study, the generalizability, a presentation of the hypothesis, limitations of the study and definitions of important terms.

Chapter II contains a review of the literature pertinent to this study.

Chapter III contains a description of the sample, the experimental design, development of the attitude inventory, treatment of the data, and the development of the programmed text.

An analysis of the data is presented in Chapter IV, while conclusions and recommendations for further study are found in Chapter V.

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this chapter is to review the literature pertinent to this study. The chapter is divided into three main segments with appropriate sub-segments. The segments are: 1) Electronic Music: A Short History, and Electronic Music in Music Education; 2) Program Instruction in Music; and 3) The Concept of Attitude, Attitude Measurement, and Attitude Measurement in Music.

Electronic Music: A Short History

The twentieth century has produced a revolution in musical thought which has profoundly affected the total organization of music. During the first quarter of the century, composers began to make demands that exceeded the capabilities of most instrumentalists.

Delone et al.[1] stated the following in 1975:

> We stand in the midst of one of the most revolutionary of all periods in the history of art music. At no time in the past have so many conceptually opposing musical developments existed side by side: tonal vs. atonal; highly organized (serial) vs. freely organized (chance) vs. probabalistic (stochastic) music; music for traditional instruments vs. music for electronic instruments; and even music with sounding elements vs. music without sound! Such a plurality of compositional approaches naturally puts the listener in a difficult position - he is often confronted with music for which he has very little of the experience necessary for bringing intelligible order to the perceived sound. It is for this reason that performers are often unwilling to perform this music, or if performed, that listeners are unwilling (or unable) to hear it. How, after all, are we to understand a new (or even relatively new) language without experience?

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Music produced by electronic synthesizers is but one aspect of the total twentieth century picture. It is not new. Forerunners of present day synthesizers were being demonstrated before the end of the nineteenth century. Otto Luening[2] states:

> There is a tendency on the part of today's public to assume that everything even remotely connected with the media of electronic music was discovered yesterday. The advocates of a new composer who uses the media like to profess that their man invented electronic music, or perhaps even discovered music itself. However, the historical record contradicts such a premise and sets the contemporary scene into proper perspective without in any way detracting from its importance.

In order to understand how electronic music came about, one would have to observe what was happening in music in the years immediately preceding the end of the nineteenth century.

In the nineteenth century, Wagner had launched an attack on tonality with the pushing of chromaticism to its limits. Debussy explored new harmonic parameters with nondiatonic scales. The revolutionaries came at the turn of the century with such composers as Stravinsky, Busoni, Satie, Scriabin, Varese and Schoenberg. It was Schoenberg who took the next logical step in seeking new methods of composition. He was not alone in his venture for almost all composers after 1900 believed they were witnessing the decay of tonal music. Richard Strauss[3] spoke of himself and his contemporaries as "triflers who had something to say in the last chapter." Honegger[4] stated that "the collapse of music is obvious . . . nothing is to be gained from resisting it." Hindemith, Bartok, and Prokofiev[5] expressed doubt that music as they had known it e.g., music written within the boundaries of tonality, within a key system, and employing major and/or minor scales could survive.

It was a general feeling that in the period of time from Bach to Wagner, everything had been exploited tonally. Western art music had exhausted its possibilities, not because of new and different ideas, but because new ideas no longer seemed possible within the old harmonic framework.

To the young composers who emerged after World War II, Henry, Xenakis, Babbitt, Boulez, Stockhausen, Berio, Cage, Ussachevsky and others, consonance versus dissonance and tonality versus atonality were irrelevant. They conceived a new music that knew no boundaries and no formal categories. Playwrights, composers, and painters of this period accepted all materials and the possibility of any kind of statement. They were cognizant of the possibility of the harmonic era dying and were attempting to usher in a new era of sound and an entirely new aesthetic of music.[6]

This trend of thought was in direct relationship with the new cultural era that was thrust into prominence in the twentieth century. Between 1876 and 1913, the world had absorbed the implications of the Quantum theory, Freud's interpretation of dreams, the invention of the telephone, the invention of the phonograph, the invention of the incandescent light, discovery of X-rays, the powered flight of the Wright brothers, Einstein's theory of relativity, the first motion picture theater, the theory of atomic structure, Henry Ford's Model T, and many others.

By 1900 the entire civilized world was connected by telegraph, and there were more than 1.4 million telephones, 20 million electric lights and 8,000 registered automobiles in the United States.[7]

The first half of the twentieth century was a period of contradiction as were the Baroque and the Romantic periods. There were the Nationalists, the Neo-Classisist, the Second Viennese school with Schoenberg, Berg, and Webern, the New Romantics, the Impressionists, and the Experimentalists.

In the recent past, since 1950, there have been two trends that prevailed in twentieth century music. The first was the transformation of the German Post-Romantic idiom into the dodecaphonic of twelve-tone styles of Schoenberg, Berg and Webern. The second was the advent of electronic music produced by synthesizers and in connection with that trend, music produced by digital computers in the last ten years.

The first trend is exemplified in such works as Schoenberg's String Quartet No. 4, op. 37, Berg's Opera, Wozzeck, Webern's Concerto for nine instruments, Stravinsky's Threni, Dallapiccola's Variations for orchestra, Krenek's Symphony No. 4, and Nono's Variazioni Canoniche.

The second trend is exemplified in such works as Boulez's Etude I and Etude II, Cage's Fontana Mix-feed, Dockstader's Apocalypse, El-DABH, HALIM-a's Leiyla and the Poet, Babbitt's Ensembles for Synthesizer, Luening's Lyric scene, Varese's Poeme Electronique and Xenakis' Concrete P.H.

Paris, a city that has been the cradle of many Avante-Garde movements throughout the history of the arts, was the center that saw the establishment of Musique Concrete, the first school of electronic music. The school was centered around Pierre Schaeffer, an engineer, radio announcer, biographer and amateur musician. The composers Oliver Messiaen and Pierre Boulez were also associated with this school. In 1948 some of the first compositions of Musique Concrete were produced in the research center of Radio-diffusion Francaise. These sounds were produced by manipulating previous recorded sounds and treating them electronically. Bird calls, train whistles, and other extra musical sounds were also utilized.

At about the same time that Musique Concrete was being developed, the American School centered at Columbia University and under the leadership of Otto Luening, Milton Babbitt, and Vladimir Ussachevsky began experimenting with music for the tape recorder. The first public concert of compositions for the tape recorder was given in New York in 1952.

In 1952, the third school of electronic music was started in the studio of the West German Radio in Cologne with Herbert Eimert as its director. The leading composer of this group, which included Pousseur, Gredinger, and Eimert, was Karlheinz Stockhausen. The difference in the German school and the French and American schools was that it used sounds derived from an electronic generator rather than non-electronic sources. As it happened in the past with figured bass, when an idea crosses the Alps from another country, the Germans turn it into a sophisticated technique far different from that of its predecessor. In this sense, the Germans were the only ones producing pure electronic music - e.g., music produced by pure electronic sounds. They emphasized the building up of complex sound forms out of sinusodial waves, that is, pure sounds stripped of their overtones. The German school takes its point of departure from the music of Webern. Stockhausen and the other composers of this school took Webern's ideal of an absolutely pure music that was controlled in every dimension. They used standard composing devices such as canon, imitation, augmentation, diminution, and retrograde. These devices were also used by the American and French schools but the Germans extended the principles of the tone row to include rhythm, resulting in total serialization.

Technological advancements led to the invention of the magnetic tape recorder and the RCA Electronic Synthesizer was developed. Electronic music has spread onto the college and university campus and a few complex systems such as the Moog, Arp, Buchla, Putney, and Syn-Ket synthesizers are in use. As advanced and complex as these systems are, they are already passé due to the technological advancement of the use of the computer for music composition. By the early 1960's the computer was introduced as a means of instantly producing what the composer dictated. This eliminated the laborious task of composing, mixing, splicing, and re-recording on tape. A composer could now dictate to the computer and have a complete composition produced in a matter of minutes.

R. A. Moog and others are now working to interface synthesizers with computers so that a complex set of effects can be programmed and then produced instantly. This development would clear the way for a home-model synthesizer that is full-scaled computer-controlled.[8]

Electronic Music in Music Education

One of the questions of concern to music educators today is - does electronic music have any place in the curriculum? Some members in that group think that is does, others think not. Those that do, think that it belongs as a new area of study and sound in the general music course. They also think that it is a deeply educational experience that fosters creativity and insight.[9]

In 1967, Peabody Conservatory in Baltimore established a five-day workshop in electronic music for inservice teachers. In 1968, they repeated the workshop. It increased from twelve participants during the first summer to thirty-six participants during the second summer. Inservice training of this nature is needed in order to introduce educators to the use of equipment used in producing electronic music in the classroom. It is also needed in order to let educators experience and discover the opportunities for creativity associated with this medium.

Placing electronic music in a context of traditional music is also an area of concern to music educators. Ivey[10] suggests that electronic music could be utilized as an introduction to contemporary music as a whole, with this leading into the music of the past. This is a reversal of the usual presentation of music history.

Barlow[11] states that:

> The difficulties of attempting to place electronic music in a context of traditional music education are self-evident. The art is simply too new and still too experimental to have established any kind of tradition in its methods or any substantial body of literature that might serve as the basis for a systematic presentation of its esthetic and structural principles.

Most music educators approach electronic music and the use of electronic techniques with misgivings simply because they have no clear cut view of what can be accomplished with the medium. We live in a technological world but our system of education is still run on an industrialized basis. Music educators have failed to take advantage of the new technological advancements in the field of electronics.

In 1971, Walter Ihrke[12] sent a questionnaire out to 270 member schools of the National Association of Schools of Music. He wanted to gather information about the degree and extent of electronic technology used in music instruction. Two hundred thirty responses were returned to him. From the replies, four types of electronic technology were identified: electronic piano studios, electronic music studios, computer assisted music instruction, and modular training stations. Ihrke visited thirty schools eliminating those which had well known electronic activity. He found that the schools visited were not availing themselves of the opportunities offered by the new technologies. Electronic music was confined to only its own area in the curriculum and had yet to make an impact on the other courses. In his conclusion, Ihrke states that:

> . . . electronics in training and electronic music are here to stay, and sooner or later educators must design a training rationale, which incorporates these with traditional concepts and procedures.

Music educators should look at electronic music as a logical evolution of music in the twentieth century. Although it is highly manipulative and uses much gadgetry it still has a relationship with conventional music. The rhythmic nature of electronic music is either very free, very complex, or non-existent in a traditional sense. Some twentieth century instrumental music displays some of the same freedoms and complexities found in electronic music. This music is basically sound-oriented in contrast to theme-oriented conventional music. The total absence of thematic content is also a feature of some recent instrumental music. In such works as Lutoslawski's Three Poems and Ligeti's Atmospheres, these characteristics are evident.

Once music educators recognize electronic music as a respectable member of the musical family and as an entity in twentieth century music, the way will be paved for its acceptance in a context of traditional music education. This will involve a shift of emphasis to the physical aspects of sound.

Summary

Electronic music is essentially a sound-oriented music. Any basic avenue to the understanding and exploration of it must be grounded in the nature of sound itself. Up to the present point in time, music education has accepted the timbres of conventional instruments as representing the totality of sound resources. Little attention has been paid to the physical nature of sound itself.

Because young people are ready to accept and explore the many possibilities of dealing with creativity in the electronic medium, music educators should accept the challenge and place electronic music in a context of traditional music education. They can no longer ignore the possibilities afforded by synthesizers, computers, and the related fields of science and mathematics.

PROGRAMMED INSTRUCTION IN MUSIC

At the National Conference on the Uses of Educational Media in the Teaching of Music in 1964, many delegates agreed that the new educational media could offer vast opportunities for improving the teaching of music.[13]

Leon Dallin[14] stated that:

> Teaching machines and programmed instructional materials have been a center of interest and controversy in music education circles during the past decade. Earlier misapprehensions and overly optimistic expectations about the outcomes of programmed instruction seem to have been replaced by more realistic attitudes. The hopes of some and the fears of others that teaching machines eventually would replace teachers and conventional methods of instruction have been dispelled. Music teachers now generally recognize that the principles of programmed learning have many applications in their field, and they welcome programmed texts and recordings as valuable new teaching resources.

The development of programmed music instruction is no longer in the embryonic stage. It was predicted in 1959 that program instruction would contribute significantly to efficient and effective music teaching. This prediction was brought forth by Charles L. Spohn[15] while engaged in research at Ohio State University. He tested the effectiveness of programmed materials in aural comprehension. Spohn used 22 students in an experimental group which received programmed learning and 19 students in a control group which received a conventional method of teaching. He found that certain aspects of music instruction could be programmed effectively and that the programmed instruction compared favorably with the conventional method of teaching.

Programmed music instruction is used extensively at the college and university level. This knowledge was acquired when Dallin[16] sent a questionnaire to 752 music departments inquiring about their use of and interests in programmed, automated, and self-instructional teaching materials. He received responses from 444 institutions. Of those, 107 indicated that they were currently using these methods of instruction. Of the remaining 337 reporting institutions, 163 planned to adopt this type of instruction. Many additional schools expressed interest in these methods and were receptive to the idea of future applications.

Often many faculty members of colleges and universities develop programmed methods specifically designed to satisfy the needs and utilize the facilities of their own departments. These programs usually involve the use of prepared tapes to teach aspects of aural perception, music literature, or music appreciation. Because they are developed for a specific situation many of these methods and innovations are not adopted by other institutions in some distant locale and under somewhat different conditions.

Tarratus and Spohn[17] wanted to find out if a set of programmed taped interval drills, which were developed for use at a large midwestern university could be used effectively in a smaller southern state college in which the educational situation was quite different. The tapes contained programmed information on learning how to identify melodic ascending intervals. To investigate the effectiveness of the tapes in another situation, a study was conducted at Northwestern State College in Natchitoches, Louisiana. Tarratus and Spohn conducted their investigation during 1964. They used two groups of students, a control group and an experimental group. All students were college freshmen. The test consisted of three parts: a) ascending melodic, b) descending melodic, and c) harmonic. Each part contained twenty-four intervals which were randomized in their order of presentation. The students made judgments as to the quality of the intervals - perfect fifth, major third, etc. The same test was given as a posttest at the end of the ten-week drill period. They concluded, as a result of statistical measures, that the college freshmen at Northwestern State College were able to learn intervals by using taped drills outside class. They also found that students from two contrasting geographical regions and in a different educational setting made similar learning gains using the same instructional materials adapted to local environment.

The early textbooks on programmed instruction in music were geared toward the development of fundamentals of music and the teaching of music theory. For example, Fundamentals of Music[18] by Homme and Tosti deals with scales, note values, the relationship of notes to the piano keyboard, key signatures and dynamics.

Musical Notation,[19] published for the elementary school level is another programmed text geared toward music fundamentals.

Paul Harder published a series of programmed methods in music theory. His Basic Materials in Music Theory[20] was developed at Michigan State University while presenting music theory to large numbers of summer music students. Another part of that series is Harmonic Materials in Tonal Music[21] which is published in two parts. It was developed at Michigan State University to be used in the first two years of music theory. Basic Materials in Music Theory and Harmonic Materials in Tonal Music are now provided with cassette tapes. In addition to the other series of programmed texts, Harder has written another programmed method in music theory entitled Bridge to 20th Century Music.[22] Published in 1973, its primary purpose is a systematic examination of impressionist techniques.

Anthony Costanza[23] studied a programmed approach to melodic and harmonic score reading utilizing aural and written material. His study had two purposes: 1) to determine if materials using programmed instruction methods could be developed to teach melodic and harmonic score reading skills, and 2) to determine if melodic and harmonic score reading skills could be significantly increased by the developed programmed materials. He developed a score-reading test to measure melodic and harmonic reading skills. The programmed material consisted of 320 aural and visual frames organized into eight sections of forty frames each. The subject was instructed to follow a part or parts of t e score as he listened to a tape-recorded musical example in each section. He also had to determine where the error was if there was one. Constanza concluded that : 1) melodic and harmonic score reading skills can be effectively taught by programmed instruction utilizing aural and visual materials, 2) the score reading test developed for the study was an effective instrument for measuring melodic and harmonic score reading skills, and 3) melodic and harmonic score reading skills developed are transferable and could be applicable to other musical situations involving these skills.

Merrell Sherburn[24] developed a programmed method for the learning of basic ear training and sight singing for college music majors which used a sequence of taped and written material. Tapes and written lessons were sequenced and made available in the listening laboratory at Michigan State University. According to the author, this material is currently (1977) being developed into two books, Basic Ear Training and Harmonic Perception. Basic Ear Training will deal with the melodic/rhythmic aspects of ear training while Harmonic Perception will deal with the harmonic/contrapuntal aspects.

Robert G. Sidnell[25] investigated the use of programmed training tapes as a means of improving score reading skills of student instrumental conductors at Michigan State University. He used music from public school performances for the material on the drill tapes. Short excerpts were re-recorded in which only one pitch or rhythm error was allowed in an otherwise near perfect performance. Errors were programmed so that detection and identification were accomplished in four frames. Sidnell developed twenty tapes of twelve excerpts each. He also developed comparable non-programmed material for the purpose of an experimental study. The drill materials were tested at Michigan State University under experimental conditions. A matched-pair two group design was used to test the materials. Each group was exposed to two tapes per week during a ten-week term. Programmed drills were given to the experimental group while non-programmed drills were given to the control group.

He concluded that: 1) Extra class drill material specifically directed to the improvement of score-reading skill is beneficial. 2) Drill material of a self-instructional nature, arranged in a programmed format is superior to non-programmed material in bringing about gains in score-reading skill.

Laurin P. Crowder[26] was interested in the effectiveness of programmed learning in teaching the fundamentals of orchestration. He carried out his research in order to construct a teaching instrument which would expand programmed learning potentialities in the fundamentals of orchestration.

In developing the program, he used the linear programming technique modified to incorporate considerable conversational chaining. The program's format consists of four horizontal bands on each page. The subject is directed to write his response in each frame and then turn to the back of the page for the correct response. The program was tested in orchestration classes at Mississippi State University, Auburn University, and the University of South Alabama. At each test site, the students were instructed to consult no source of information on orchestration other than the programmed text until the field test was completed. Lecture was limited to facets of orchestration not covered by the program. Twenty-six students made up the test population. A pre-test/posttest consisting of one hundred multiple choice items was administered to each of the students. They scored a 100% degree of accuracy on 96% of the program's frames. Considered collectively on the total program, the subjects had a 98% degree of accuracy. Students required a mean time of eleven hours and fifteen minutes to complete the program.

Summary

There is much concern about behaviors which are modified or maintained by the consequences they produce. Behavior whose rate or form is governed by its consequences is defined by Skinner as being operant behavior.

Operant research is characterized by the use of single organisms for extended periods of time and the alteration of behavior of the single organism being studied is one of the prime investigative tools. In programmed instruction, an attempt is made to set up a program which starts with the student at his entering level. Through successive steps which require small changes in behavior, arranged so that the student is reinforced at every step, the behavior is altered to the terminal behavior required. Hopefully, this is done without failures which might discourage him.

Some music behaviors are operant and thus programmed instruction lends itself quite well to the alteration of behavior in music learning. The programmed approach can be adaptable to many learning situations in music since most musicians are disciplined in self-iniated and self-instructed progress.

The flexibility that programmed methods provide in music learning allows for individual differences in students. Today, music teachers welcome programmed texts and recordings as valuable teaching resources that offer vast opportunities for improving or revolutionizing the teaching of music.

THE CONCEPT OF ATTITUDE

In 1935, Gordon Allport[27] did an extensive review of the social psychology literature. After that review he wrote the following:

> Attitude is probably the most distinctive and indispensable concept in contemporary social psychology. No term appears more frequently in experimental and theoretical literature.

Allport's conception was reaffirmed in 1937 by Murphy, Murphy, and Newcomb[28] with the following:

> Perhaps no concept within the whole realm of social psychology occupies a more nearly central position than that of attitudes.

Allport, in the earlier study, and Stern,[29] in a latter study, attributed Thomas and Znaniecki with establishing the concept of attitude as a central feature of social psychology. Stern states:

> The term attitude was employed by them as a way of conceptualizing the unifying force which appears to lie behind what would otherwise seem to be discrete and arbitrary overt behaviors.[30]

Other writers such as Bogardus,[31] Folsom,[32] and Fromm,[33] have also equated social psychology with the study of attitudes.

The concept of attitude has undergone much refinement and extension since its inception. Fishbein stated the following in 1967:

> Despite the enormous growth of social psychology, and the diversity of interest of contemporary social psychologists, Allport's words are as true today as they were in 1935. In addition, the attitude concept has come to play an increasingly important part in almost all of the behavioral sciences and of the applied disciplines.[34]

Attitude Measurement

The method of direct questioning has enjoyed an almost exclusive position with investigators in trying to determine how another individual feels about an issue or an event. Although it is a legitimate method of collecting attitudinal information, it provides a limited amount of data. The information given must be accepted without knowing if the respondents concealed their true beliefs, and without any objective measures to verify the validity of the statements.

In 1928 Thurstone[35] stated:

> . . . if a denominational school were to submit to its students a scale of attitudes about the church, one should hardly expect intelligent students to tell the truth about their convictions if they deviate from orthodox beliefs . . . all that we can do with an attitude is to measure the attitude actually expressed with a full realization that the subject may be consciously hiding his true attitude or that the social pressure of the situation has made him really believe what he expresses.

In a situation such as this, the investigator is confined to classifying a respondent into one of three groups: 1) those with favorable attitudes, 2) those with unfavorable attitudes, and 3) those who are undecided about their attitudes toward an issue or an event. He has to construct an opinion scale in order to obtain the personal reaction of a respondent to some psychological or social stimulus.

Early efforts were made in the direction of developing opinion scales by such investigators as Watson,[36] Bogardus,[37] and Thurstone.[38]

<u>Watson's Test of Fairmindedness</u>

This test was developed in 1925. It was designed to provide a measure of prejudice on twelve different issues related to religious observance, moral code, and political beliefs. After adding selected responses from a group of three hundred items placed in six categories, Watson obtained a numerical score for each issue. A five-point scale ranging from unqualifiedly true (+2 points) to unqualifiedly false (-2 points) was developed. Each of the six categories represented a list of opinions to which respondents indicated their degree of acceptance.

Bogardus Scale of Social Distance

E. S. Bogardus[39] developed the Social Distance scale in 1925. It has been the most widely used instrument of its type. It is a 7-point scale that measures the amount of social distance between oneself (respondent) and average members of various ethnic, religious, national, or racial groups. By placing checks beside each of a number of groups (ethnic, religious, etc.), the respondents project their pattern of preference toward these groups and indicate whether or not they would allow or accept relationships such as 1) would work beside in an office, 2) would have several families in my neighborhood, 3) would marry, 4) would have as regular friends, 5) would have live outside my country, and 7) would have merely as speaking acquaintances.

A tolerance score was obtained for the respondent by averaging the step values ranging from 1 to 7 as assigned to each of the groups rated.

Thurstone's Method

Thurstone[40] used several groups of people to produce opinion statements about an issue in 1928. The statements were then edited and a list of from 100 to 150 statements were prepared. This list represented attitudes that covered a full range of opinions from one end of the scale to the other. Upon a second editing (giving special attention to neutral statements and throwing out double-barreled statements), about 80 to 100 statements were actually scaled. The statements were then mimeographed on small cards. There was one statement to each card. Two or three hundred subjects were asked to arrange the statements in eleven piles ranging from opinions most strongly affirmative to those most strongly negative. The subjects were then instructed to maintain a fairly even space or interval between piles. This brought forth the term "equal interval" which is frequently used to describe this technique.

The opinion statements were then assigned the same number of positions on the continuum as there were subjects. The median of the assigned position for any specific statement was termed its scale position and an index of the variability of the judgments for each statement (semi-quartile range) was computed. Items on which there were the highest agreement among subjects were then selected to provide evenly spaced statements along the opinion continuum. The position of each item was known to the investigator, therefore translating the checked items into an attitude scale for the subjects was simplified.

Likert's Technique

In 1932, Rensis Likert[41] published a technique for designing an attitude scale (summated ratings) which also utilized a series of statements referring to the attitude being studied. He gave attitude tests to undergraduates (chiefly male) in nine universities extending from Illinois to Connecticut, and from Ohio and Pennsylvania to Virginia. He used a total number of 2000 individuals in the study but the data used, after intense analysis, were derived from 650 persons. His Survey of Opinions test was given in the late fall of 1929. He used questionnaire material that fell into four main classes: 1) questions answered by a Yes, a question mark, or a No, 2) a series of multiple-choice questions in which one of five possible answers was to be selected, 3) a series of propositions to which five categories of response are provided, a. strongly approve, b. approve, c. undecided, d. disapprove, and e. strongly disapprove, and 4) the subject being asked to indicate his response to outcomes of a series of abbreviated newspaper narratives about social conflicts. Scores of 5, 4, 3, 2, 1 were assigned to the categories respectively.

Likert used the sigma method of scoring. The statements were checked for internal consistency or "clustering" by finding the reliability, using odd vs. even statements.

Evaluation of the items was accomplished by administering them to a group of respondents and the relation of each item score to the total score for the full set of items served as an item discriminating index. The fourteen five-point statements used yielded moderately high reliabilities when tried on three different groups with between 30 and 35 subjects in each group. The Thurstone technique relied upon the subjective judgment of a series of judges. The Likert technique depended upon internal consistency criteria. In addition, Likert's method was faster, equally or more reliable, and equally or more valid than Thurstone's method.

Guttman's Scalogram Analysis

Scalogram analysis is a technique geared toward testing a series of qualitive items for the presence of a single variable. Two individuals might give the same response to the same question and still have contradictory attitudes toward the given situation. This has been a problem of concern for investigators for a number of years. If an investigator wanted to rank respondents according to the degree of their favorableness toward some issue, it could be done within the framework of this method. This method is used to evaluate and/or modify previously constructed attitude scales rather than to construct new attitude scales. According to Guttman,[42] a scale is:

> The multivariate frequency distribution of a universe of attributes for a population of objects, if it is possible to derive from that distribution a quantitative variable with which to characterize the objects such that each attribute is a simple function of that quantitative variable.

With Guttman there is an unambigious meaning to the order of scale scores. An object with a higher score than another object is characterized by higher, or at least equivalent values on each attribute. The basic conception of the cumulative scale is that it is characterized by an internal relationship that exists among the items forming the scale, thus we have the term "unidimensional" applied to this method. This relationship is such that a person who endorses an item of a given scale position will endorse all items below it in the scale. If it is known that a person endorsed five items of a six item scale, it is also known which five items he endorsed. Likewise, all individuals endorsing only three items will endorse the same three.

Guttman uses the term "coefficient of reproducibility" to calculate the relative frequency with which a given set of values approach unidimensionality, or in other words, to measure the amount by which a scale deviates from the ideal scale pattern. This is because perfect scales are not found in practice. He submits that in practice, 85 percent perfect scales or better have been used as efficient approximations to perfect scales. The reproducibility coefficient is referred to as the "reproducibility index" and is expressed as a decimal. Guttman[43] states that:

> Coefficient of reproducibility is secured by counting up the number of responses which would have been predicted wrongly for each person on the basis of his scale

> score, dividing these errors by the total number of responses and subtracting the resulting fraction from 1.

Letting (R) equate reproducibility, the following formula will serve to clarify the procedure:

$$R = 1 - \frac{\text{number of errors}}{\text{number of responses}}$$

Used in an example for further clarification, one could say that if a scale consisted of 15 items tested on 200 individuals, the total number of responses would be 15 X 200 = 3,000. If there were 125 scaling errors for the sample, the coefficient of reproducibility would be calculated as follows:

$$R = 1 - \frac{125}{3000} = 1 - .04 = .96$$

Eighty-five percent (R) or better is used by Guttman as an efficient approximation to a perfect scale. This index is established for dichotomous items. The higher the number of responses, the greater the flexibility in the interpretation of scalability. Reproducibility alone is not a sufficient criterion for scalability. It is the primary test, but at least four other features should be taken into consideration while interpreting tests for scalability. They are: 1) range of marginal distributions, 2) patterns of errors, 3) the number of items in the scale and, 4) the number of response categories in each item.

Semantic Differential

This method, developed by Osgood, Suci, and Tennanbaum, is one of the more recent developments in self-report techniques. The Semantic Differential was not developed for the purpose of measuring attitudes. It became a by-product of the initial intent, of Osgood and his associates, to explore the dimensions of meaning.

Heise[44] defines Semantic Differential as a technique that:

> measures people's reactions to stimulus words and concepts in terms of ratings on bipolar scales defined with contrasting adjectives at each end.

He continues and gives an example of a semantic differential:

Good ___ ___ ___ ___ ___ ___ ___ Bad
3 2 1 0 1 2 3

Labels are attached to each numerical position. The position marked 0 is labeled "neutral." The 1 positions are labeled "slightly," the 2 positions "quite," and the 3 positions "extremely." Directionality is measured by this type of scale along with degrees of intensity. The technique has three features that distinguish it as an instrument for social psychological research: 1) Semantic Differentials are easy to set up, administer, and code. The procedure demonstrated high reliability and validity with Tannenbaum in 1953 and Suci in 1952. 2) There are instances in which the Evaluation, Potency, and Activity (EPA) dimensions are not as interesting separately as they are when used in some compound or combination of them (especially in multiple regression procedure). The EEPA structure in SD has an unprecendented amount of cross-cultural validation. Measurements on all three dimensions yield a vast amount of information about affective responses to a stimulus. 3) Research using the SD, and methodological research about the SD can sumulate because the form of an SD is basically the same no matter what the stimulus may be.

There are many other methods that measure attitudes. For example, Cook and Selltiz's Multiple-Indicator Approach to Attitude Measurement, Guttman's Cornell Technique, Multidimensional Scaling of Attitudes by John Ross, The Indirect Testing of Social Attitudes by Kidder and Campbell, and Measuring Attitudes by Error-Choice: An Indirect Method by Kenneth R. Hammond.[45]

It is not within the framework of this chapter to report on all methods. Only the more popular and frequently used methods have been expounded upon. The remainder of this segment will concentrate on the area of attitude measurement in music.

Attitude Measurement in Music

The Watson Measurement of fairmindedness was one of the early attempts to measure attitudes toward some psychological or social stimulus (1925). Fifteen years before that (1910), an effort was made by C. W. Valentine[46] to test the attitude of school children and adults toward musical elements. His objective was to find out if a feeling for consonant intervals developed with age. He also wanted to find out if there were any differences in this respect among children of different cultural groups with varying degrees of musical training. Intervals were played on a piano and the subjects were asked to record on paper their judgments on a seven-point scale of very pleasing, pleasing, slightly pleasing, indifferent, slightly displeasing, displeasing, and very displeasing. He found the greatest preference to be for intervals of a major third, minor third, octave, major sixth, minor sixth, fourth, tritone, fifth, major second, minor seventh, major seventh, and minor second in that order.

During the same time that Valentine was working on his interval study, C. S. Myers was conducting a study on the differences in attitudes towards tones. Myers[47] states the following:

> The experimental results described in this paper are to be regarded as preliminary to an inquiry into the individual mental differences underlying man's attitude towards music.

He used ten tuning-forks placed in a support to produce tones that ranged from 400 to 1300 vibrations per second. The pitch of each fork differed from that of its neighbour by 100 vibrations. He also used a mechanism with a steel band and a rubber knob that could be depressed and released to strike each fork and set it into vibrations. After hearing isolated tones, each subject was asked to write down his general attitude toward it. Myers wanted to know if the subject thought the tone was pleasing or displeasing and, if so, why. After eight single tones were sounded, the subject was also asked to express his attitude about simultaneous tones, or what Myers calls bichords. He then describes the main aspects from which a given tone may be regarded. According to him, there are four in number - the intrasubjective, the objective, the character, and the associative aspects. He reached many conclusions, some of them are that 1) low tones are more potent in evoking suggestions and intellectual activity; high tones depend rather on their physiological effect, 2) the objective aspect occurs more frequently and the intrasubjective and character aspects occur less frequently in the case of bichords than in the case of single notes and, 3) impossibility of comparison arises either from a conflict between the dictates of one or more aspects, or from reliance on the objective aspect.

In 1920, M. L. Mohler[48] attempted to measure judgment of orchestral music using the Trabue scales for Measuring Judgment of Orchestral Music. The test used phonographic records of sixteen different musical compositions in groups of three or four. There were some problems with this test, for records were rated by so called "expert judges" and "non-expert judges" on a continuum of best to poorest. After hearing the records, each subject was asked to write down what he considered best, next best, poor, and poorest. His method of obtaining results only allowed for the counting of ratings that were judged best record and poorest record. Reliability and validity are questionable with this study. Trabue states that:

> Unfortunately the tests do not seem to be as reliable as one would desire, although they are probably more reliable than any estimates of ability the average teacher of music would be able to make.

Jacob Kwalwasser[49] devised two tests on feelings toward musical elements. The Test of Melodic Sensitivity was constructed for the purpose of evaluating the basic affective responses upon which an appreciative attitude toward music is established. The test consists of 35 two-measure melodic fragments and attempts to measure the subject's ability to distinguish the better of two melodic progressions. The items in the test increase in difficulty as one progresses toward the end.

The Test of Harmonic Sensitivity was constructed for the purpose of measuring one's ability to discriminate between good and poor harmonic progressions. Thirty-five three-chord progressions are used in the test. Half of them are labeled good if they follow established melodic and harmonic practices. The other half are labeled poor if they violate these practices. The subject is asked to choose the better of the two progressions. These progressions also increase in difficulty as one progresses toward the end.

Max Schoen[50] devised the Test of Musical Feeling and Musical Understanding. His purpose was to reveal the individual's sensitivity for the appropriateness of tones in a melody. Melody is defined as a succession of tones differing from each other in pitch and duration. He also adds that these tones give the effect cf an aesthetic unity.

The test consists of sixteen alternate terminal phrases and four original antecedent phrases. Four of the sixteen terminal phrases are original. One of four values is assigned to the four terminal phrases: 0 if it is judged poor, 2 if it is judged fair, 4 if it is judged good, and 6 if it is judged very good.

Bullock[51] submits that there have been two basic types of tests developed to measure the valuative aspects of musico-aesthetic attitude. These two types are verbal and tonal. The differences in the two types are that verbal tests do not employ musical stimuli; tonal tests do.

A test of the verbal type is the Vernon Measure of Musical Taste. This test, developed by P. E. Vernon[52] evaluated musical taste through the use of thirty imaginary concert programs compiled from actual programs from victrola record catalogs and radio announcements.

In regard to defining musical taste, Vernon states the following:

> From an impartial psychological viewpoint the only satisfactory definition of an individual's musical taste would seem to be the degree of approximation of his musical likes and dislikes to the opinions of a consensus of musical leaders, conductors and critics of the time.

The subjects were asked to give their verbal opinion as to whether they would like to attend each concert. They assigned marks to each concert program on a numerical continuum of from 0 (I do not in the least want to go to this one) to 4 (I should very much like to go to this one). The influence of special compositions or performers was also to be indicated.

Two tests of the tonal type to which Bullock refers are the Adler[53] Music Appreciation Tests series A and B. They were developed in the spring and fall of 1927 respectively. Each test contains six sets of four versions of a musical excerpt. The four versions in each set consists of the original and three distorted versions: one dull, one chaotic, and one sentimental. The tests were based upon the method of Abbott and Trabue[54] on the Measurement of Ability to Judge Poetry.

Kate Hevner[55] devised a test in 1934 for measuring aesthetic appreciation in music. This test is also based upon the Abbott-Trabue method. It consists of forty-eight excerpts from the beginning of piano compositions. Each excerpt is paired with a mutilated version in which one element of the piece, either melody, rhythm, or harmony is altered. Subjects are asked to indicate which version is better and which element has been altered in the mutilated version. Reliability and validity were low in this test below the college level.

After Thurstone's work with equal intervals in 1928, investigators attempted to construct a systematic approach of developing attitude scales in music. Seashore and Hevner[56] devised a timesaving device for the construction of attitude scales. This time- and labor-saving device was used for obtaining subjective ratings of stimuli by the method of equal-appearing intervals. It consisted of two scales made up of twenty-five statements each. The authors state that:

> This device may have some importance because it is especially applicable to the making of attitude scales after the method devised by Thurstone . . .

Their procedure followed the method of Thurstone and Chave in their book, The Measurement of Attitudes.[57] In their third step, statements are given in mimeographed form to subjects who sort them by the method of equal-appearing intervals.

Seashore and Hevner devised a method of rating on a nine-point scale which was printed on the left-hand margin for each item. This was substituted for the standard method (Thurstone) of sorting items into nine piles from separate slips. They concluded that the rating method saved from 50% to 87% of time on the various processes involved in making attitude scales by Thurstone's method of equal-appearing intervals. They also reported that subjects found their method easier and more pleasant.

Leland R. Long[58] constructed the Long Music Interest Inventory. It was constructed to provide an objective means of measuring the musical interests of band and orchestra students. While implying that interest has a direct bearing upon attitude, the author states that:

> While attempting to study the musical and intellectual capacities of my band and orchestra students by administering a battery of standardized intelligence and talent tests, I was stumped in a search for any test which would give objective data on my student's interest in instrumental music. Many students who were superior mentally and rated high in pitch, rhythm, and tonal memory were just average members of musical organizations; whereas, a number of students who were merely average in comparative test scores, were doing quite outstanding work. The thought occurred that the reason for this difference, and in general for many differences in attitude in rehearsal and toward home practice, was in degree of interest each student possessed or had developed in his instrumental work.

In 1949, Farnsworth[59] constructed a test entitled Rating Scales for Musical Interests. It consists of five simple self-rating scales. One test was geared toward general interests in music while the others evaluate interest in serious, hit parade, waltz music and popular music.

The use of music tests in psychiatric diagnosis was recommended by Cattell and Saunders.[60] Their I.P.A.T. Music Preference Test consists of musical excerpts grouped to represent seven personality factors. They stated a two-fold purpose: 1) to investigate relations between musical choice and personality in normal and pathological subjects, and 2) to construct a music choice test for personality diagnosis.

Williams[61] did a study that investigated the effects of musical aptitude, instruction, and social status on attitudes toward music. His study had four purposes. The first was to determine whether there was a difference in attitude toward current popular, serious chamber, serious symphonic, and serious vocal music between experimental students, who received musical instruction, and control students who did not. The second was to determine whether experimental students of three different socioeconomic statuses had differences in attitude toward the selected types of music before and after instruction. The third purpose was to determine whether experimental students of two classifications of musical aptitude had different attitudes toward the selected types of music before and after instruction. The fourth purpose was to determine which of the variables used in socioeconomic status and musical aptitude accounted for the greatest variance in attitude toward the selected types of music.

He used 299 male and female subjects from the Southern Illinois University in Carbondale, Illinois and Shawnee Community College in Ullin, Illinois. His control group consisted of 137 students selected from various disciplines exclusive of music. The experimental group consisted of 162 students enrolled in music appreciation courses at both institutions. A semantic differential was devised for each concept to assess students' attitudes. This test had five scales: current popular, folk, serious vocal, serious symphonic, and serious chamber. Each of the scales consisted of ten evaluative, bipolar adjective pairs describing two brief musical examples. Each adjective pair reflected one of six factors, general, quality, mood, sensation, structure, and emotion. Subjects were asked to record their responses for each scale by checking along a seven-point range for each adjective pair.

He found that the three levels of socioeconomic status of those who had instruction did not significantly influence the attitudes held toward the five categories of music. This led him to believe that in regard to the population studied, determination of socioeconomic status would be of little aid in curriculum planning for attitude development. He also found that the two levels of music aptitude had no significant effect upon attitude. In addition, he found that of the three measures used to determine socioeconomic status and the three measures used to assess musical aptitude, none emerged as high predictor variables of musical attitude on the five selected types of music.

Another study using Osgood's semantic differential technique was done by Arthur R. Buss.[62] He developed the Buss Musical Semantic Differential. His study, which used 434 subjects, was an investigation of the potential use of the semantic differential (SD) technique as a method for measuring attitudes toward music. He assumed that if individual attitudes about music differed, there would be corresponding differences in the way each individual ranked music on the semantic factors. Buss' instrument consisted of twenty-four bipolar adjectival scales and ten pieces of music randomly selected from A Dictionary of Musical Themes. Test subject's responses were evaluated in terms of four factors which accounted for 53% of the variance. The four factors were potency, evaluation, novelty, and complexity.

Attitudes toward music of music teachers and college undergraduates was the concern of Mehling[63] in 1972. His study had a purpose that was three-fold. First, he wanted to examine differences in attitudes toward music in college undergraduates who were not music majors. Secondly, he wanted to examine musical needs of college undergraduates who were not music majors, and thirdly, he wanted to examine music faculty perception of undergraduate nonmusic major attitudes and needs.

He used 1,734 college undergraduates from five state universities in Michigan. His faculty sample came from music faculty and graduate assistant staff at these same institutions.

Mehling developed the Music Attitude Scale (MAS) and the Musical Needs Profile (MNP) for his study. Some of his findings are that 1) there were no significant differences in either musical attitudes or needs between the four levels of college undergraduate nonmusic majors, 2) college music teachers perceive the musical attitudes and needs of college undergraduates to be less positive than they actually are, 3) college undergraduates who have had music training outside the public school, consisting of private vocal or instrumental lessons, demonstrate more positive musical attitudes and needs than undergraduates who have not had such training, and 4) students who have taken one or more college music courses reflect a more positive attitude toward music than students who have not had a college music course.

In 1972, Bradley[64] did a study that investigated musical preference in contemporary art music. His purpose was to design, implement, and evaluate an experimental series of sequentially structured lessons in listening to selected contemporary art music, and to discover the effect of a fourteen-week program on the musical preferences of seventh grade students who participated. He also decided to investigate the possible effects of learning transfer on musical preferences by investigating changes in students' expressed preferences both for selected compositions studied in the classroom, and for selected similar compositions to which students had not been exposed. He selected twenty-four contemporary art compositions that were considered by a panel of judges to be musically significant. These compositions represented tonal, polytonal, atonal, and electronic musical styles. After the selection, four compositions of each style were used in the study. One half being used as study selections, the other half as transfer selections.

Classes in the control group recorded their musical preferences initially as a pretest. At the end of the study, they were recorded as a posttest without any exposure to the listening program. Bradley developed the Music Preference Inventory (MPI) to measure the expressed musical preferences of the students for contemporary art music.

He found that the results of the study indicated that a fourteen-week course in representative and significant contemporary art music can bring about a positive change in the expressed preferences of seventh grade students for the selections prescribed for the study. He concluded with the following statement:

> . . . The acceptance of a composition involves many complex factors. This study has provided significant evidence, however, in support of the idea that a broader base of musical understanding is valuable in the development of positive preferences that can lead to acceptance of new music . . .

Willman[65] did a study of attitudes achieved through the medium of electronic music. His purpose was to test a basic ungraded program of study in electronic music suitable for use in grades five through eight. He used 339 students drawn from two elementary schools and one junior high school in the Grand Forks, North Dakota Public Schools. The students were grouped into seven pairs of experimental and control groups. The experimental groups received music instruction using an electronic music-based curriculum while the control received more general, traditional music instruction. Measurements were made with a battery of four pre/posttests to determine any possible significant differences in attitude toward music, competencies in electronic music, and musical concept development that existed between the experimental and control groups. His findings were that:

1) There were no significant differences between the control and experimental groups in attitude toward music.

2) In a majority of the groups tested, the experimental groups showed a significantly better mastery of competencies in electronic music than did the control groups.

3) Exposure to and involvement with electronic music contributed to a higher level of conceptual development for a majority of the experimental groups (for the portion of the musical concepts measured by the fourth test) than the control groups.

4) Students' opinions of electronic music and their reactions to its inclusion in music class are much more positive in seventh and eighth grades than in fifth and sixth grades.

One of his recommendations is that further study should be undertaken toward the development of musical concepts through exposure to, and involvement with electronic music.

Summary

The more widely known tests for measurement in music have been developed to assess achievement, performance, and aptitude. Most of these approaches have developed directly from psychological measurements. Others, whose foundations are not so empirical have been deemed rather dubious.

A variety of approaches have been made toward the measurement of music and attitudes. Some of the early approaches were called Music Preference Tests. In the majority of these tests, music preference is implied as being the result of attitude.

Music attitude tests fall into two main categories: 1) verbal measures of attitudinal response that do not engage the use of a musical stimulus, and 2) tonal measures of attitudinal response that do engage the use of a musical stimulus.

CHAPTER III

DESIGN OF THE STUDY

Introduction

The primary purpose of this study was to develop a basic self-instructional method for the Arp 2600 Portable Electronic Synthesizer. Another purpose was to ascertain whether there would be any differences in attitude toward electronic music between the groups used in this study.

This chapter contains a description of the sample, the experimental design, development of the attitude scale, treatment of the data, and the development of the programmed text.

The Sample

The sample for this study consisted of students enrolled in the Youth Music program at Michigan State University during the summer of 1977. The Youth Music program is a two week or four week program in intensive music training. While the primary emphasis is on performance learning, students are also required to enroll in music theory and literature courses. The courses meet six days per week for the period in which the student is enrolled. Electronic music has been a part of the theory curriculum for three years previous to the summer of 1977. Students for this study were drawn from the Theory III classes indicating a high competence in music theory.

Experimental Design

The design used in this study is Campbell and Stanley's non-equivalent pretest, posttest control group design number 10. No claim for random assignment to groups can be made. Schematically, the design is as follows:

0	X	0
0		0

There were sixteen students in the control group and sixteen in the experimental group. The groups were given the pre and posttest. The control group did not receive the programmed method but was taught the same content by group instruction.

In discussing their design 10, Campbell and Stanley[1] state the following:

> One of the most widespread experimental designs in educational research involves an experimental group and a control group both given a pretest and a posttest, but in which the control group and the experimental group do not have pre-experimental sampling equivalence. Rather, the groups constitute naturally assembled collectives such as classrooms, as similar as availability permits but yet not so similar that one can dispense with the pretest. The assignment of X to one group or the other is assumed to be random and under the experimenter's control . . . Design 10 should be recognized as well worth using in many instances . . .

Development of the Attitude Inventory

Fifty statements about electronic music were selected from statements obtained from undergraduates in the Music 135 and Music 271 classes at Michigan State University. These classes are designed for non-music majors but the enrollment in Music 271 is totally elective without conforming to any requirement.

While listening to recordings of electronic music compositions, students were asked to write their impressions of the music in declarative statements on 5 x 8 cards. During analysis of the statements, fifteen were eliminated after it was determined that some were irrelevant and others were characterized by duplication. Music education faculty members reviewed the final form of the inventory to insure a measure of validity and accuracy. The final form of the inventory consisted of thirty-five statements about electronic music. Response to the inventory was on a scale of one to five as follows:

Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
(1)	(2)	(3)	(4)	(5)

At this point, the scale is reproduced in Appendix A. Student scores on the attitude inventory were obtained by summing the total of the individual responses with consideration for reverse scaling where necessary.

Treatment of the Data

The thirty-five item attitude scale was administered to thirty-eight high school students in grades ten, eleven, and twelve at Eastern High School in Lansing, Michigan. These students were thought to be similar to the experimental sample since they were enrolled in high school performance classes. The purpose of this trial administration was to secure data on reliability and validity. A test of reliability was done on the scale to determine internal consistency. The reliability coefficients used for the computation were Cronbach's Alpha and Standardized Item Alpha.[2] The realibility coefficients were Alpha = .75

and Standardized Item Alpha = .76. Table 3.1 contains the statistics of the trial administration of the attitude scale.

Table 3.1 -- ATTITUDE SCALE STATISTICS. N = 38

Maximum Score 132	Minimum Score 55
Mean	90.39474
Variance	122.24538
Standard deviation	11.05646
Alpha	.75
Standardized Ite, Alpha	.76

While the reliability estimates were moderate, the scale, with minor revisions, was thought to be appropriate for the study.

The data collected by the attitude inventory were keypunched on computer cards and processed at the computer center of Michigan State University. An analysis of covariance was used for the statistical analysis in this experiment. This program is available as a part of the Statistical Package for the Social Sciences (SPSS).

Further data regarding the attitude inventory can be of use in interpreting the results of this research. In the following summary, each statement together with descriptive and factor information is found.

	Item-total Correlation	Alpha	Factor	Loading
1. Electronic music is noise.	.49	.73	1	.44
2. There is a rich and varied pleasure in electronic music.	.39	.73	2	.44
3. Once someone has indulged in electronic music they cannot allow themselves to be without it.	.11	.75	3	.37
4. Electronic music makes people peculiar and narrow-minded.	.17	.74	4	.45
5. Music that uses electronic systhesizers is the most representative music of our times.	.14	.76	4	.46
6. Electronic music has nothing to offer me.	.74	.71	1	.82
7. Listening to electronic music helps eliminate fatigue.	.27	.74	4	.64
8. Electronic music has no place in the classroom.	.20	.74	3	.31
9. Electronic music does not bore me.	.57	.72	1	.61

	Item-total Correlation	Alpha	Factor	Loading
10. I would not choose electronic music to put on my stereo for occasional listening.	.68	.71	1	.66
11. The electronic synthesizer is not really a musical instrument.	.20	.74	3	.34
12. Given a choice of electronic music and art music for listening purposes, I would choose art music.	-.40	.78	2	-.69
13. The electronic synthesizer is just something with which you can fool around.	-.01	.75	4	.50
14. People should attend electronic music concerts.	.39	.73	1	.65
15. The importance of electronic music has been over estimated.	-.17	.76	3	-.55
16. One does not have to have a creative mind to produce electronic music.	.22	.74	1	.39
17. Electronic music is hard to grasp.	.37	.73	2	.79

	Item-total Correlation	Alpha	Factor	Loading
18. I would buy an electronic music album.	.57	.72	1	.66
19. Electronic music depresses me.	.70	.72	1	.68
20. Music produced by synthesizers contains a variety of interesting and unique sounds.	-.40	.76	3	-.47
21. Electronic music does not have enough continuity in the sound.	.37	.73	2	.43
22. Electronic music leaves me with a very strange feeling.	.33	.73	1	.31
23. Electronic music should never replace conventional music.	-.30	.77	1	-.59
24. Electronic music is very disturbing.	.63	.72	1	.74
25. Electronic music is highly expressive.	.51	.72	1	.50
26. Electronic music is composed of sounds that are hollow and artificial.	.39	.73	3	.46

	Item-total Correlation	Alpha	Factor	Loading
27. Electronic music is a novelty and should be treated as such.	.12	.74	3	.24
28. I would want to listen to an electronic music concert.	.51	.72	1	.54
29. The more I hear music produced by synthesizers, the more I dislike it.	.69	.71	1	.78
30. Electronic music is a legitimate medium of musical expression.	.22	.74	2	.42
31. I feel quite relaxed when I listen to electronic music.	.41	.73	2	.53
32. Listening to electronic music can spark creativity.	.29	.73	3	.65
33. Electronic music expresses feeling and emotion.	.33	.73	2	.43
34. I like electronic music that sounds close to conventional music.	-.02	.75	4	-.20
35. Electronic synthesizers are the most expressive musical instruments yet designed.	-.23	.76	4	-.49

The Development of the Programmed Text

There are two basic models used in the development of programmed methods. They are the linear technique and the branching technique. In the strict linear model, the learner is directed through every frame in the program. In the branching model, the learner is directed through varying sequences of frames. This is dependent upon the accuracy of his responses. Upon making an incorrect response, the learner is directed through a series of review frames to alter the behavior which led to the error.

The linear technique was chosen for this program because 1) it provides a greater amount of reinforcement than the branching technique. 2) Many programmers have found that a frame sufficiently difficult to produce a high rate of error tends to lessen the confidence of the learner. In the branching paradigm such frames must exist else there would be no need for many of the branches. Finally, 3) the branching paradigm tends to cause a textbook to be bulky and unwieldy unless the programmed unit is extremely restricted.

The programmed text consists of 347 frames. The frames are arranged in six horizontal bands on each page of the text. The student was instructed to complete the frame at the top of the page and then to turn the page where the correct response will be found. Upon finishing the last frame in the first band, the student is instructed to return to the first page of the method and to begin with band two. Upon completing band two, the student is instructed to return to the first page and to begin with band three. This continues until all six bands are completed. All frames are numbered in the proper sequence. The first frame begins with the number one. The correct responses on the page following the student's responses are numbered in this same manner. The frames that contain the correct responses have parentheses around the numbers. The advantages of having the answers on the pages following the student's responses are that no paraphernalia is needed to cover the answer as he proceeds through the program; it is inconvenient to cheat by uncovering the answer; and the student is required to remember his response in a given frame on the front of the page as he checks the correct response on the page that follows.

The format for this program is patterned after that devised by Brethower.[3] All of the frames do not require written answers. In some frames the student has to turn knobs on the synthesizer, push slides, and plug cords into holes called mini-jacks. At the end of the last frame there are diagrams and special exercises with which the student can experiment.

Summary

The sample for this study consisted of high school students enrolled in the Youth Music Program during the summer of 1977 at Michigan State University. Three groups were used in the experiment. One group was taught electronic music using class instruction and two groups were taught electronic music using the programmed text. An attitude test was given to the three groups before and after instruction to ascertain any differences in attitudinal change toward electronic music. The comparison was made between only two groups.

The first draft of the program consisted of eighty frames. It was determined that the frames were too long because there were numerous facts in each frame. Therefore, a redevelopment of the program was undertaken. In the redevelopment phase, frames were shortened so that the majority of the frames contained only one fact. Frames that contained more than one fact did so because certain material about functions on the synthesizer could not be presented in a coherent manner without relating them to other facts within the same frame.

This researcher visually observed students working with the program. No tutorial assistance was made available and student error rate was below 5%.

CHAPTER IV

ANALYSIS OF THE DATA

Introduction

One of the purposes of this study was to investigate the effects of exposure to this method on attitude toward electronic music as opposed to the effects of exposure to group instruction on attitudes toward electronic music between two groups of students.

Descriptive Data of the Sample

Data for this study were secured by the inventory described in Chapter III and contained in Appendix A. The results of the pre and posttest administration of this inventory are found in Table 4.1.

Table 4.1 — DESCRIPTIVE ATTITUDE DATA FOR THE EXPERIMENTAL SAMPLE. N = 42

Group	N	Pretest Mean	Pretest Standard Deviation	Posttest Mean	Posttest Standard Deviation	Gain
Control 1	16	102.31	5.77	98.00	6.79	-4.31
Experimental 2	16	99.06	6.46	100.81	5.28	+1.75
Experimental 3	10	100.3	5.65	102.10	5.56	+1.80

Hypothesis

Only one hypothesis was advanced for this research. In order to test this hypothesis it is stated in the null form:

Hypothesis) There will be no differences between the two groups in attitude toward electronic music.

Only two of the groups were used for the comparison in this study. The third and smaller group (N = 10) provided more extensive data for the development of the self-instructional program and the attitude inventory. The results of the covariance analysis of the data are contained in Table 4.2.

Table 4.2 -- ANALYSIS OF COVARIANCE OF SAMPLE DATA

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	P
Covariate (Pretest)	33.01	1	33.01	.873	.35
Between Groups (Method)	44.54	1	44.54	1.178	.28
Within Groups (Error)	1096.16	29	37.79		
Total	1173.72	31			

Table 4.2 reveals no significance for the pretest as a covariate. Similarly, the F ratio for differences between groups does not indicate statistical significance. Therefore, the decision is to not reject the null hypothesis stated above.

Pretest Analysis

For purposes of clarity, data from the pretest were analyzed in order to determine if significant differences existed among the three groups. The pretest descriptive data are found in Table 4.1, the ANOVA data is contained in Table 4.3.

Table 4.3 -- ANOVA ON SAMPLE PRETEST DATA. N = 42

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	P
Between Groups	85.64	2	42.82	1.18	.318
Within Groups	1414.47	39	36.268		
Total	1500.11	41			

The data in Table 4.3 reveals no differences between experimental groups at the beginning of the study.

Summary

An analysis of covariance was used to test for differences between instructional strategies. It was found that no statistical differences existed in attitude toward electronic music among the groups.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The primary purpose of this study was to develop a self-instructional method for the Arp 2600 Portable Electronic Synthesizer. One other purpose was also involved in this study: to investigate the effects of exposure to this method on attitude toward electronic music as opposed to the effects of exposure to group instruction on attitude toward electronic music.

This program was designed for high school aged students with an expressed interest in music. The sample consisted of students enrolled in the Youth Music Program at Michigan State University during the summer of 1977. More specifically, the sample consisted of students from the Theory III section of Youth Music theory classes.

The review of literature indicates that much research has been done on the concept of attitude. This research is accompanied by a multitude of definitions for the concept. Although highly diversified in character, attitude definitions generally reflect the theories that have been formulated by different attitude researchers. A large amount of research has been done by psychologists in the measurement of attitudes. Most of the approaches developed from psychological measurements have been adapted to tests for measurement in music. A variety of approaches have been made toward the measurement of music and attitudes. Some of the early approaches were called Music Preference Tests. In the majority of these tests, music preference is implied as being the result of attitude. Music attitude tests fall into two main categories: 1) verbal measures of attitudinal response that do not engage the use of a musical stimulus, and 2) tonal measures of attitudinal response that do engage the use of a musical stimulus.

In the early sixties, music educators became aware of the many possibilities that programmed instruction could offer in effective music teaching. Since most musicians are disciplined in self-initiated and self-instructed progress, the programmed approach was easily adapted to many learning situations in music.

Music educators have to concern themselves with the question of whether electronic music has any place in the curriculum. Some music educators think that it does while others think that it does not.

Electronic music is more objectively listener oriented than traditional music and any avenue to the understanding and exploration of it must clearly be grounded in the nature of sound itself. Clearly it is easier to control tone production objectively through an electronic medium as opposed to music produced through a traditional medium.

Students are ready to accept and explore the many possibilities of creativity in the electronic medium. Music educators must become aware of the possibilities afforded by synthesizers, computers, and the related fields of science and mathematics. They should accept electronic music and place it in a context of traditional music education.

The instrument used in this study to measure attitudes toward electronic music was a thirty-five item attitude inventory. The data gathered was subjected to an analysis of covariance to determine the statistical differences in the results. The hypothesis was tested for significance at the .01 level of confidence. No statistical differences were found.

Conclusions

An analysis of the data supports the following conclusions:

1) A viable, self-instructional program in fundamental electronic music production on the Arp 2600 Portable Electronic Synthesizer has been developed and used. Students using this method achieved appropriate instructional objectives in the use of the synthesizer.

2) No statistical differences in attitude toward electronic music existed between the two groups involved in this study as a result of exposure to the two methods of instruction.

Discussion

In relation to the first conclusion, a 347 frame beginning self-instructional program was developed and used with high school aged musicians. This program is limited to the basic functions of the Arp 2600's oscillators, filters, and envelope generators. While the students were progressing through the method, informal observations were made by the researcher. There was no attempt to give them any tutorial assistance. Students generally found that the program was easy to do and that the diagrammed patches helped them in understanding where to put the patch cords. They also enjoyed working with the method.

As a result of progressing through this programmed method, students that were involved in this study were able to 1) define terms used in connection with synthesizer music production, 2) name events, basic sound waves, and symbols and 3) analyze aurally and visually, the obtained sound effects.

Another outcome of this study is the attitude inventory. This inventory, with revisions, may be usable in future research.

No statistical difference in attitude was found between the two groups used in the experiment. The lack of a statistical difference with respect to an analysis of the data could be attributed to measurement error although the attitude inventory has an acceptable reliability. The small sample may also have contributed to the fact that there was no statistical difference between the two groups. Finally, the lack of a statistical difference between the two groups may be attributed to the short time in which this study took place. Attitude shift is very unlikely in such a short period of time.

Recommendations for Future Research

1) This study should be replicated using a larger sample over a longer period of time with program revisions as well as revisions in the attitude inventory.
2) The replication of this program with people of non-musical background is also recommended.

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APPENDICES

APPENDIX A

ATTITUDE INVENTORY TOWARD ELECTRONIC MUSIC

THE FOLLOWING SCALE CONSISTS OF THIRTY-FIVE ITEMS DESIGNED TO SAMPLE YOUR OPINIONS ABOUT ELECTRONIC MUSIC. PLEASE READ EACH STATEMENT, DECIDE HOW YOU FEEL ABOUT IT, AND CHECK EACH ITEM ON THE FOLLOWING NUMERICAL SCALE. (1-STRONGLY DISAGREE, 2-DISAGREE, 3-NOT SURE, 4-AGREE, 5-STRONGLY AGREE.) SINCE THIS IS NOT AN EXAM THERE CAN BE NO RIGHT OR WRONG ANSWERS.

	STRONGLY DISAGREE (1)	DISAGREE (2)	NOT SURE (3)	AGREE (4)	STRONGLY AGREE (5)
1. Electronic music is noise.					
2. There is a rich and varied pleasure in electronic music.					
3. Once someone has indulged in electronic music they cannot allow themselves to be without it.					
4. Electronic music makes people peculiar and narrow minded.					
5. Music that uses electronic synthesizers is the most representative music of our times.					
6. Electronic music has nothing to offer me.					
7. Listening to electronic music helps eliminate fatigue.					

	STRONGLY DISAGREE (1)	DISAGREE (2)	NOT SURE (3)	AGREE (4)	STRONGLY AGREE (5)
8. Electronic music has no place in the classroom.					
9. Electronic music does not bore me.					
10. I would not choose electronic music to put on my stereo for occasional listening.					
11. The electronic synthesizer is not really a musical instrument.					
12. Given a choice of electronic music and art music for listening, I would choose art music.					
13. The electronic synthesizer is just something with which you can fool around.					
14. People should attend electronic music concerts.					
15. The importance of electronic music has been over estimated.					
16. One does not have to have a creative mind to produce electronic music.					

	STRONGLY DISAGREE (1)	DISAGREE (2)	NOT SURE (3)	AGREE (4)	STRONGLY AGREE (5)
17. Electronic music is hard to grasp.					
18. I would buy an electronic music album.					
19. Electronic music depresses me.					
20. Music produced by synthesizers contains a variety of interesting and unique sounds.					
21. Electronic music does not have enough continuity in the sound.					
22. Electronic music leaves me with a very strange feeling.					
23. Electronic music should never replace conventional music.					
24. Electronic music is very disturbing.					
25. Electronic music is highly expressive.					
26. Electronic music is composed of sounds that are hollow and artificial.					

	STRONGLY DISAGREE (1)	DISAGREE (2)	NOT SURE (3)	AGREE (4)	STRONGLY AGREE (5)
27. Electronic music is a novelty and should be treated as such.					
28. I would want to listen to an electronic music concert.					
29. The more I hear music produced by synthesizers, the more I dislike it.					
30. Electronic music is a legitimate medium of musical expression.					
31. I feel quite relaxed when I listen to electronic music.					
32. Listening to electronic music can spark creativity.					
33. Electronic music expresses feeling and emotion.					
34. I like electronic music that sounds close to conventional music.					
35. Electronic synthesizers are the most expressive musical instruments yet designed.					

APPENDIX B

ITEM-TOTAL STATISTICS ON ATTITUDE INVENTORY TOWARD ELECTRONIC MUSIC

Item-Total Statistics -- N = 38

	SCALE MEAN	SCALE VARIANCE	CORRECTED ITEM-TOTAL CORRELATION	ALPHA
Question 1	88.21053	112.49502	.49034	.73048
Question 2	88.13158	114.76600	.38294	.73584
Question 3	86.65789	123.79872	-.11533	.75958
Question 4	88.57895	117.98009	.17786	.74489
Question 5	87.36842	124.40114	-.14149	.76125
Question 6	88.31579	106.92461	.74176	.71617
Question 7	87.15789	116.08250	.27073	.74050
Question 8	88.36842	117.04979	.20204	.74387
Question 9	88.26316	109.38834	.57281	.72416
Question 10	88.15789	106.67710	.68570	.71704
Question 11	88.50000	116.68919	.20854	.74631
Question 12	87.76316	132.72617	-.40106	.78397
Question 13	88.39474	121.97511	-.01664	.75202
Question 14	87.76316	113.15861	.39452	.73399
Question 15	86.89474	125.23186	-.17752	.76315
Question 16	87.84211	114.89331	.22945	.74296
Question 17	87.36842	112.29303	.37391	.73422
Question 18	87.78947	111.19772	.57175	.72682
Question 19	88.39474	111.97511	.70689	.72617
Question 20	85.94737	128.05121	-.40444	.76466
Question 21	87.86842	114.54979	.37696	.73580
Question 22	87.50000	114.47297	.33676	.73709
Question 23	88.13158	128.49573	-.30240	.77121
Question 24	88.39474	108.67781	.63286	.72156
Question 25	87.86842	111.09033	.51123	.72813
Question 26	87.89474	113.12376	.39173	.73406
Question 27	87.94737	118.80797	.12239	.74774
Question 28	87.97368	108.62091	.51111	.72531
Question 29	88.07895	105.04765	.69620	.71413
Question 30	88.18421	117.07326	.22222	.74282
Question 31	87.36842	112.45519	.41464	.73267
Question 32	87.81579	115.12731	.29428	.73916
Question 33	87.76316	113.59104	.33715	.73659
Question 34	87.05263	121.83499	-.02454	.75503
Question 35	87.71053	126.85989	-.23920	.76761

APPENDIX C

THE PROGRAMMED TEXT

A BASIC SELF-INSTRUCTIONAL PROGRAM FOR THE ARP 2600 PORTABLE ELECTRONIC SYNTHESIZER

A BASIC SELF-INSTRUCTIONAL PROGRAM FOR THE ARP 2600 PORTABLE ELECTRONIC SYNTHESIZER

TO THE STUDENT

PLEASE READ BEFORE DOING THE PROGRAM

This is a programmed text. Unlike a regular text, a programmed text dictates the nature of participation on the student's part. Each page of the text is divided into six horizontal bands (or frames). As you work through this program, you are requested to read carefully and to formulate your answers to the questions and problems fully before exposing the answer or discussion in the frame following the one on which you are working.

Do not proceed vertically down the pages. After reading the information in the top frame on each page, turn the page and continue through each top frame until you are told to go back to page one where you will proceed through the second set of frames. IT IS RECOMMENDED THAT YOU SIT IN FRONT OF THE SYNTHESIZER WHILE DOING THIS PROGRAM.

TURN TO THE TOP OF PAGE 1

1.

In some frames, one or more words is missing. Your response will be to write in the missing word(s) before turning to the next page where you will find the correct response.

60.

If seen on an oscilloscope, aperiodic waveforms would form a pattern or a diagram that would not repeat itself and would occur only once, or at irregular intervals and only upon command. For example

 or .

118.

The voltage processor will mix, invert, and slow down a signal or waveform.

176.

Push the left and right speaker volume controls to the fourth line from the bottom.

233.

Patch any waveform from a vco output into the vco2 control input jack (11th from the right). (Use prewired patch or a patchcord - the choice is yours).

291.

In the KYBD (up) position, the repeat is activated only when a key is depressed and will discontinue when the key is released.

2.

In some frames, one or more words is missing. Your response will be to write in the missing word(s) before turning to the next ______________ where you will find the correct __________________.

61.

If seen on an oscilloscope, aperiodic waveforms would form a pattern that __________ __________ repeat itself.

119.

The voltage processor will ______________, invert, or ______________ ______________ a signal or waveform.

177.

Push the left and right ______________ volume controls to the ______________ line from the bottom.

234.

Move the attenuator up to the third line above the input jack.

292.

In the KYBD position, the repeat is activated only when a key is __________________ and will discontinue when the key is ______________.

(2)

Page, (frame) response, (answer).

(61)

Would, not.

(119)

Mix, slow down.

(177)

Speaker, fourth.

GO TO THE NEXT FRAME

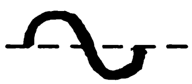
(292)

Depressed, released.

3.

Other frames do not require a written answer, they require action.

62.

The four basic waveforms or waveshapes produced on a synthesizer are a)  sine wave, b)  sawtooth wave, c)  triangle wave, and d)  square wave.

120.

In the lower half of the control surface, under the words <u>voltage processor</u> there are mini-jacks numbered 1 through 7.

178.

Move the initial oscillator frequency slider in vco-1 to the right. Stop halfway between 100/0.3 and 1KhZ/3.0.

235.

Put the resonance slider on MAX.

293.

When the switch is in the center it is in the off position.

4.

Other frames do not require a written answer, they require

__________________.

63.

The four basic waveforms or waveshapes produced on a synthesizer are ____________, ____________ triangle, and ____________.

121.

Under the words voltage processor, there are mini-jacks numbered _______ through _______.

179.

Move the initial oscillator frequency slider in vco-1 to the ____________. Stop halfway between __________ and __________.

236.

Move the initial filter frequency between 100 and 1kHz and play the keyboard.

294.

When the switch is in the center, it is in the _____________________ position.

(4)

Action.

(63)

Sine, sawtooth, square, (Any order is correct).

(121)

1, 7,

(179)

Right,	100	1kHz
	0.3	3.0

GO TO THE NEXT FRAME.

(294)

Off.

5.

This action is demonstrated by the turning of a knob or the sliding of a switch.

(64)

The aperiodic waveshape on a synthesizer is white noise.

122.

These mini-jacks are inputs to the voltage processor.

180.

Move the fine tune slider to the middle.

237.

Use a different frequency level.

295.

The repeat rate is determined by the setting of the initial oscillator frequency controlling the wave.

6.

This action is demonstrated by the turning of a __________ or the sliding of a __________.

65.

The aperiodic waveshape on a synthesizer is called __________ __________.

123.

These mini-jacks are __________ to the voltage processor.

181.

Move the Fine tune slider to the __________.

238.

Experiment with the sound.

296.

The __________ __________ is determined by the __________ of the initial oscillator frequency controlling the wave.

(6)

Knob, switch.

(65)

White noise.

(123)

Inputs.

(181)

Middle.

GO TO THE NEXT FRAME.
NO RESPONSE REQUIRED.

(296)

Repeat rate, setting.

7.

In addition, other frames require that you plug in patchcords. Patchcords are cords with plugs on each end.

66.

On the Arp 2600, a degree of white noise is produced in a low-frequency output called pink noise.

124.

In the section with the words "sample and hold," there is a column of four mini-jacks.

182.

Go to the voltage control filter VCF (fifth panel from the right).

239.

The third panel from the right contains the two Envelope Generators.

297.

Open the VCF and tune VCO-3 to one octave below middle C (4th panel from the right).

8.

Patchcords are cords with ______________ on each ______________.

67.

On the Arp 2600, a degree of white noise is produced in a low-frequency output called _________ ___________.

125.

In the column with the words "sample and hold," there is a column of ________________ mini-jacks.

183.

The voltage control filter is on the ______________ panel from the _____________.

240.

The third panel from the right contains the two __________________ ______________________.

298.

Close the VCF and raise the ADSR and VCO-2 slider (4th panel from the right) into the VCF.

(8)

Plugs, end.

(67)

Pink, noise.

(125)

Four.

(183)

Fifth, right.

(240)

Envelope Generators.

GO TO THE NEXT FRAME.

9.

Do not turn the page to look at the correct response until you have written your own response in each frame.

68.

To turn on the Arp 2600, flick the power switch up in the lower right hand corner. (* Check the diagram at the end of this manual that corresponds with this frame for confirmation.)

126.

The upper and lower mini-jacks in this column are inputs.

184.

Move the initial filter frequency slider between 1kHz and 10kHz.

241.

The two Envelope Generators produce transient waveforms.

299.

Switch the keyboard repeat switch to AUTO.

10.

Do not turn the page to look at the correct response until you have ______________ your own response in each blank _________.

69.

To turn on the Arp 2600, flick the power switch _____________ in the lower _________ _________ corner.

127.

The upper and lower mini-jacks in this column are _______________.

185.

Move the initial filter frequency slider between ____________ and ______________.

242.

The two Envelope Generators produce ___________ ____________.

300.

Adjust the VCO-2 frequency for tremolo speed.

---

(10)

Written (filled in), frame (blank).

(69)

Up, right, hand.

(127)

Inputs.

(185)

1 kHz, 10 kHz.

(242)

Transient, waveforms.

GO TO THE NEXT FRAME.

11.

Remember that it is recommended that you sit in front of the Arp 2600 while going through this program.

70.

A red light will come on just above the switch when this is done.

128.

All remaining mini-jacks in this column are outputs.

186.

Move the Fine tune slider to the middle.

243.

The rise and fall time of these waveforms can be controlled by the six vertical sliders on the panel.

301.

Play any note on the keyboard. It will continue to repeat itself according to the tremolo speed.

12.

It is recommended that you ________________ in __________________ of the Arp 2600 while going through this program.

71.

A ______________ light will come on just above the _______________ when this is done.

129.

All remaining mini-jacks in this column are __________________.

187.

Move the ______________ ___________________ slider to the _______________________.

244.

The ______________ and ______________ time of these waveforms can be controlled by the six vertical ___________ on the panel.

302.

Move the switch to KYBD. The repeat will discontinue when the key is released.

(12)

Sit, front.

(71)

Red, switch.

(130)

Outputs.

(187)

Fine tune, middle.

(244)

Rise, fall, sliders.

GO TO THE NEXT FRAME.

13.

We will begin the study of a Basic Self-Instructional Method for the Arp 2600 Portable Electronic Synthesizer by considering instructions for unpacking and setting it up.

72.

With regard to synthesizers, patching means taking a sound from its source out to the speakers or monitors by means of cords or sliders if it is prewired as the Arp 2600.

131.

An Attenuator is the opposite of an amplifier.

188.

Keep the Resonance slider at Min.

245.

On the top envelope generator, the four vertical sliders are labeled Attack time, Decay time, Sustain voltage, and Release time (ADSR).

303.

Turn the Portamento switch on (next to the slider control).

14.

We will begin the study of a Basic Self-Instructional Method for the Arp 2600 Portable Electronic Synthesizer by considering instructions for ______________________ and ____________________ it ______________.

73.

With regard to synthesizers, ____________ means taking a sound from its source out to the ______________ or monitors by means of cords or sliders if it is prewired as the Arp 2600.

132.

An Attenuator is the _______________ of an amplifier.

189.

Keep the __________ __________ at __________.

246.

On the top envelope generator, the four vertical sliders are labeled __________ time, __________ time, __________ voltage and __________ time (ADSR).

304.

Open the VCO-2 attenuator on the VCF panel and adjust the initial oscillator frequency on the VCO-2 oscillator to $1\frac{\text{kHZ}}{3.0}$.

(14)

Unpacking, setting, up.

(73)

Patching, speakers.

(132)

Opposite.

(189)

Resonance slider, Min.

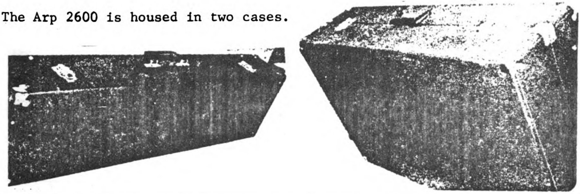
(246)

Attack, Decay, Sustain, Release.

GO TO THE NEXT FRAME.

15.

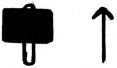
The Arp 2600 is housed in two cases.



74.

Because the Arp 2600 has a built-in patch system, most sounds can be obtained without the use of patchcords.

133.

When it is wide open or all the way up, it lets a signal through at full strength. ( OPEN).

190.

Move the vertical slider labelled VCO-1 (2nd from the left in that panel) to the fourth line up.

247.

Move all attenuators (sliders) to their closed position.

305.

Move the Fine Tune slider to the middle.

16.

The Arp 2600 is housed in ______________ cases.

75.

Most sounds can be obtained from the Arp 2600 without the use of ______________. This is because of the built-in ______________ system in the synthesizer.

134.

When it is wide open or all the way ___________ it lets a signal through at ______________ ______________.

191.

Move the vertical slider labelled ___________ to the ______________ line up.

248.

Move all attenuators to their ______________ position.

306.

Open the VCF mixer slider all the way (far right panel - 1st slider on the left).

---

(16)

Two.

(75)

Patchcords, patch.

(134)

Up, full strength.

(191)

VCO-1, fourth.

(248)

Closed.

GO TO THE NEXT FRAME.

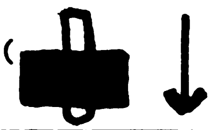
17.

The larger case houses the main unit, the smaller case houses the keyboard.

76.

Five patchcords are provided with the synthesizer.

135.

Closing the attenuator (sliding it down) gradually weakens the signal passing through until there is no signal at all. ( CLOSED).

192.

This is prewired from the VCO-1 oscillator and patches the sound from the VCO-1 to the VCF without the use of patchcords. Move over to the far right panel and move the left mixer VCF vertical slider all the way up.

249.

Slide the initial oscillator frequency of VCO-2 to $\frac{1\text{kHz}}{3.0}$.

307.

Attenuate the portamento slider from Min to Max while playing low and high notes on the keyboard.

18.

The larger case houses the ______________ ______________, the small case houses the ____________________.

77.

_________________ patchcords are provided with the synthesizer.

136.

Closing the attenuator gradually _________________ the signal passing through until there is no signal at all.

193.

Move to the far _______________ panel and move the left mixer _______________ vertical slider all the way up.

250.

Slide the _________ oscillator _________ of VCO-2 to $\frac{\text{1kHz}}{3.0}$.

308.

Notice the sliding effect that starts midway between the 2nd and 3rd line.

(18)

Main unit, keyboard.

(77)

Five.

(136)

Weakens.

(193)

Right, VCF.

(250)

Initial, frequency.

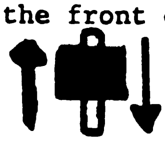
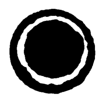
GO TO THE NEXT FRAME.

19.

There are four latches on the cover of the main unit, one latch on each side and two on top adjacent to the handle in the middle.

78.

On the control-panel of the synthesizer, the objects protruding through the front of it are slider controls, mini-jacks, and slide switches.

 slider control,  mini-jacks,  slide switch.

137.

Most of the attenuators in the 2600 function as an input to a filter, amplifier, or oscillator, or as an output from a filter, amplifier or oscillator.

194.

The Pitch Bend switch on the keyboard should have the marker on it straight up the middle.

251.

Put the Fine tune slider in the middle.

309.

To play two notes on the keyboard, patch a cord from the upper voice top mini-jack, (left side of the keyboard control panel) to the KBD CV input mini-jack of VCO-1. (4th from left.)

20.

There are ____________ latches on the cover of the main unit, one latch on each __________ and two on __________ adjacent to the handle in the middle.

79.

The objects protruding through the front of the control-panel are ____________ ____________, ____________, and ____________ ____________.

138.

Most of the attenuators in the 2600 function as an __________ to a filter, amplifier or oscillator, or as an ____________ from a filter, amplifier, or oscillator.

195.

The ____________ ____________ switch on the keyboard should have the marker on it straight up the ________________.

252.

Put the Fine tune slider in the ____________________.

310.

Patch another cord from the upper voice bottom mini-jack to the KBD CV input jack of the VCF. (13th from the right.)

(20)

Four, side, top.

(79)

Slider, controls, mini-jack, slide, switches.

(138)

Input, output.

(195)

Pitch Bend, Middle.

(252)

Middle.

GO TO THE NEXT FRAME.

21.

To remove the front cover (the part without the handle) from the main unit, open the latches, take the main unit by the handle and lift it out of the cover.

80.

There are six slide switches.

139.

The amplitude (volume) of signals coming through the input jacks across the middle is controlled by each of the vertical attenuators above them.

196.

The long white octave switch should be straight up.

253.

Move the VCO-2 vertical slider on the VCF panel all the way up.

311.

Tune the VCO-1 and VCO-2 to unison (use initial oscillator frequency).

22.

To remove the front cover from the main unit, open the ___________, take the main unit by the _______ and lift it out of the cover.

81.

There are __________________ slide switches.

140.

The ___________ of signals coming through the input jacks across the middle is controlled by each of the ___________ ___________ above them.

197.

The long white octave switch should be ___________ ____________.

254.

Move the VCO-2 vertical slider on the ______________________ panel all the way __________________.

312.

Move the VCF sliders for VCO-1 and VCO-2 up to the 3rd line.

(22)

Latches, handle.

(81)

Six.

(140)

Amplitude (volume), vertical, attenuators.

(197)

Straight up.

(254)

VCF, up.

GO TO THE NEXT FRAME.

23.

Sit the main unit on a table or desk, but also against a wall so it cannot slide or fall.

82.

Two slide switches are on the first panel.

141.

The functions of the left-right slider controls are indicated separately on the control panel.

198.

The LFO speed, vibrato delay, vibrato depth and portamento should all be down.

255.

Move the two Reverberator sliders up to the fourth line (far right panel).

313.

Move the VCF attenuator all the way up (open).

24.

Sit the main unit on a __________ or __________, but also against a __________ so it cannot slide or fall.

83.

____________ slide switches are on the _____________ panel.

142.

The ____________ of the left-right slider controls are indicated separately on the ____________ ______________.

199.

The LFO speed, vibrato delay, vibrato depth and portamento should all be _______________.

256.

Move the _____________ sliders up to the _____________ line.

314.

Adjust the ADSR Envelope Transient Generator to A-closed, D-open, S-open, R-closed (A & R can be moved up one line for a different attack and release attenuation).

---

(24)

Table, desk, wall.

(83)

Two, first.

(142)

Functions, control, panel.

(199)

Down.

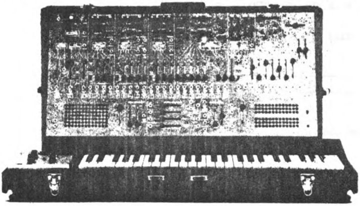
(256)

Reverberator, fourth.

GO TO THE NEXT FRAME.

25.

The keyboard unit has two latches adjacent to the handle. Lay the keyboard unit down in front of the main unit with the handle on the bottom side. Lift off the cover and place it out of your way.



84.

One slide switch is beside the VCO 2 slider marked audio DC.

143.

The knob in the upper left corner is rotary attenuator for signals fed to the microphone preamplifier.

200.

The VCO-1 oscillator generates square and sawtooth waves.

257.

Move the slide switch for the keyboard Gate/Trig up (3rd panel from the right).

315.

Set the Reverberation sliders at one to two lines up.

26.

The keyboard unit has two latches adjacent to the handle. Lay the keyboard unit down in _________ of the main unit with the handle on the ___________ side. Lift off the cover and place it out of your way.

85.

___________ slide switch is beside the VCO_2 slider marked ___________ _____________________.

144.

The knob in the upper left corner is a ________________ _____________ for signals fed to the microphone preamplifier.

201.

The VCO-1 oscillator generates ___________________ and ________________ waves.

258.

Move the slide switch for the keyboard Gate/Trig _________________.

316.

Open the VCF mixer slider.

(26)

Front, bottom.

(85)

One, audio, DC.

(144)

Rotary attenuator.

(201)

Square, sawtooth.

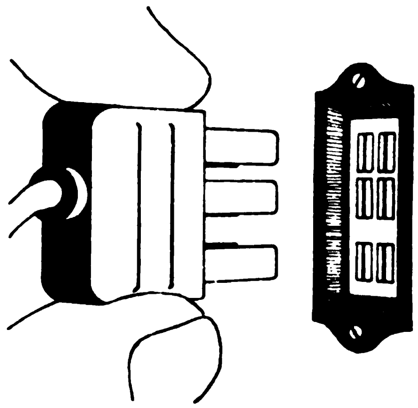
(258)

Up.

GO TO THE NEXT FRAME.

27.

There is a cable connector with six prongs on the left side of the keyboard. Plug it into the socket on the left side of the main unit. This connects the keyboard to the main unit.



86.

The other switch is at the top of the first panel. It is marked range.

145.

The bottom on the 3rd panel from the right is a manual starter for the envelope generators.

202.

To hear the differences in the waves, take a patchcord and put it in the sawtooth output of VCO-1 and the left input speaker mini-jack (far right panel).

259.

Open the VCF slider above the ADSR mini-jack, all the way.

317.

Move the keyboard Gate/Trig switch up and the VCO-1 and VCO-2 audio switches up.

28.

There is a cable connector with six prongs on the left side of the keyboard. Plug it into the socket on the ______________________________ ___________________ of the main unit.

87.

The other switch is at the __________ of the first panel. It is marked ________________.

146.

The __________ on the 3rd panel from the right is a ______________ _______________ for the envelope generators.

203.

Put a patchcord in the sawtooth _______ of VCO-1 and the left ________ speaker mini-jack in order to hear the differences in the waves.

268.

Open the __________ __________ above the ADSR mini-jack all the way.

318.

Play harmony on the keyboard (two voices). If you have any trouble with this patch check the diagrams at the end of the last frame that corresponds to this frame.

---

(28)

Left, side.

(87)

Top, range.

(146)

Button, manual, starter.

(203)

Output, input.

(260)

VCF, slider.

GO TO THE NEXT FRAME.

29.

There is a grounded power cable with three pins that is supplied with the 2600. Plug it into the right side of the main unit and into an electrical source.

88.

There is a slide switch on the VCO-1 (voltage controlled oscillator-1) marked audio.

147.

The keyboard controls the 2600 by generating four voltages.

204.

You will not hear a sound until you patch another cord from the right input to the left output. This connects the two speakers.

261.

Patch a cord from the ADSR mini-jack control input (12th from right) to the Envelope Transient Generator output.

319.

The interval latch jack requires the use of the footswitch.

30.

Plug the three-pinned grounded cable into the ________ side of the main unit and into an ____________ source.

89.

There is a slide switch on the _____________ oscillator marked _____________________.

148.

The keyboard controls the 2600 by generating ______________ voltages.

205.

Patching a cord from the right input to the left output ____________ the two speakers.

262.

Patch a cord from the ADSR mini-jack control ______________ to the _____________ transient generator.

320.

When the footswitch connected to the interval latch jack is depressed, the interval between the two keyboard voices remains constant and the pitches are controlled by the lower voice only.

(30)

Right, electrical.

(89)

VCO-1, audio.

(148)

Four.

(205)

Connects.

(262)

Input, envelope, output.

GO TO THE NEXT FRAME.

31.

There are two basic conceptions involved in electronic sound synthesis.

90.

There is one slide switch each on the VCO-2 (voltage) and VCO-3 (voltage) oscillators. Each slide switch is marked audio.

149.

The four voltages are Gate signal, Trigger signal, lower-voice control voltage, and upper-voice control voltage.

206.

To change the frequency (pitch) of the voltage, move the initial oscillator frequency slider of VCO-1 to the right and left.

263.

With each ADSR attenuator closed (down) move the attack time attenuator to the second line.

321.

Plug the footswitch into the interval latch jack.

32.

There are ______________ basic conceptions involved in electronic sound synthesis.

91.

There is __________________ slide switch _____________________ on the VCO-2 and VCO-3 oscillators. Each slide switch is marked ____________.

150.

The four voltages are ________________ signal, _______________ signal, lower-voice ____________ voltage, and ________________ control voltage.

207.

To change the frequency of the voltage, move the initial oscillator ___________ slider of VCO-1 to the ___________ and _____________.

264.

Press the manual start button. Play the keyboard.

322.

Using the previous patch, try different intervals, 4ths, 5ths, 2nds, 7ths, etc.

(32)

Two.

(91)

VCO-2, VCO-3, audio.

(150)

Gate, Trigger, Control, upper-voice.

(207)

Frequency, right, left.

GO TO THE NEXT FRAME.

GO TO THE NEXT FRAME.

33.

First, any sound that can be heard by the human ear can be generated and modified by purely electronic means.

92.

The last slide switch is above the Sample/Hold Gate (S/H Gate).

151.

The Gate signal tells the keyboard to memorize the note being played.

208.

When the Fine tune slider is moved, the frequency is changed still further. Play a scale on the keyboard.

265.

The keyboard acts as a control to the signal in the same manner as the manual start button.

323.

After the interval has been set, only one note is necessary to produce that interval.

34.

Any sound that can be heard by the ____________ ______________ can be generated and modified by purely ______________ means.

93.

The last slide switch is above the _________________ gate.

152.

The Gate signal tells the keyboard to ______________ the note being played.

209.

When the Fine tune slider is moved, the ______________ is _______________ still further.

266.

Experiment with combinations of the ADSR sliders in different settings after trying each one separately.

325.

The Trigger Mode switch controls how trigger signals are generated when more than one key is being played (left side of keyboard control board).

(34)

Human, ear, electronic.

(93)

Sample/Hold (S/H).

(153)

Memorize.

(209)

Frequency, changed.

GO TO THE NEXT FRAME.

GO TO THE NEXT FRAME.

35.

The sound of a trumpet or bassoon, the hoofbeat of horses can all be produced electronically with the proper equipment.

94.

Mini-jacks are small holes on the front of the synthesizer in which you can put patchcords.

154.

It also tells the envelope generators marked AR and ADSR when a key is being held down.

210.

Take the patchcord out of the sawtooth output of VCO-1 and put it in the square wave output.

267.

The initial oscillator frequency of VCO-2 can also be moved to different positions.

325.

The multiple position allows for the trigger to be fired every time a key is depressed.

36.

The sound of a trumpet or bassoon, the hoofbeat of horses can all be produced ___________ with proper _____________.

95.

Mini-jacks are small _______________ on the front of the synthesizer in which you can put ______________.

154.

It also tells the envelope generators marked AR and ADSR when a _________________ is being held down.

211.

Take the patchcord out of the _____________ output of CVO-1 and put it in the _________ _________ output. (*Check the diagram at the end of this manual that corresponds with this frame is you are having trouble with this patch.)

268.

Push the VCF Resonator attenuator up using the same patch.

326.

In the multiple position, the trigger output fires the ADSR Envelope Generator every time a key is depressed.

(36)

Electronically, equipment.

(95)

Holes, patchcords.

(155)

Key.

(211)

Sawtooth, square wave.

GO TO THE NEXT FRAME.

GO TO THE NEXT FRAME.

37.

This equipment, which is sound-generating and sound-modifying, can be controlled electronically.

96.

There are 34 mini-jacks in a row across the center of the synthesizer.

156.

The Trigger signal indicates the exact instant a key is depressed.

212.

Close the VCO-1 (initial oscillator frequency) slider (2nd panel from the left) and the VCO-1 slider on the VCF (voltage control filter) panel (4th panel from the right).

269.

Move the resonance slider from MIN to MAX (back and forth).

327.

In the single position, a trigger signal is produced for the first depressed key only.

38.

This equipment which is ____________ and _________________ can be ____________________ electronically.

97.

There are ______________ mini-jacks in a row across the _________ of the synthesizer.

156.

The Trigger signal indicates the exact instant a ________________ is ______________________.

NO RESPONSE REQUIRED. GO TO THE NEXT FRAME.

270.

Move the initial filter frequency to 10 kHz.

GO TO THE NEXT FRAME.

(38)

Sound-generating, sound-modifying, controlled.

(97)

34, center.

(57)

Key, depressed.

GO TO THE NEXT FRAME.

GO TO THE NEXT FRAME.

GO TO THE NEXT FRAME.

39.

A synthesizer imitates, invents, mixes, shapes, and produces sound waves upon the instructions given it by the user.

98.

An output takes a signal or a waveform from some source.

158.

The lower-voice and upper-voice control voltages allow for two notes to be played simultaneously.

213.

Push the VCO-2 slider up to the 3rd line on the voltage control filter panel.

271.

Play the keyboard.

328.

The noise Generator generates aperiodic waveforms.

40.

A __________ imitates, invents, mixes, shapes, and produces __________ __________ upon the instructions given it by the user.

99.

An output takes a signal or a waveform __________ some source.

157.

The lower-voice and upper-voice control voltages allow for __________ notes to be played __________.

214.

Push the VCO-2 slider __________ to the 3rd line on the __________ __________ filter panel.

272.

Move the initial oscillator frequency of the voltage controlled filter/resonator to 10 (all the way to the left).

329.

The __________ __________ generates aperiodic waveforms.

(40)

Synthesizer, sound waves (wave forms).

(99)

From.

(158)

Two, simultaneously.

(214)

Up, voltage control.

GO TO THE NEXT FRAME.

(329)

Noise Generator.

41.

When someone speaks, sings or plays an instrument, air waves are generated. These air waves transmit the sound to the ear.

100.

An input takes a signal or waveform to some source.

159.

The first step in the path of the sound source from the Arp 2600 is the voltage controlled oscillator (VCO).

215.

Slide the initial oscillator frequency and the Fine tune slider on the VCO-2 to the left and right.

273.

Pull the Transpose Two Octave Switch down (long white switch) on the keyboard control panel.

330.

Open the initial filter frequency slider on the VCF (4th panel from the right) to halfway between 1 kHz and 10 kHz.

42.

When someone speaks, sings or plays an instrument, __________ __________ are generated. These air waves transmit the __________ to the __________.

101.

An input takes a signal or a waveform __________ some source.

160.

The first step in the path of the sound source from the Arp 2600 is the __________ __________ __________.

216.

Slide the initial oscillator frequency and the Fine tune slider on the VCO-2 to the __________ and __________.

274.

Start at the bottom of the keyboard and play up chromatically. ADSR setting should be A-3rd or 4th line, D-2nd line, S-2nd line, and R-all the way down.

331.

Push the Fine tune slider to the middle and keep the Resonance slider on MIN.

---

(42)

Air, waves, sound, ear.

(101)

To.

(160)

Voltage controlled oscillator.

(216)

Left and right.

GO TO THE NEXT FRAME.

GO TO THE NEXT FRAME.

43.

The sound waves can be picked up by a microphone and converted into electrical signals.

102.

The two mini-jacks labelled "gate" and "trig" are outputs.

161.

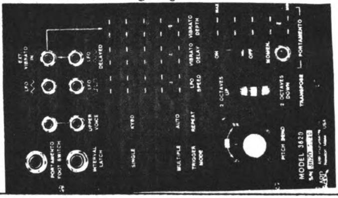
The second step is the voltage controlled filter (VCF).

217.

Increase and decrease the width of pulse wave by moving the width of pulse slider from left to right.

275.

The control panel on the keyboard consists of a knob, four switches, three slider controls and eight jacks.



332.

Open the noise generator slider (on the VCF panel) all the way. (Above the 14th jack from the right.)

44.

The ______________ ______________ can be picked up by a microphone and ___________________ into electrical signals.

103.

The two mini-jacks labelled ____________ and ____________ are __________________.

162.

The second step is the ____________ ____________ ____________.

218.

______________ and _____________ the width of pulse wave by moving the width of pulse slider from left to right.

276.

The ____________ ____________ on the keyboard consists of a knob, four switches, three slider controls and eight jacks.

333.

Move back to the noise generator under VCO-2 and push the slider marked MAX and MIN all the way up.

(44)

Sound, waves, converted.

(103)

Gate, trig, outputs.

(162)

Voltage controlled filter.

(218)

Increase, decrease.

(276)

Control panel.

GO TO THE NEXT FRAME.

45.

The electrical signal for each individual sound has a particular shape which can be seen on a device equipped with a screen called an oscilloscope.

104.

The 32 remaining mini-jacks across the center of the synthesizer are inputs.

163.

The third step is the mixer.

219.

The second oscillator (VCO-2) generates sine, sawtooth, triangle, and variable width pulse waves at four independent outputs.

277.

The knob is the pitch bend control.

334.

Attenuate the slider next to it from low frequency to pink noise to white noise.

46.

The ____________ ____________ for each individual sound has a particular ____________ which can be seen on a device equipped with a screen called an _______________.

105.

The __________________ remaining ______________ across the center of the synthesizer are ___________________.

164.

The third step is the __________________.

220.

The second oscillator (VCO-2) generates sine, sawtooth, triangle, and variable width pulse waves at _______________ different _______________.

278.

The knob is the _______________ _______________ control.

335.

As you move up, the low frequencies of this aperiodic wave are filtered out.

(46)

Electrical, signal, shape, oscilloscope.

(105)

32, mini-jacks, inputs.

(164)

Mixer.

(220)

Four, outputs.

(278)

Pitch Bend.

GO TO THE NEXT FRAME.

47.

The shape of each signal is called its waveshape or waveform.

106.

There are four input jacks above this row.

165.

The fourth step is the panpot (distributes the signal equally or unequally on the left and right speaker).

221.

Listen to the differences in each waveform by patching a cord from the waveform source to the speakers.

279.

It bends notes up to one octave sharp or flat.

336.

The noise generator can also be used in conjunction with other waveforms.

48.

The shape of each ______________ is called its ______________

or ___ ___________.

107.

There are __________________ in put jacks above this row.

166.

The fourth step is the _______________.

NO RESPONSE REQUIRED. GO TO THE NEXT FRAME.

280.

It bends notes up to one octave _______________ or _______________.

337.

Patch a cord from the NG (noise generator) output to the noise generator pulse width modulation jack directly above it (VCO-2 panel).

(48)

Signal, waveshape, waveform.

(107)

Four.

(166)

Panpot.

GO TO THE NEXT FRAME.

(280)

Sharp, flat.

GO TO THE NEXT FRAME.

49.

A clarinet sound, a flute sound, a trombone sound are all different. Each of these instruments would produce waveforms with different shapes if viewed on an oscilloscope.

108.

One of the input jacks is the input to the microphone preamp in the upper left corner.

167.

The fifth step is the signal going out to the speakers.

222.

The third oscillator (VCO-3) generates sawtooth and pulse waves at two independent outputs.

281.

Portamento permits the gliding from one note to the next.

338.

Patch another cord from the pulse width modulation (PWM) output to the left mixer input (top right corner).

50.

A clarinet, flute, or trombone would produce ________________ with different ______________ if viewed on an __________________.

109.

One of the input jacks is the input to the ____________________ ___________________ in the upper left corner.

168.

The fifth step is the _____________________ going _______________ to the speakers.

223.

The third oscillator (VCO-3) generates ____________________ and _________________ waves at _____________ independent outputs.

282.

____________________ permits the gliding from one note to the next.

339.

Patch another cord from the right input to the left output in order to connect both speakers.

(50)

Waveforms, shapes, oscilloscope.

(109)

Microphone preamp.

(168)

Signal, out.

(223)

Sawtooth, pulse, two.

(282)

Portamento.

GO TO THE NEXT FRAME.

51.

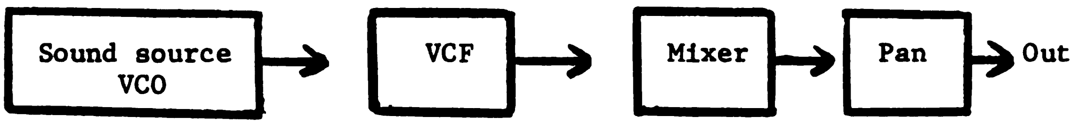
Waveforms come under two classifications. They are periodic and aperiodic.

110.

The microphone preamp will accept microphone signals and signals from other electric instruments through its input jack.

169.

In a diagram it would look like this.



224.

The pitch can be controlled by the initial oscillator frequency slider, Fine tune slider, or the keyboard.

283.

The sliding control determines the speed of the glide.

340.

Work the initial oscillator frequency slider and the pulse width slider on VCO-2. Play the keyboard.

(52)

Periodic or (Aperiodic) and Aperiodic or (Periodic).

(111)

Microphone, signals, electric.

GO TO THE NEXT FRAME.

(225)

Pitch, controlled, keyboard.

(284)

Sliding, speed.

GO TO THE NEXT FRAME.

53.

Periodic waveforms are ones that are produced by most musical instruments.

112.

There are three input jacks in the upper right hand corner.

170.

In order to get a sound from the voltage control oscillator-1 (VCO-1), all input attenuators and output level controls should be in their off position.

226.

Listen to any of these waves independently by patching a cord from the output to the speaker input (far right panel).

285.

The Repeat switch has three positions: Auto (bottom), Off (middle), and KYBD (top).

342.

In experimenting with the Arp 2600 some basic rules to follow are: 1) Generally signal paths are from left to right and control paths (control of a signal, for example, with an Envelope Generator) are from bottom up.

54.

Periodic waveforms are ones that are produced by most

_______________ _______________.

113.

There are ___________ input jacks in the upper right hand corner.

171.

In order to get a sound from the voltage control oscillator-1, all input attenuators and output level controls should be in their ____________ position.

227.

When patchcords are not used, the two speakers are prewired and automatically connected. However, a stronger signal can be obtained with the use of patchcords.

286.

The Repeat Switch has three positions: ______________, ______________, and ______________.

343.

2) When using two voices on the keyboard, with some filter settings, the upper voice will not sound as loud as the lower voice. A patchcord connecting the upper voice output jack to the VCF CV input jack can alleviate this problem.

---

(54)

Musical instruments.

(113)

Three.

(171)

Off.

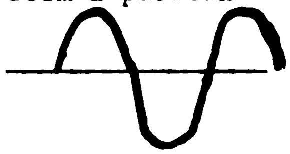
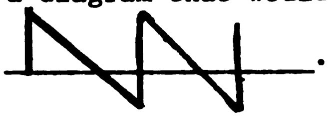
GO TO THE NEXT FRAME.

(286)

Auto, off, KYBD.

GO TO THE NEXT FRAME.

55.

If seen on an oscilloscope, periodic waveforms would form a pattern or a diagram that would repeat itself. For example,  or .

114.

They are labelled Left Input, Pan, and Right Input.

172.

This is down for vertical sliders and left for horizontal sliders.

228.

A low-pass filter changes the timbre of a signal by reducing the high frequency portion of that signal as it passes through it.

287.

The Repeat Switch is used to create repetitive attacks on notes.

344.

3) To connect the two speakers with a patchcord disconnecting the prewired connection, patch from the source output to the speaker left input. Use another patchcord to patch from the right input back across to the left output. (The entire process can also be reversed.) This will connect the two speakers and allow for stronger signals when more than one signal is used simultaneously.

56.

If seen on an oscilloscope, periodic waveforms would form a pattern that would __________ _____________.

115.

They are labelled _________ _________, _________, and _________ ______________ ______________.

173.

This is __________ for vertical sliders and _______________ for horizontal sliders.

229.

A low-pass filter changes the timbre of a signal by _____________ the _________ _________ portion of that signal as it passes through it.

288.

The Repeat Switch is used to create ______________ ________________ on notes.

345.

All patchcords should be handled by the plug end, not by the cord part.

(56)

Repeat, itself.

(115)

Left Input, Pan, Right Input.

(173)

Down, left.

(229)

Reducing, high, frequency.

(288)

Repetitive attacks.

GO TO THE NEXT FRAME.

57.

Snare drums, thunder, and the wind produce aperiodic waveforms.

116.

All other mini-jacks in the upper half of the control surface are outputs.

174.

Push all range switches, beside the row of vertical sliders, to audio position.

230.

The voltage controlled Filter/Resonator (VCF) is a low-pass filter with variable cutoff frequency and resonance.

289.

In the Auto (down) position, the last note depressed will be repeated indefinitely until a new note is played, causing continuous striking of the new note.

346.

You have now completed this program. It is hoped that the understanding of the basic functions underlying the Arp 2600 Portable Electronic Synthesizer which you have acquired in the course of completing this program will lead to a desire, upon your part, for a broader and deeper knowledge of the subject.

58.

Snare drums, thunder, and the wind produce ________________

____________________.

117.

All other mini-jacks in the ____________ ______________ of the control surface are ________________.

175.

Push all range switches, beside the row of vertical sliders, to ________________ position.

231.

The voltage controlled Filter/Resonator is a __________________ filter with ___________ ____________ frequency and resonance.

290.

In the __________ position, the last note depressed will be repeated indefinitely until a __________ note is played.

347.

This program covers only the basic functions of the Arp 2600's panel. No attempt was made to cover functions of the Internal clock and the Sample/Hold circuit for it was deemed that these functions were beyond the basic level for which this method was intended. Following the last frame, you will find five diagrammed patches with which to experiment.

59.

Aperiodic, waveforms.

RETURN TO PAGE 1 AND BEGIN WITH FRAME 60 OF BAND 2.

(117)

Upper half, outputs.

RETURN TO PAGE 1 AND BEGIN WITH FRAME 118 OF BAND 3.

(175)

Audio.

RETURN TO PAGE 1 AND BEGIN WITH FRAME 176 OF BAND 4.

(232)

Low-pass, variable, cutoff.

RETURN TO PAGE 1 AND BEGIN WITH FRAME 233 OF BAND 5.

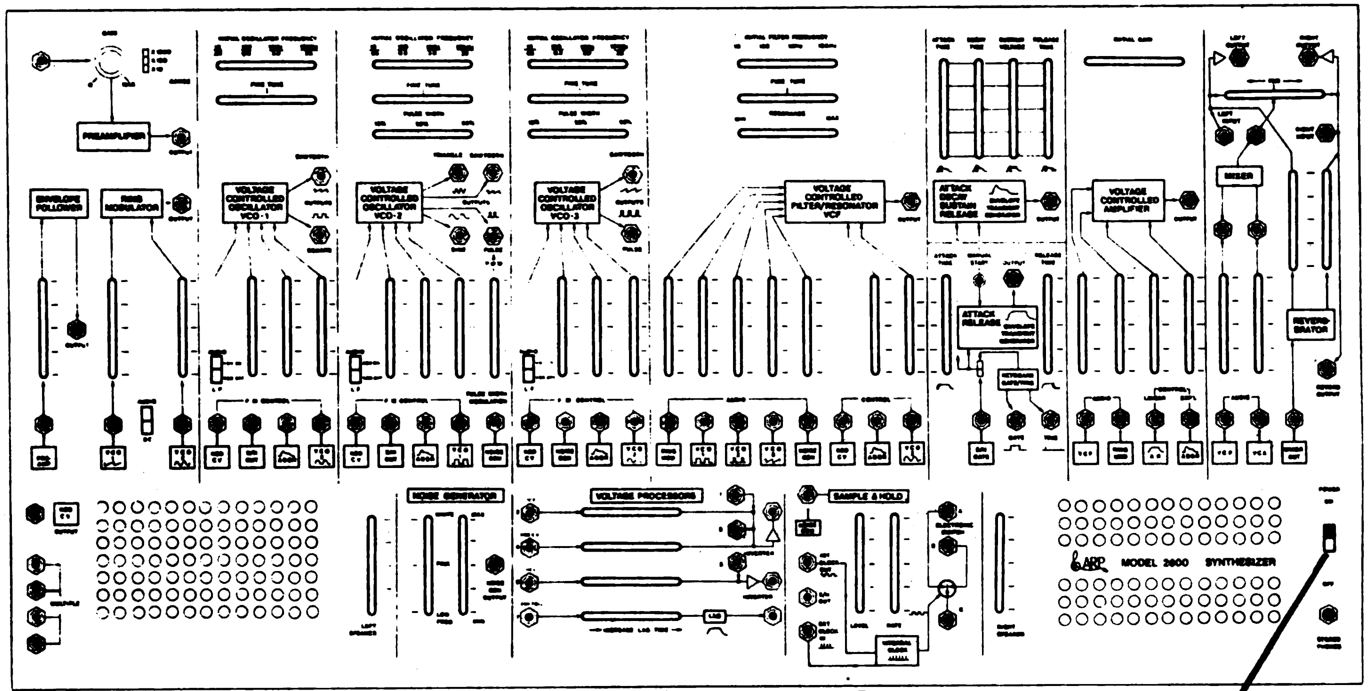
(290)

Auto, new.

RETURN TO PAGE 1 AND BEGIN WITH FRAME 291 OF BAND 6.

(347)

THE END

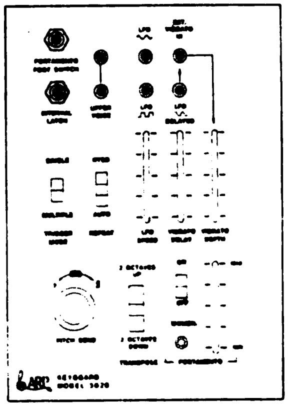


2600 FRONT PANEL FACSIMILE

POWER SWITCH

PATCH TITLE: FRAME 68

NOTES:



3620 KEYBOARD CONTROL FACSIMILE

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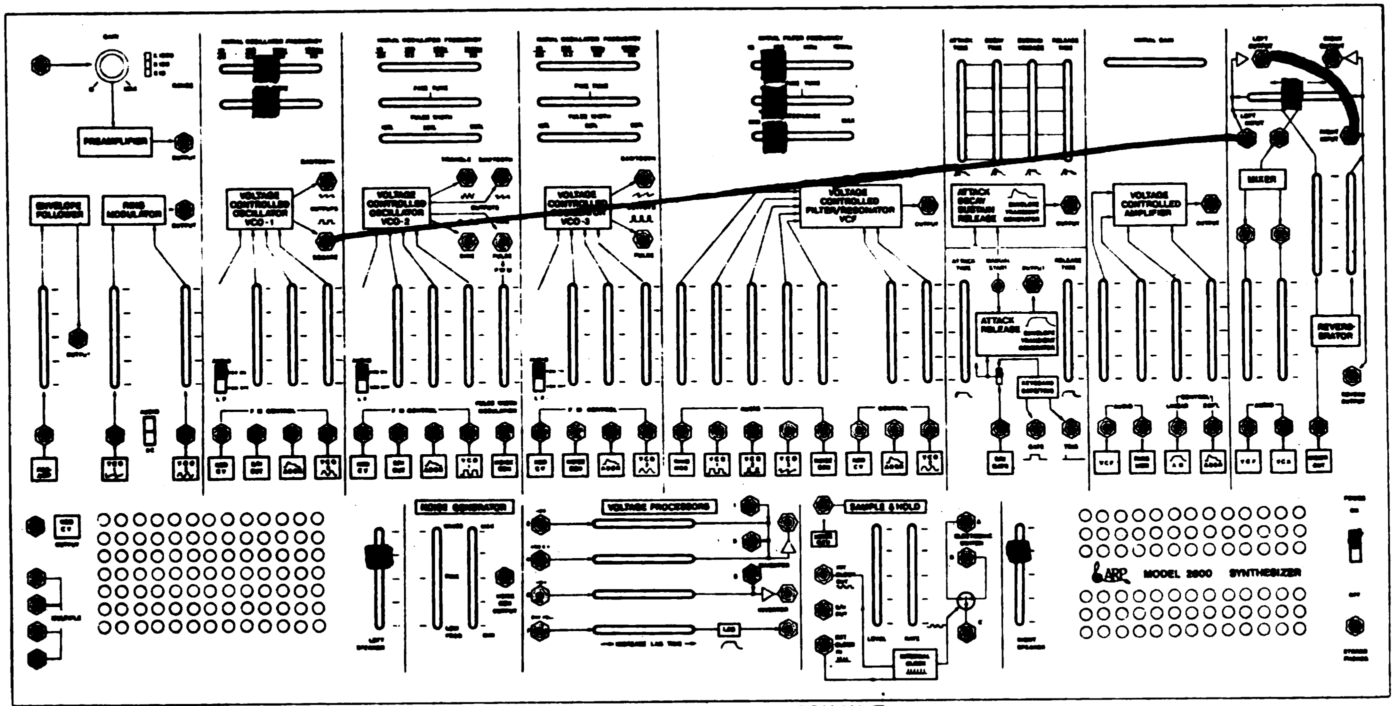
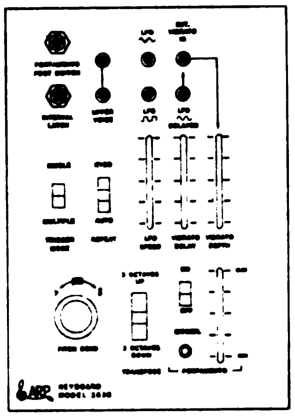


2600 FRONT PANEL FACSIMILE



3620 KEYBOARD CONTROL FACSIMILE

PATCH TITLE: FRAME 211

NOTES:

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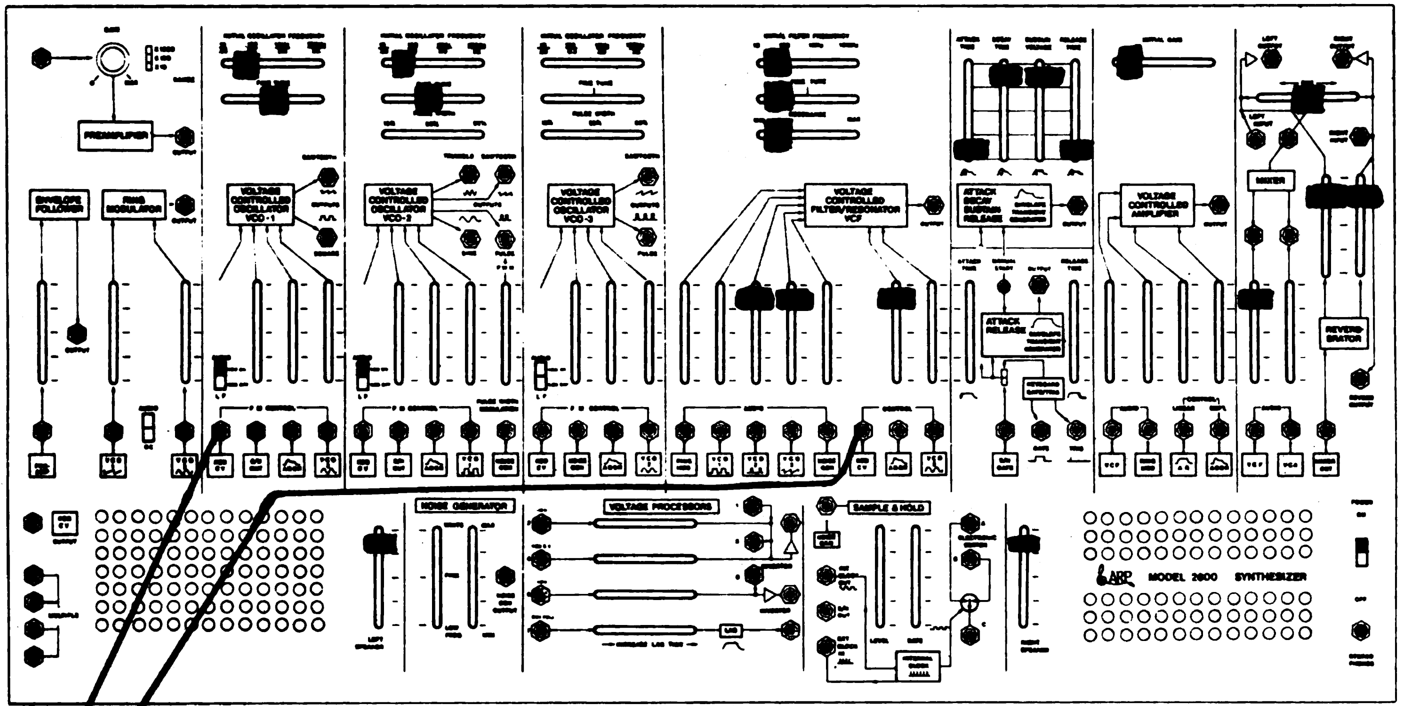
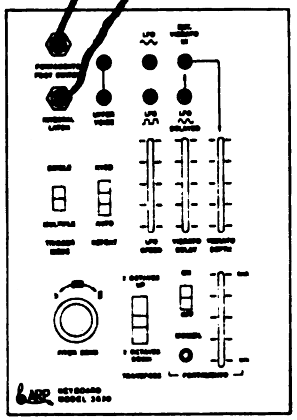


2600 FRONT PANEL FACSIMILE



3620 KEYBOARD CONTROL FACSIMILE

PATCH TITLE: FRAME 318 TWO-VOICE PATCH

NOTES: TUNE VCO-1 & VCO-2 OSCILLATORS TO UNISON

ANOTHER EFFECT CAN BE OBTAINED BY MOVING THE PORTAMENTO

SLIDES BETWEEN THE SECOND AND THIRD LINE.

ARP 2600 & 3620 KEYBOARD FACSIMILE PAD

25 sheets