INTRODUCTION

This book is written for those who ore interested in learning how to use a sequencer but who have little or no background in this subject. It is important for you to understand that sequencing skills ore not dependent upon keyboard performance skills. Sequencing is not just for performers; many non-performing composers and arrangers ore using sequencers to create dynamic, musical sequences. Musicianship, not performance skills, is the main requirement for creating expressive musical sequences.

Rapid advances in electronic technology have profoundly changed the way that music is composed, performed, recorded, and taught. Musicians at every artistic level, from professionals to hobbyists, have already incorporated some aspect of technology into their music making. Many musicians, however, have not yet begun to take advantage of the creative power offered by MIDI sequencers.

The development of the sequencer has affected almost every aspect of contemporary music. This is somewhat ironic, because a sequencer itself does not produce any sound. The leap from typewriter to word processor has changed the way we work with the printed word. The enormous leap from tape recorder to sequencer (a music processor) has dramatically changed the way we work with sound. If you plan to compose, arrange, record or edit music, a sequencer is an indispensable tool. This book will help you to understand how to use a sequencer to enhance your music.

ACKNOWLEDGEMENTS

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Chapter One

Sequencer Basics

Before we can define the term sequencer, we must first have a basic understanding of MIDI — an acronym for Musical Instrument Digital Interface. The phrase "musical instrument" is self explanatory; "digital" pertains to numbers, and "interface" can be defined as a connection which allows two or more devices to communicate with each other. Therefore, MIDI can be described as a digital communication system which MIDI-equipped instruments and equipment use to communicate with each other.

Every MIDI-equipped instrument contains MIDI ports (connector jacks) and a MIDI processor which converts musical data into digital information, the common language for all MIDI instruments and equipment. See Figure 1.

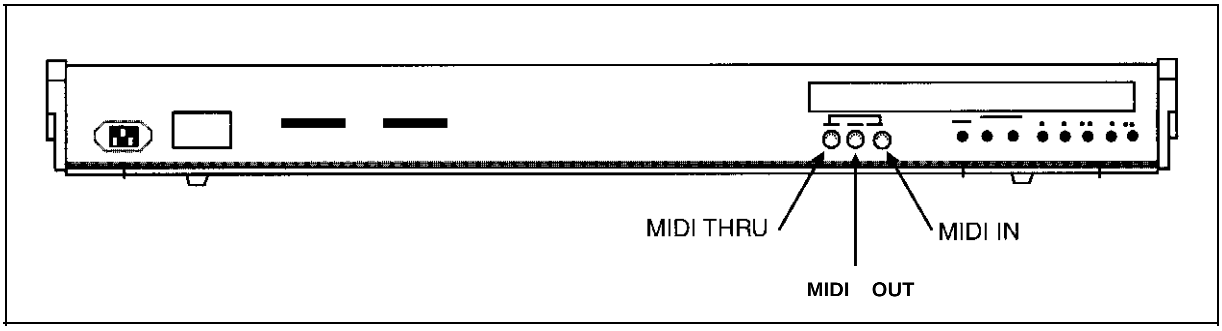


Figure 1

MIDI cables are used to connect the MIDI ports on electronic instruments and equipment to other MIDI ports or electronic instruments and equipment. In this way, MIDI instruments and equipment can communicate with each other.

It is important to understand that MIDI cannot transmit sound; audio signals do not travel through MIDI cables. MIDI cables transmit musical performance information in a digital format. Performance information is generated by a performer's physical movements on a musical instrument. For example, a performer playing an electronic keyboard physically generates performance information that describes various components of the sound , pitch, tone quality, loudness, and duration. The description of these musical components is transmitted by physical movements, such as the speed with which each key was struck, the length of time the keys were held, the use of volume pedals, and the use of sustain switches. The MIDI processor inside the keyboard instantaneously converts these physical movements into performance information which can be stored in memory or sent to other MIDI-equipped instruments and devices such as sequencers.

WHAT CAN SEQUENCERS *DO?*

It might be easier to understand how this process works if you understand a basic difference between a tape recorder and a sequencer. A tape recorder records only the finished product: sound. A sequencer records everything that goes into making the sound but not the sound itself. In other words, the sequencer records the performance information and then on playback "tells" a MIDI-equipped instrument what to do to reproduce the sound.

WHAT CAN YOU DO WITH RECORDED PERFORMANCE INFORMATION?

Sequencers make it possible to **edit** any aspect of performance information. For example, most sequencers allow us to correct wrong notes, to increase or decrease a song's tempo, to play a song back in a different key, and more. A sequencer also makes it possible to save or to **store** edited performance information, usually on a computer disk. This storage capability allows us to recall the data and **play back** any song at a later time without having to re-record the music. A sequencer, therefore, is a device that can record, edit, store, and play back digital data which represent a musical performance. [Note: some sequencers also have the capability of recording acoustic sounds as well as MIDI data. Audio recording capabilities will be discussed later in this book.)

SEQUENCERS vs. TAPE RECORDERS

Sequencers share a few similarities with tape recorders. Both use controls such as PLAY, RECORD, STOP, PAUSE, REWIND and FAST FORWARD. Both store information on media: a tape recorder uses magnetic tape, and a sequencer uses either computer memory or a computer disk , usually the hard drive in a computer. But that's just about where the similarity ends. Sequencers have many advantages over tape recorders, which make it possible to create and to edit music in ways which are difficult, if not impossible, when using tape recorders.

First, sequencers offer independent tempo/key variables. Increasing or decreasing the playback speed of a tape recording will change both the pitch and the tempo. Sequencers, however, can play back a song in any key without a change in tempo. They can also play back a song over a wide range of tempos without changing the key.

Second, sequencers offer easier recording techniques. A musician using a tape recorder is limited by his or her performance ability. A musician using a sequencer, however, can record a musical part at a very slow tempo, then play back the part at a faster tempo without changing the sound's pitch or timbre. Many sequencers allow the user to type in notes and performance data instead of playing the parts on a keyboard. This feature is especially useful for those who do not have strong keyboard skills.

Finally, sequencers have extensive editing capabilities which far surpass anything that is possible with tape. With a sequencer it is possible to change the pitch, starting time, duration, volume level, or tone quality of any note.

SEQUENCER APPLICATIONS

If you like to **perform** music, you can use a sequencer to create minus-one recordings for practice or for performance. The sequencer enables you to play back your song in any key and at any tempo. If you like to **compose** music, you can use the sequencer to record instrumental parts one at a time to create an electronically produced rendition of the score. In addition, you can experiment with different tone colors by changing the sounds used for each instrumental part. If you like to **listen** to music, you can use the sequencer like a CD player and play back pre-recorded music which is available from music publishers as **Standard MIDI Files** (SMFs) (The Standard MIDI File format is an industry standard format for saving sequence data.) Additional SMFs are also available from the Internet.

NPFS OF SEQUENCERS

There are three types of sequencers: a **hardware sequencer**, a **software sequencer**, and an **integrated sequencer.** A hardware sequencer is a discrete component which, in some cases, contains internal sound generating capabilities. Hardware sequencers include features such as built-in MIDI ports and an internal disk drive for storing data. See Figures ***2A*** and 26.

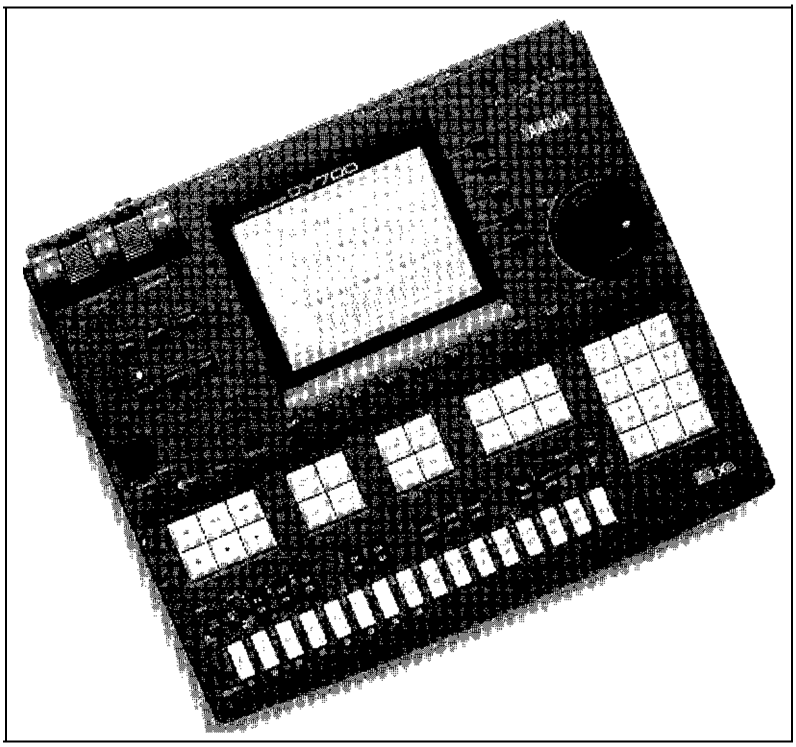


Figure 2A

The Yamaha QY700 is an example of a hardware sequencer which contains a built-in sound generator.

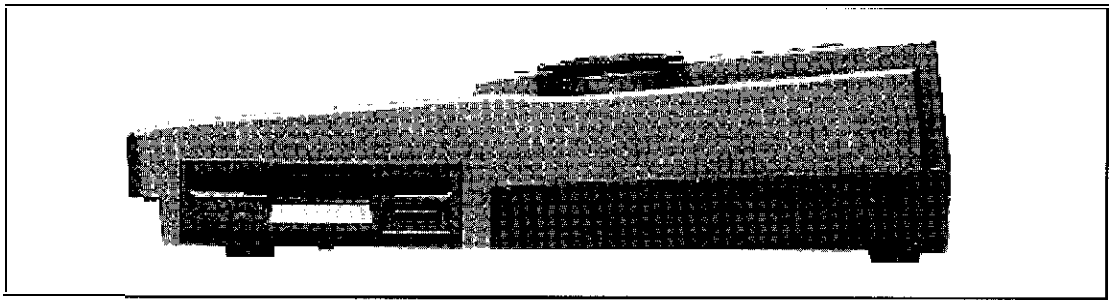


Figure 2B

Song data on the QY700 is stored by using the built-in disk drive.

Software sequencers are computer programs which enable a computer to function as a sequencer. The term "software" can be defined as digital data which instruct computers how to perform a particular function. At the present time there are dozens of software sequencer programs available for computers. Software sequencers usually consist of at least one disk and on owner's manual. Since most computers are not currently manufactured with built-in MIDI ports, software sequencers require the use of a MIDI **computer interface.** An interface, you may recall, is a connecting device that allows two or more instruments or devices to communicate with each other. A MIDI computer interface, then, is a device which allows synthesizers and other

MIDI-equipped instruments to communicate with a computer. A MIDI computer interface usually is an add-on component which takes the form of a small box. A computer is usually connected [through an interface) to a synthesizer by two MIDI cables; one to send information and one to receive information. A third cable connects the MIDI interface to the computer. See Figure 3.

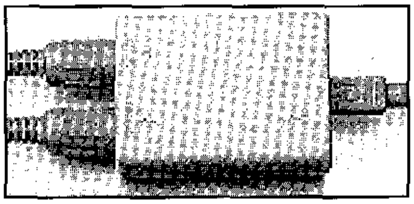


Figure 3
A standard MIDI computer interface with MIDI cables
The cable on the right connects to the computer.

In Figure 4 we see a typical setup consisting of one MIDI keyboard, a MIDI interface, and a computer.

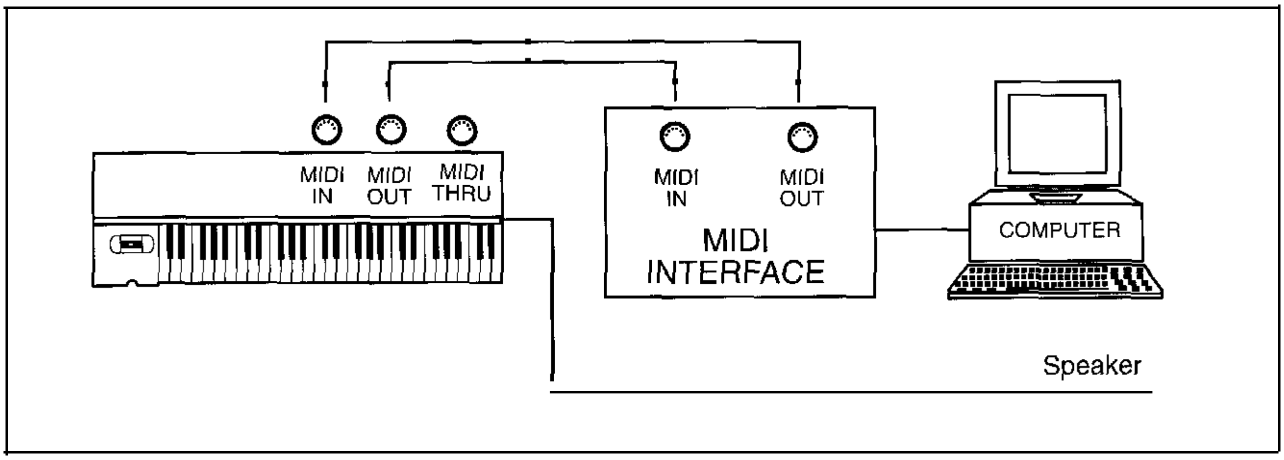


Figure *4*
The most common MIDI setup: a MIDI keyboard, a MIDI interface, and a computer.

In Figure 4 there are three cable connections on the MIDI keyboard: MIDI IN, MIDI OUT, and audio out. Remember, MIDI cables transmit performance information about sound, not the sound itself. In order for you to hear the keyboard, you must connect the keyboard's audio output to headphones or to a speaker. (If your keyboard has stereo outputs, use both audio outputs. The sound of any sequence can usually be improved by creating a stereo mix.)

Note: Figure 4 shows the most common way of connecting a MIDI keyboard to a computer. ***There*** are two other ways to do this: a direct keyboard/computer connection, and sound card connection. A *few* electronic instruments have a built-in *direct* keyboard/computer connection *(sometimes called a personal computer interface). This connection is identical to a standard* **MIDI** IN/OUT connection; *however,* it allows you to bypass an external MIDI computer interface and to connect the keyboard directly into the computer. The *connection to a* Macintosh is through either the modem or printer port. The connection to an IBM compatible is through a *serial* port.

If you own an IBM compatible computer, you can sometimes use the computer's internal sound card as a M/D/ interface. *Many sound* cards can send and receive MIDI data through the card's joystick port. Using the soundcard as a MIDI interface requires a special adapter cable which has a joystick connector on one end and MIDI IN and MIDI OUT ports on the other end.

Integrated sequencers are sequencers which are built into electronic musical instruments such as synthesizers, digital pianos, and drum machines. Many of today's electronic instruments contain powerful integrated sequencers. See Figure 5.

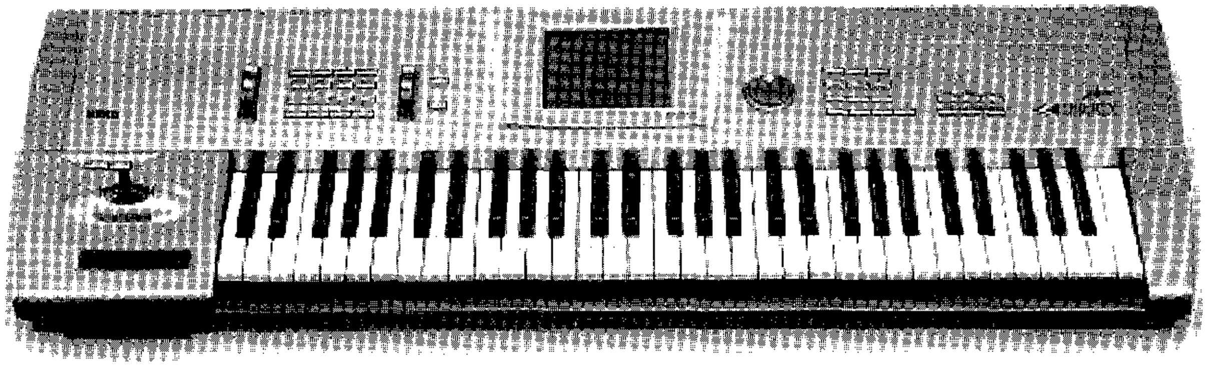


Figure 5

The Korg Trinity contains a powerful integrated sequencer which can store up to 80,000 notes. Other popular instruments with integrated sequencers ore manufactured by companies such as Ensoniq, Kurzweil Roland, and Yamaha.

WHICH TYPE OF SEQUENCER IS BEST: HARDWARE, SOFTWARE OR INTEGRATED?

There is no such thing as the "best" type of sequencer. Each of the three types has advantages and disadvantages. For example, the advantages of the **hardware sequencer** are portability and price (when compared to the price of a computer, MIDI interface, and software). If the hardware sequencer doesn't contain an internal sound generator, however, you will still have to purchase and carry a MIDI keyboard or an expander module (a synthesizer without a keyboard). Another drawback of a hardware sequencer is the small screen size compared to a typical computer monitor.

The **software sequencer** format is the least expensive way to go if you already own a computer, a MIDI keyboard, and a MIDI interface. Software sequencers range in price from approximately US $19.00 to US $500.00. In addition, software sequencers offer the greatest variety of features. Some sequencer pro grams will print musical scores from your recordings. Others will also allow you to record vocals and acoustic instruments with your MIDI data. Software sequencers take advantage of your computer monitor and include large, graphic screen displays which use color to help identify various recording and editing functions. If you don't own a computer, however, you will have to make a considerable investment to get up and running. If portability is important, you will probably want to invest in a laptop computer.

The **integrated sequencer's** main advantage over hardware sequencers and software sequencers is portability. Everything you need to record, play back, and play along with your music is in one piece. Plug in the keyboard, connect it to speakers and you are ready to go. like the hardware sequencer, however, the integrated sequencer suffers from a relatively small viewing area.

In short, if portability is not an issue and you want to be able to print musical scores and record acoustic sounds with your MIDI data, the software sequencer is the way to go, If portability is important, you can choose one of the following options: 1) a laptop computer and a software sequencer; 2) a keyboard with an integrated sequencer; or 3) a hardware sequencer and a keyboard.

HOW A SEQUENCER WORKS

Figure 6 shows how a sequencer's recording and playback functions work. For the purpose of clarity, Figure 6 displays a hardware sequencer with built-in MIDI ports. One MIDI cable (the dotted line) connects the MIDI OUT port of the synthesizer to the MIDI IN port on the sequencer. This connection enables the sequencer to record MIDI data generated by the synthesizer. The second MIDI cable (the solid line) connects the MIDI OUT port of the sequencer to the MIDI IN port on the synthesizer. This connection enables the synthesizer to produce sound from the MIDI data it receives from the sequencer.

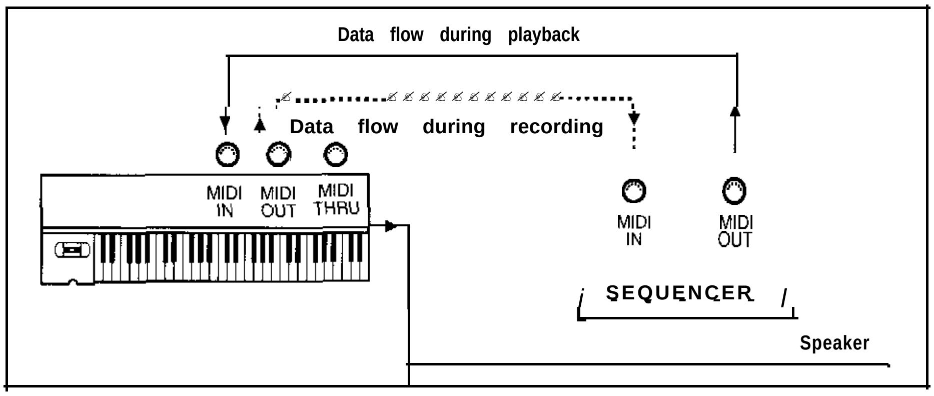


Figure 6
In this diagram the dotted line shows the flow of MIDI data during recording. The solid line shows the MIDI data flow during playback.

Figure 7 depicts a typical MIDI setup consisting of one MIDI keyboard, a MIDI interface, and a computer. Let's examine the recording and playback functions in detail.

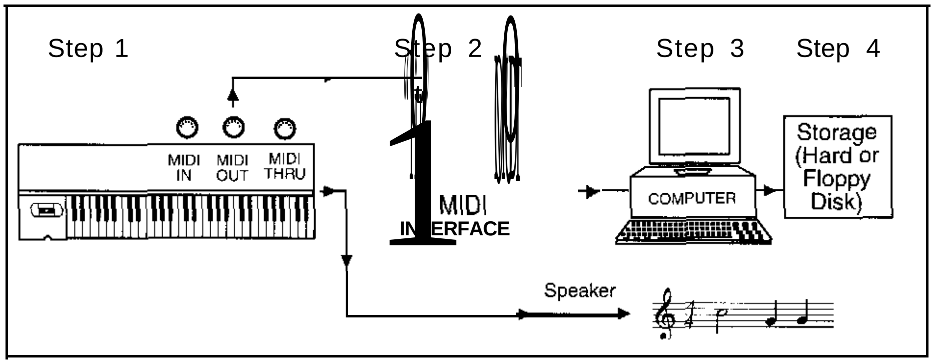


Figure 7
A closer look at the MIDI data flow during the recording process

Here's what happens in Figure 7

step 1 The music performed on the keyboard is converted to MIDI data by the MIDI processor inside the synthesizer. In other words, the MIDI processor converts every aspect of the performance into digital data.

Step 2 The MIDI data from the synthesizer travel through a MIDI cable into the MIDI computer interface.

step 3 The computer interface sends data into the computer memory.

step 4 The data are stored permanently on a hard disk or a floppy disk, In Figure 8 you can see how the sequencer plays back the musical performance.

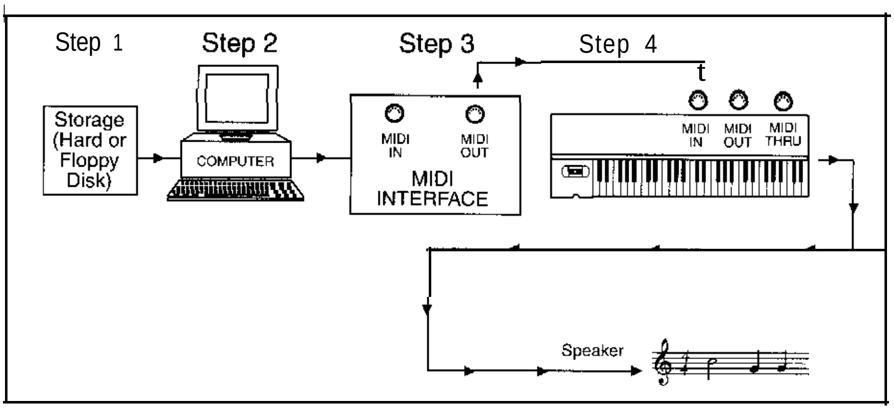


Figure 8
A closer look at the MIDI data flow during playback.

Step 1 The data stored on a hard disk or a floppy disk are loaded into the computer memory.

Step 2 The computer reads the data and sends the data out to the MIDI computer interface.

Step 3 The data travel through the computer interface and into the MIDI IN port of the synthesizer.

Step 4 The MIDI processor inside the synthesizer executes the performance information and the synthesizer reproduces the original performance.

WHAT NPES OF DATA DOES A SEQUENCER RECORD *AND PLAY BACK?*

The digital data traveling through MIDI cables represent messages or commands that are expressed by a series of zeros and ones. These zeros and ones can represent many different types of information, depending upon the specific instruments and devices used in a MIDI setup. This book will focus on MIDI **channel voice messages** — the type of information most useful for sequencing. MIDI channel voice messages can include the following information:

- **Note-On** - This message signals the beginning of a note. Whenever you press a key on the keyboard, a note-on message sends out digital information that translates into a “Start playing NOW!” command. The note-on message also includes information indicating how quickly a key is struck. This information is called the **velocity level,** which is often used to control the loudness and brightness of a note.

- **Note-Off** - This message signals the end of a note. Whenever you release a key on the keyboard, a note-off message sends out a “Stop playing NOW!” command. Most sequencers display note-off messages by listing the duration time for each note-on message.

- **Program Change** The word **program** is used to describe a preset sound in an instrument’s memory. A preset sound contains specific information about pitch, loudness, tone quality, and other properties of sound. For example, Program 1 might be a piano sound, Program 2 might be a guitar sound, and so on. A program change message signals a program change on your instrument. For example, when you push a button to select Program 3 on your instrument, a program change message sends out a “Go to Program 3 NOW!” command.

- **Pitch Bend** -The pitch bend change message sends information about the pitch bend controller. Whenever you move the pitch bender on your instrument, the pitch bend change message sends out a stream of digital information that represents the physical movement of the pitch bender.

- **Aftertouch** Aftertouch information is generated on many electronic keyboards by applying additional pressure to a key after it is depressed. As the key is pressed harder and harder, more and more information is transmitted. This information is commonly used to increase the brightness of a sound or to increase the amount of vibrato.

- **Control Change** The control change message sends information about a setting for a controller. Controllers include devices such as volume pedals and sustain switches.

Note on, note off, program change, pitch bend, aftertouch, and control change-These are the messages used most often with sequencers. The ways in which these messages are generated, recorded, and edited will determine the musicality of your sequences.

Not all MIDI equipped instruments can transmit or receive all of these messages, however. For example, most MIDI-equipped digital pianos do not use pitch bend controllers or generate aftertouch data. The more messages that an instrument can transmit and receive, the greater the expressive capobilities of the instrument.

SEQUENCER TRACKS AND MIDI CHANNELS

The multi-track capability of sequencers makes it possible to build multi-layered musical arrangements by recording individual musical parts one at a time. let's suppose that on Track 1 of the sequencer you want to record an electric piano part. On Track 2 you want to add a bass part. On Track 3, you want to add a drum part. In order to record these three parts however, each track must be set to a separate MIDI channel. MIDI channels can be thought of as electronic pipelines that enable sequencer tracks to access synthesizer sounds. MIDI data can be transmitted and received on 16 separate channels numbered from 1 through 16. This means that it's possible to hear up to 16 different timbres (instrumental sounds) using only one synthesizer. Because each track is assigned to a separate MIDI channel, parameters such as the program number, volume level and stereo placement can be adjusted individually.

If you look at Figure 9, you can see a column labeled "Chart" for MIDI "channel." Channel 1 is assigned to Track 1, Channel 2 is assigned to Track 2, and Channel 3 is assigned to Track 3. In practice, any three of the 16 MIDI channels could have been used. A musical sequence which uses several different timbres is called a multi-timbral sequence.

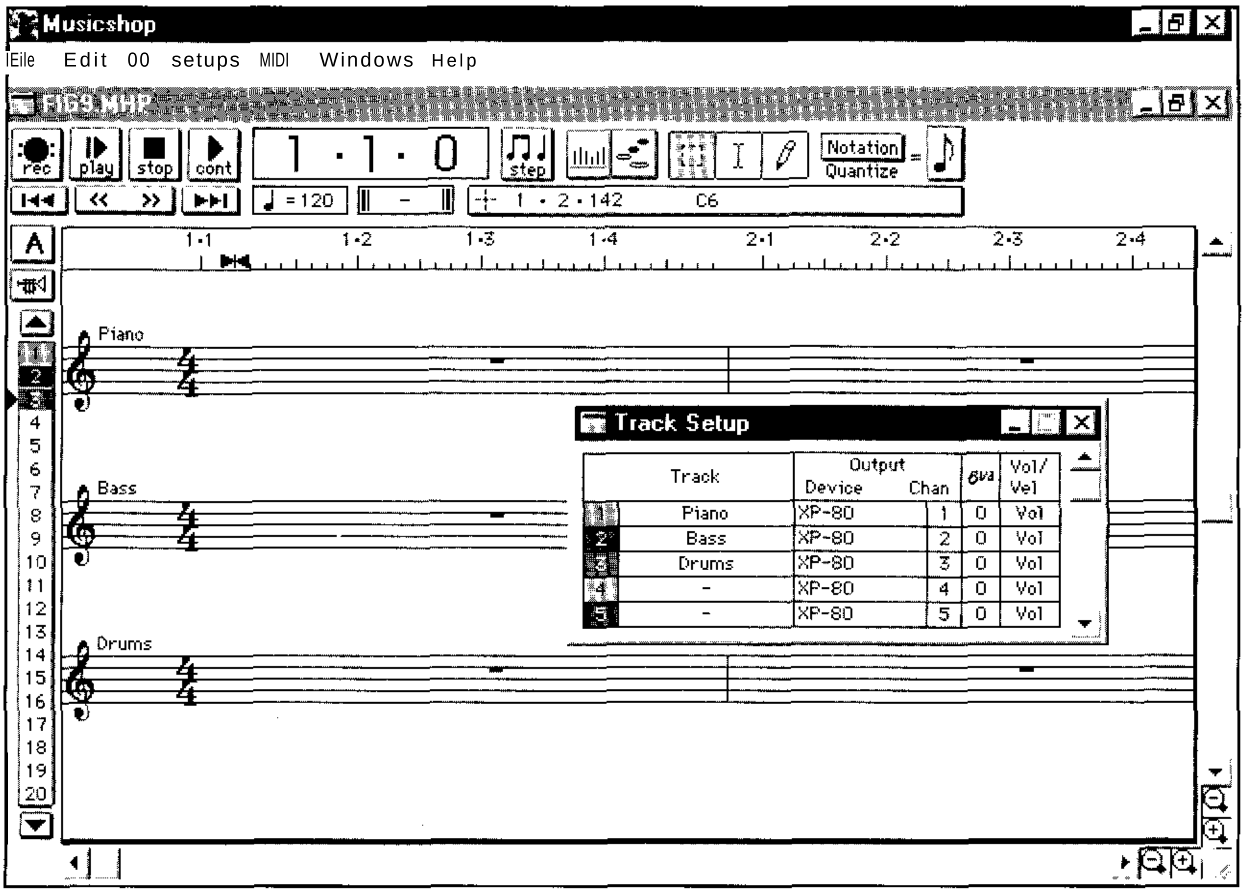


Figure 9

This screen shows a multi-timbral sequence setup using three tracks: a piano part on Track 1, a boss part on Track 2, and a drum part on Track 3. Notice that each track is set to a different MIDI channel.

Note: In order for the synthesizer to play each frack with a separate insfrumental sound, we need to use a ***multi-timbra/ synthesizer.*** *A multi-timbral synthesizer is an instrument that con simultaneously play several* programs (or sounds) on *separate* MIDI channels. (Almost every electronic keyboard *available today is multi-timbral.*

Let's review what we've just learned. MIDI messages representing musical parts are recorded on sequencer tracks one part at a time. Although it's possible to produce a multi-track sequence using only one sound, we usually want musical parts to be heard with different instrumental sounds or timbres. To accomplish this, we must select a separate MIDI channel and program number for each track.

DO I NEED MORE THAN *ONE* SYNTHESIZER *TO* CREATE *SEQUENCES?*

The answer to this question depends upon the music you want to sequence. If you want to be able to hear more than 16 different timbres at once, you will need another synthesizer. However, you may need another synthesizer even if you don't need to hear more than 16 timbres at once. This need is determined by the polyphony of the instrument you are currently using. Polyphony in this context means the number of voices [or individual pitches] that an instrument can play at the same time. For example, a six-string acoustic guitar is a six voice instrument; it can play up to six pitches at once. An acoustic piano is an eighty-eight voice instrument. The first commercial synthesizers were one-voice (monophonic) instruments; only one key could be played at a time on the keyboard. As technology advanced, synthesizers with increased polyphonic capabilities were introduced: 4 voice instruments, 8 voice, then 16, 32 and 64 voices. Most instruments manufactured today have at least 32 voices which means that you can hear up to 32 different pitches at once, and that those pitches can be assigned to as many as 16 different timbres. This is more sonic power than many musicians will ever need.

CONNECTING ADDITIONAL INSTRUMENTS *TO* A SEQUENCER

The two most common ways of connecting additional instruments to a sequencer are by using the MIDI THRU port on your primary keyboard and by using a multi-port MIDI interface.

The easiest way to connect another instrument to a sequencer is to use the MIDI THRU port on your primary keyboard. The MIDI THRU port functions as relayer. It receives a copy of the information that is sent to the MIDI IN port, and relays the same information to another instrument. Figure 10 illustrates how the MIDI THRU port can be used.

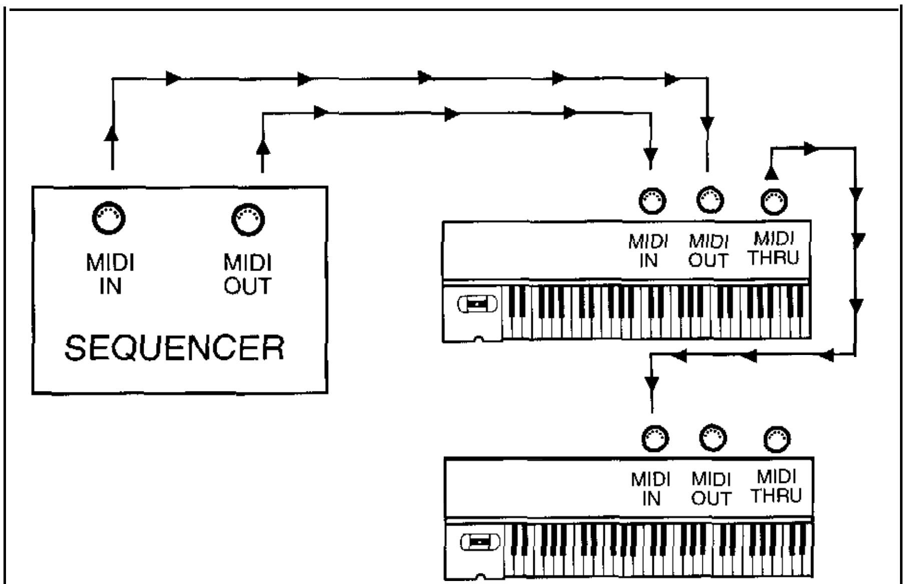


Figure 10
Using multiple sound generators with a hardware or integrated sequencer.

In Figure JO, the MIDI data from the sequencer travels from the MIDI OUT port through a MIDI cable into the MIDI IN port on Synthesizer A. The MIDI cable from the MIDI THRU port on Synthesizer A sends an exact copy of the sequencer data to the MIDI IN port of Synthesizer B. This connection makes it possible for the sequencer to control both synthesizers. To complete the setup, you need to select the MIDI channels for each synthesizer. For example, if you wanted Synthesizer A to play on MIDI channels 1-8 and Synthesizer B to play on MIDI channels 9-16, you need to de-activate channels 9-16 on Synthesizer A and then de-activate channels 1-8 on Synthesizer B. If you don't de-activate the channels, you won't be able to assign instrumental sounds to specific sequencer tracks; both synthesizers will play all of the tracks. The most powerful way of connecting additional synthesizers to a software sequencer is to use a **multi-port MIDI interface.** Standard MIDI interfaces have one MIDI IN port and MIDI OUT port. Multi-port MIDI interfaces are available with different configurations of MIDI IN ports and MIDI OUT ports. **Figure** I I shows an example of a MIDI interface with eight separate MIDI IN and OUT ports. This interface allows you to connect up to 8 synthesizers to your computer. Since each synthesizer has a separate MIDI connection, you can use any or all of the 16 channels on each module for up to 128 MIDI channels.

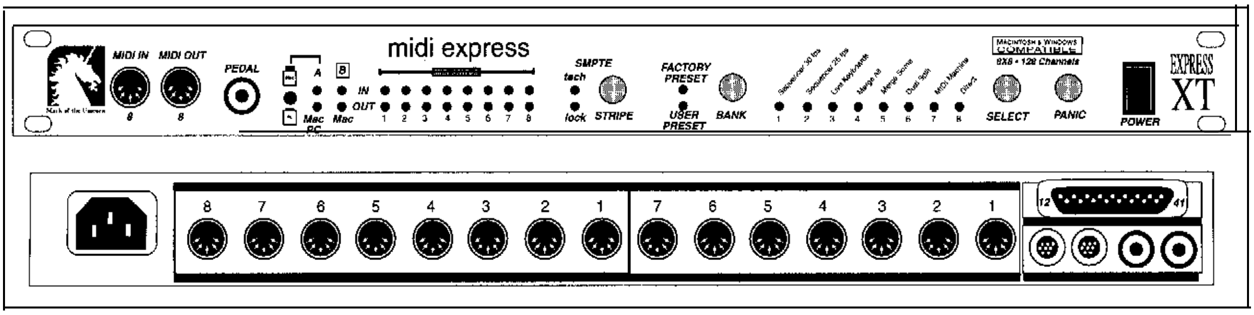


Figure 11
Each of the 8 separate MIDI OUT ports on this multi-port interface can accommodate 16 channels This odds up to 128 MIDI channels. These interfaces can be found in complex MIDI setups which are used for recording and performing.

Chapter Two

Using Sequencers

Section 1- Basic Sequencer Controls And Playback Features

let's assume that you now are the proud owner of a MIDI keyboard, a MIDI interface, and a computer. You also purchased sequencing software for your computer, and you've just finished installing the program on your computer. (Note: installing a sequencing program is usually not a difficult procedure. Computer operating systems are becoming more intelligent, and most of the well-known sequencing programs include detailed installation tutorials.]

Most sequencers are packaged with some type of demonstration sequence. Before we learn about recording a sequence, let's learn something about the easiest part of using a sequencer: playing back sequence data (commonly known as "song files"). Although there are great differences in the look and the layout of various sequencing programs, there are many common features shared by almost every sequencer. Here is a listing of the most common playback features. Most of these features are accessed by clicking on menu prompts which appear on the computer screen.

Transport Controls

The first group of playback features is called the **transport control** group. These controls let you start and stop sequence playback in several ways. (Before you attempt to play back a sequence, be sure you have loaded a song file into the sequencer's memory. In Section 1, I explained that most sequencers store song data on computer disks. To play a specific song, you must load the song data from the computer disk into the sequencer's memory.)

PLAY This feature will cause the sequencer to begin song playback.

STOP - This feature will stop song playback. In some cases, this will also "rewind" the song back to measure 1.

PAUSE - This will also stop song playback, but when playback is resumed the song will continue from the point where it was stopped.

RECORD - This feature starts the recording process on the selected track. (Recording will be discussed in detail later in the next section.)

GO TO This lets you start song playback at a specific location within the song. For example, if you wanted to start the song at measure 44, you would type in "44" and press PLAY. (This feature is very useful when you are using a sequencer as a rehearsal aid.)

LOOP - When the loop feature is activated, a track will ploy through once, then repeat endlessly. Some sequencers allow you to loop a specific musical phrase or a group of measures anywhere within a song. To do this, you must specify the starting point and the ending point of the loop.

TEMPO - This feature enables you to change the playback tempo of a sequence. A change in tempo on a sequencer will not produce a change in pitch because the performance information, not the sound itself, is being sped up or slowed down.

Track *Parameters*

The second group of standard playback features is called the **track parameter** group. These features allow you to alter the way in which the MIDI data for each track is played back. Track parameters include the following:

VOLUME This feature lets you adjust the volume level for each track in the sequence.

MUTE The mute feature does not erase or destroy a track. Instead, it silences a track without the need to lower the track volume level. This feature is useful when you have recorded several tracks and want to hear only a specified number of tracks.

SOLO The solo feature enables you to hear only one track. This feature is useful when you want to listen to only one track in a sequence that contains many tracks. (Note: some sequencers give you the option of soloing more than one track at a time. This feature is sometimes called **group solo**.)

PAN This feature lets you assign each track to a specific location in a stereo mix. You can pan a track to the right speaker, the left speaker, or anywhere in between the speakers.

TRANSPOSE - Most sequencers allow you to transpose tracks to any key. On most sequencers each number represents a semitone. For example, a transposition value of "+2" means that the music will be transposed two semitones higher. A transposition value of "-12" means that the music will be transposed 12 semitones (1 octave) lower.

PROGRAM -A program is a specific sound on a synthesizer. By changing the program number on a track, you can select different sounds without touching your synthesizer. This feature makes it very easy to select the most appropriate sound for any musical part.

Changing **track parameters** makes it possible for you to take an existing song file and to transform it into a different arrangement without any additional recording. For example, you can take an existing sequence and change the tempo, transpose the song to a different key, mute tracks, change the volume levels of tracks, re-assign the stereo mix, and select different programs for each track. A creative musician can use these features to make a dramatic transformation in the sound of a sequence. Figure 12 shows a typical screen layout from a sequencing program. Most of the transport controls and track parameters are immediately accessible.

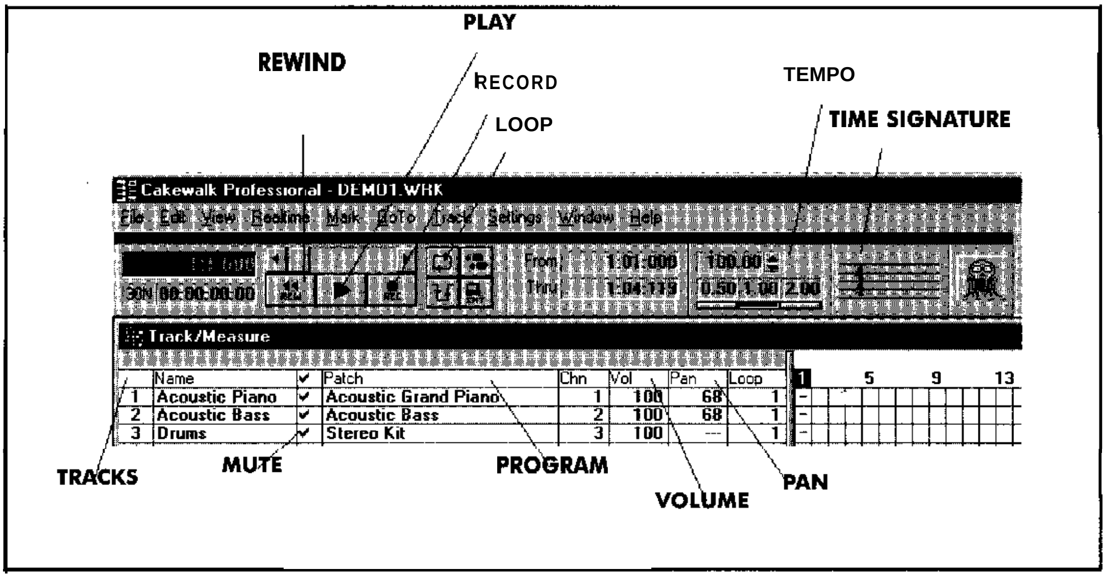


Figure 12
A typical sequencer screen layout showing several transport controls and track parameters.

Section 2 ▪ Recording A Sequence

Now that you have a basic understanding of how sequencers play back song files, let's examine the steps that you can take in order to record a multi-track sequence. We'll continue to use a typical setup consisting of one MIDI keyboard, a MIDI interface and a computer.

Note: Although *the* following *steps will* work with most sequencers, p/ease remember that *all* sequencers do not work exact/y alike and that one step in this list may involve *two* steps on your sequencer, or vice versa.

Step 1 ▪ Put the keyboard in multi-timbral mode.

This should be done before you boot up the sequencing software. The keyboard must be in multi-timbral mode in order for it to use more than one MIDI channel at a time. On most instruments this is done by pressing a button labeled "MULTI" or "PERFORMANCE."
(Note: *If* your keyboard has an integrated sequencer but you prefer *to* use a *software **sequencer,*** put the keyboard in "SEQUENCER" or "SEQ" mode. This is usually the best way for an *external* ***sequencer to** access **the** multi-timbral* capabilities of your instrument.)

Step 2 ▪ load the sequencing software.

It's always a good idea to load the sequencing software after you set up the keyboard in Step 1. Some sequencers "look" to see what instruments are connected to the MIDI interface and then send out commands to the instrument as the program is loading.

Step 3 ▪ Turn on the sequencer's "MIDI OUT" capability.

This feature is sometimes called "MIDI THRU" or "MIDI ECHO." The menu prompt for this feature is usually found under headings such as "OPTIONS," "PREFERENCES," "MIDI," or "SETUP." When this feature is activated, the sequencer will send any incoming MIDI data through the sequencer's MIDI OUT port.

Step 4 • Turn off the keyboard's "LOCAL ON" capability.

If the keyboard's "LOCAL ON" capability is activated after completing Step 3, the synthesizer will ploy two identical notes for every one note you play on the keyboard,. The synthesizer's micro processor (or "brain"] receives one command to play a note from the keyboard and another command from the sequencer to play the same note (assuming you completed Step 1). This doubling of every note changes the tone quality of certain sounds. It also reduces the number of notes that can be played simultaneously. The keyboard's "LOCAL ON/OFF" setting can usually be found in the "MASTER," "SETUP," "MIDI," or "GLOBAL" section.

(Note: be sure to go back to the "LOCAL ON" setting when you turn off your computer. If you don't, you won't get any sound when you play the keyboard.)

step 5 • Activate the metronome (if desired).

A metronome is a clicking sound which enables you to hear the beats of each measure of a sequence. It is not necessary to use the metronome when you are recording a sequence using only one track. However, since you will usually need to use a metronome when you record multi-track sequences, you should get used to recording with a metronome. Be sure that your synthesizer sound is soft enough for you to be able to hear the clicks.

Note: Some sequencers allow you to specify the number of clicks per measure (quarter notes, eighth notes, etc.) and will produce a different-pitched sound for the first beat of every measure. Other sequencers let you select a drum kit sound on your keyboard to use as *a metronome* and also include a variety of pre-sequenced *drum patterns which can be used as metronomes. This feature is especially* helpful for those who have no idea how to play drums *or who need strong reinforcement of the beat. See Figure 13.*

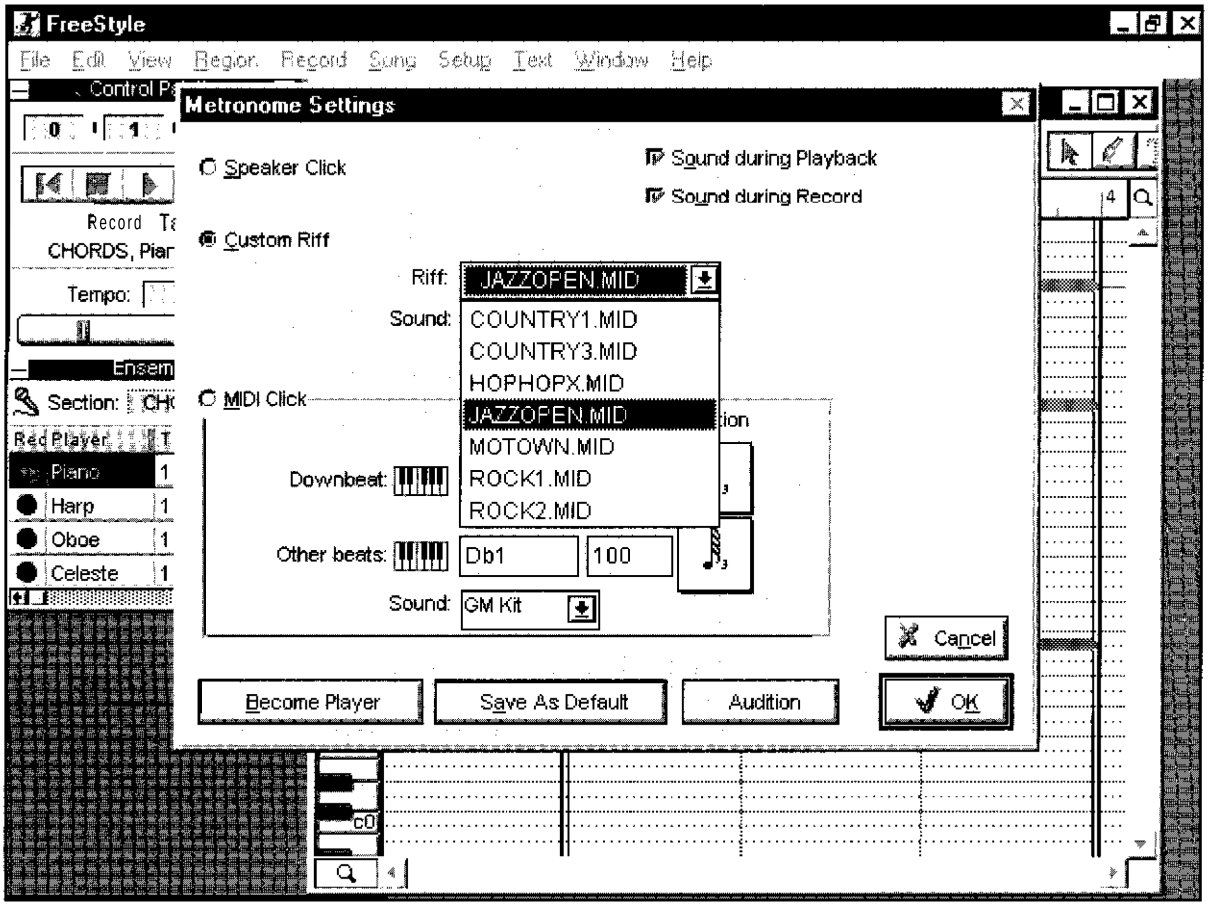


Figure 13

This sequencing program gives you three choices for a metronome: Speaker Click (a click from the computer speaker), Custom Riff (a drum pattern metronome), and MIDI Click (which allows you to use any program on your synthesizer).

Step 6 ▪ Set the number of lead-in measures for the metronome.

A lead-in measure allows you to hear one measure of metronome clicks before the sequencer begins recording. On some sequencers, it is possible to vary the number of lead-in measures.

Step 7 ▪ Set the song tempo.

If you know the tempo of the piece you want to record, you can usually type in the bpm (beats per minute) *value* on the computer screen. If you aren't *sure* of the tempo, press the RECORD button, listen to the metronome and adjust the tempo control until it reaches the tempo you want.

Note: If you are reading music *but can't play the music at the indicated tempo, choose a slower tempo for the recording process. For example, if the music has a tempo marking of 80 bpm, set the tempo indicator to 50 bpm and record the* melody *at this tempo. After you finish recording, change the tempo indicator to 80 bpm, and the sequencer will play back at the correct tempo without a change in pitch.*

Step 8 ▪ Set the time signature.

On most sequencers, first locate the time signature on the sequencer screen and then enter the desired time signature. Most sequencers automatically set up a new song with four quarter note beats to the measure.

Note: Some sequencers also let you enter a song key signature. This feature makes it easier to view *frocks in standard musical notation.*

Step 9 ▪ Select a MIDI channel for Track 1.

Each sequencer track has a column which indicates the MIDI channel assigned to that track. You can select any unused MIDI channel.

Step 10 ▪ Select the sound for Track 1.

Many software sequencers can recognize the specific keyboard used in the setup and can show a list of the keyboard's programs. This list is usually accessed by clicking the mouse on the space reserved for a track's program name.

Most electronic keyboards contain two different types of program groups - General MIDI programs and proprietary programs. General MIDI (or GM) programs are standardized sounds which use a specific set of program locations. For example, Program 1 on any GM compatible instrument (from any manufacturer] will always be an acoustic piano sound; Program 57 will always be a trumpet sound. There are 128 GM instrumental sounds and sound effects. There are also 8 GM drum kits. A complete listing of the GM sounds can be found at the end of this book. Figure 14 shows a pop-up menu listing of GM program groups.

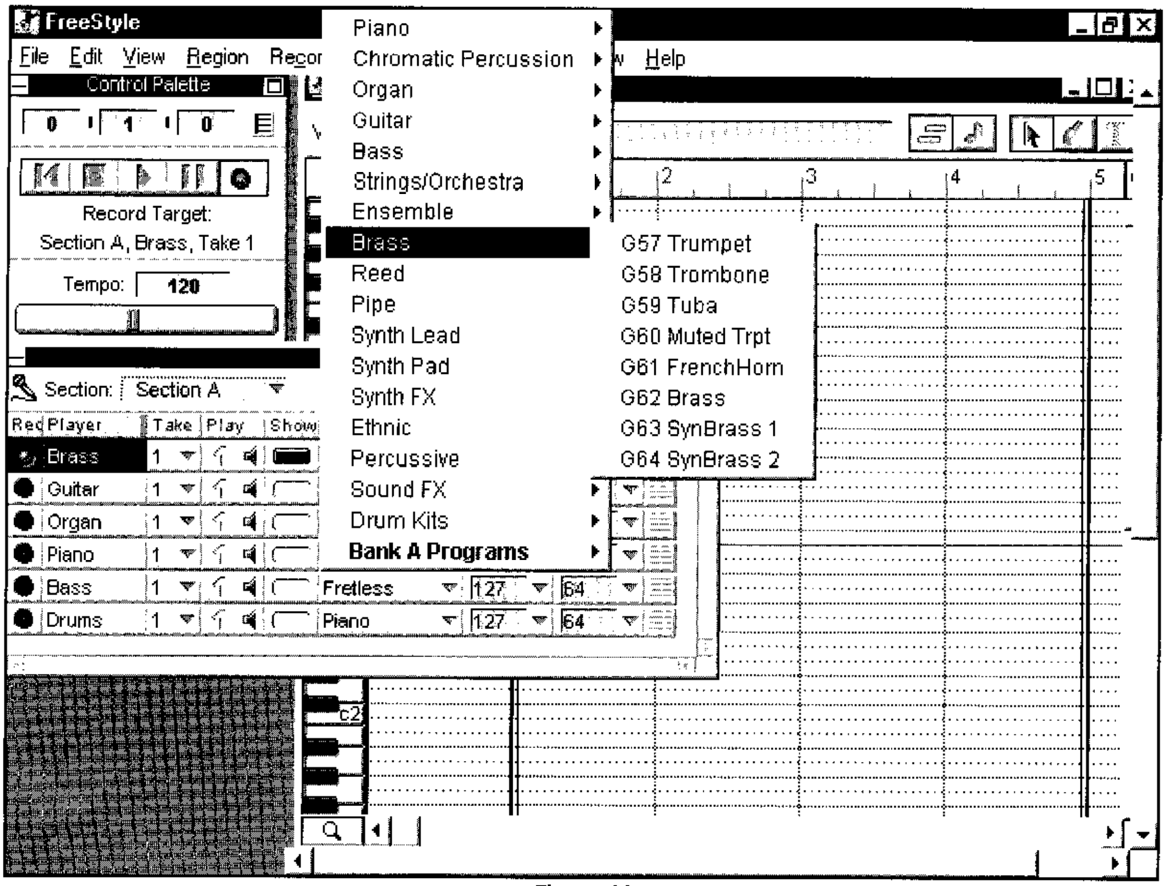


Figure 14
Many sequencers utilize pop-up menus to help find specific programs.

Note: Although every *instrument containing GM sounds will have the same programs in the same order, the quality of the sounds can vary greatly from one instrument to another.*

In addition to GM sounds, most electronic keyboards have a set of proprietary programs. These are sounds which are unique to a particular instrument. They usually include the most impressive sounds that an instrument is capable of producing.

Step 11 • Record the sequence.

Now you are ready to record the sequence. On most sequencers, you begin recording by pressing a button labeled "RECORD," "REC," or "START." While you are recording, you will hear the sound of the metronome from the sequencer. The metronome will not be recorded.

Sequencers offer a choice of the following record modes:

RECORD (sometimes called "OVERWRITE") This is the standard record mode. This mode functions like a tape recorder; it erases any existing data on the track.

OVERDUB · This mode allows you to add data to a track without erasing data already recorded. It is useful for adding notes to chords, adding drum sounds to drum tracks, adding vibrato or volume changes to a track, and so on.

LOOP This mode is a variation of OVERDUB mode. It allows you to repeat a section of a song and to record new material layer by layer on each repeat. For example, you could use the loop record mode to create a drum track by looping four measures and recording the bass drum and snare drum on the first repeat, the hi-hat and ride cymbals on the second repeat, a cowbell and tambourine on the third, and so on.

PUNCH IN This mode allows you to re-record any portion of a track without having to record the entire track. For example, if you made a mistake in the ninth measure of an otherwise perfect recording, you could use the PUNCH-IN mode to re-record only measure nine without affecting the other measures.

STEP TIME · This mode makes it possible to enter music one note at a time without using a metronome. You must specify the pitch, loudness, and duration for each note. Step time is very useful for entering notes that might be difficult to play, but try to avoid creating an entire track or song using this mode. If every note is placed exactly on the beat (or a subdivision of a beat], the result is a very mechanical sound.

When you have finished recording a track, you should immediately name the track and save your sequence. It's a good idea to get into the habit of saving your work often.

Recording Additional Tracks

Let's assume that you recorded a perfect take. [We'll discuss correcting mistakes in the next section.) Recording additional tracks requires much less preparation than the first track. Steps 1 through 8 need to be set up only once. To record a second track, you can start with Step 9. You con continue repeating Steps 9 through 11 for as many additional tracks as you like.

Section 3- Editing A Sequence

Some people think the term "editing" means "correcting." Editing includes more than correcting, however. Video editing, for example, is used not only to connect separate scenes to form a continuous presentation, but also to create artistic or special effects which might be impossible to create any other way. Sequencers also offer these two types of editing: **corrective editing**, which is used to correct any type of musical mistake; and **creative editing**, which is used to enhance a sequence.

Corrective Editing

When I compared a sequencer to a tape recorder earlier in this book, I said that sequencer editing capabilities far surpass anything that is possible with tape. With a sequencer it is possible to change the pitch, starting time, duration, volume level, or tone quality of any note. In order to make a correction, however, we must first be able to see the error in some form. Most software sequencers display MIDI data in a variety of ways, including **standard music notation**, **piano-rolls**, **graphic displays**, and **event lists**. Each of these views has its advantages. Let's examine these in detail.

Standard *Musical* Notation

Standard musical notation is probably the most familiar way to look at MIDI note data in a sequencer track. It is useful for adding and deleting notes, for transposing notes, and for cutting and pasting sections of music. See *Figure 15*.

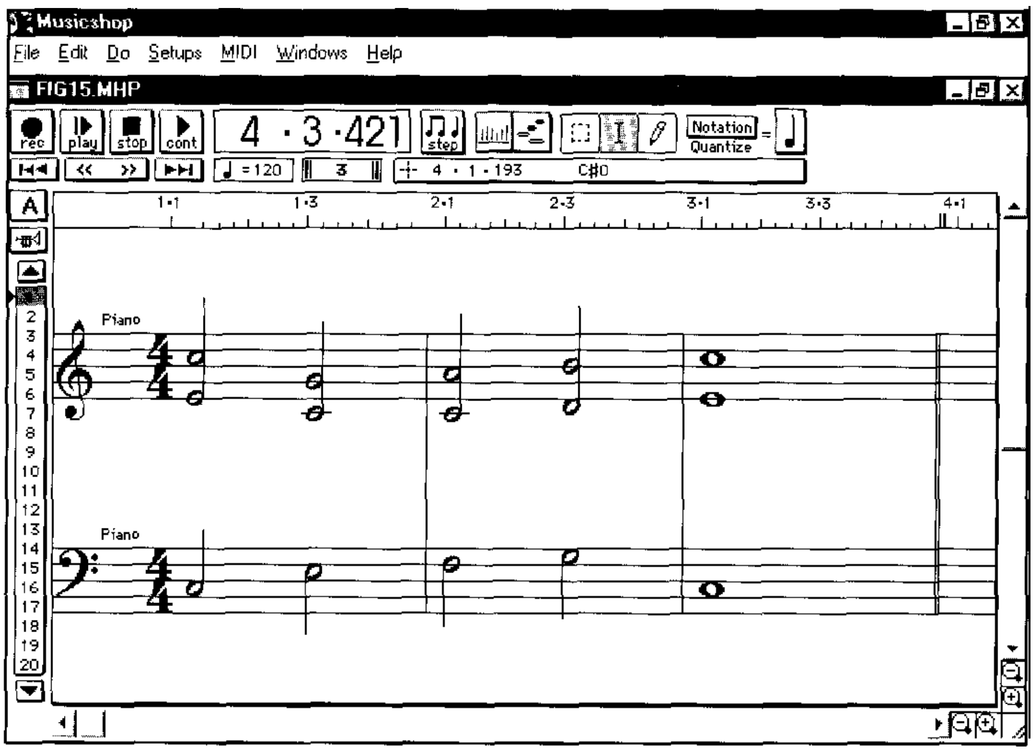


Figure 15

A track containing a basic chord progression shown in standard musical notation.

A standard musical notation view will not show you every detail in a track, however. On most sequencers, this view gives no indication of how loudly or softly the notes were played. There is also no way of showing that you might have held one chord slightly longer or shorter than another chord. Furthermore, if the track contained controller information such as volume data, there would be no way of showing the volume data in this view. This view usually displays only note start times and durations.

Piano-Roil View

Piano-roll editing displays notes as lines extending from left to right on a screen. Figure 16 shows the music from *Figure* 15 in a piano-roll view.

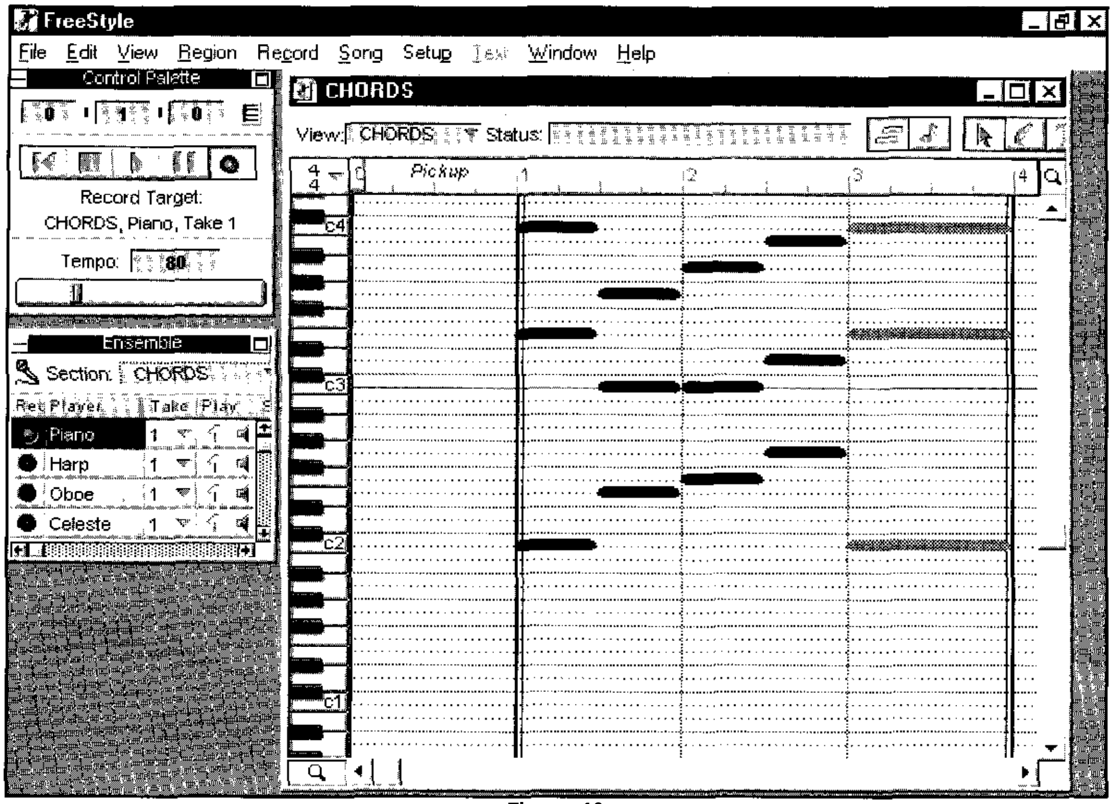


Figure 16
The some chord progression in Figure 15 shown in a piano-roll view.

The pitches of notes are represented by horizontal, heavy line blocks; the higher the block on the grid, the higher the note's pitch. If you look at the left side of figure 16, you can see a piano keyboard. You can also see the note "C" identified on the keyboard by abbreviations such as "Cl," "C2," "C3," and so on. "C" indicates the note; the numbers indicate the octave of the note. C2 is one octave higher than Cl, C3 is one octave higher than C2, and so on. On most electronic instruments, C3 represents a middle C on a piano.

In Figure 16, the highest note block on the left side of the grid represents the note C4, the highest note in the first chord of *Figure 15.* The note block directly below C represents the note E3, which is the next highest note in the chord.

In *Figure 16,* you can see an area near the top which reads "Pickup," then "1," "2," "3," and "4." These numbers stand for measure numbers. The ruler-like subdivided lines within the measures represent beats — in this case, quarter beats. In this example, all of the notes start on the beat.

Note durations are represented by the horizontal length of a note block. If you again look at the note block representing C4 on the first beat of measure 1, you can see that the block starts on the first beat of measure 1 and stretches to the beginning of the third beat. This stretch represents a half note. The longer the stretch of a note block, the longer the duration of a note.

Some sequencers can also give an indication of a note's velocity level in piano-roll view. Remember, the velocity level represents the speed with which a key is struck. Velocity is often used to control the loudness and brightness of a note. If you look at the note lines in measure 4 of Figure 16, you can see that they are not as dark as the other note lines. This means that they will sound softer than the other notes. Variations in velocity levels can be viewed much more easily on a color monitor. Piano-roll view, like standard notation view, is useful for adding and deleting notes as well as for transposing specific notes. On most sequencers, you can use a mouse to alter a note's pitch, starting time, or duration simply by grabbing the note line and dragging it to the desired value. This capability makes it easy to perform several types of note editing.

Graphic *Display*

Although every sequencer view is a type of graphic display, I use the phrase graphic display to represent a view which shows information about velocity levels and controllers instead of note pitches and rhythms. Figure 17 shows a C major scale which begins loudly and ends softly. The graphic display at the bottom of the screen shows the velocity level for each note in the scale. The higher the vertical line under each note, the louder the note.

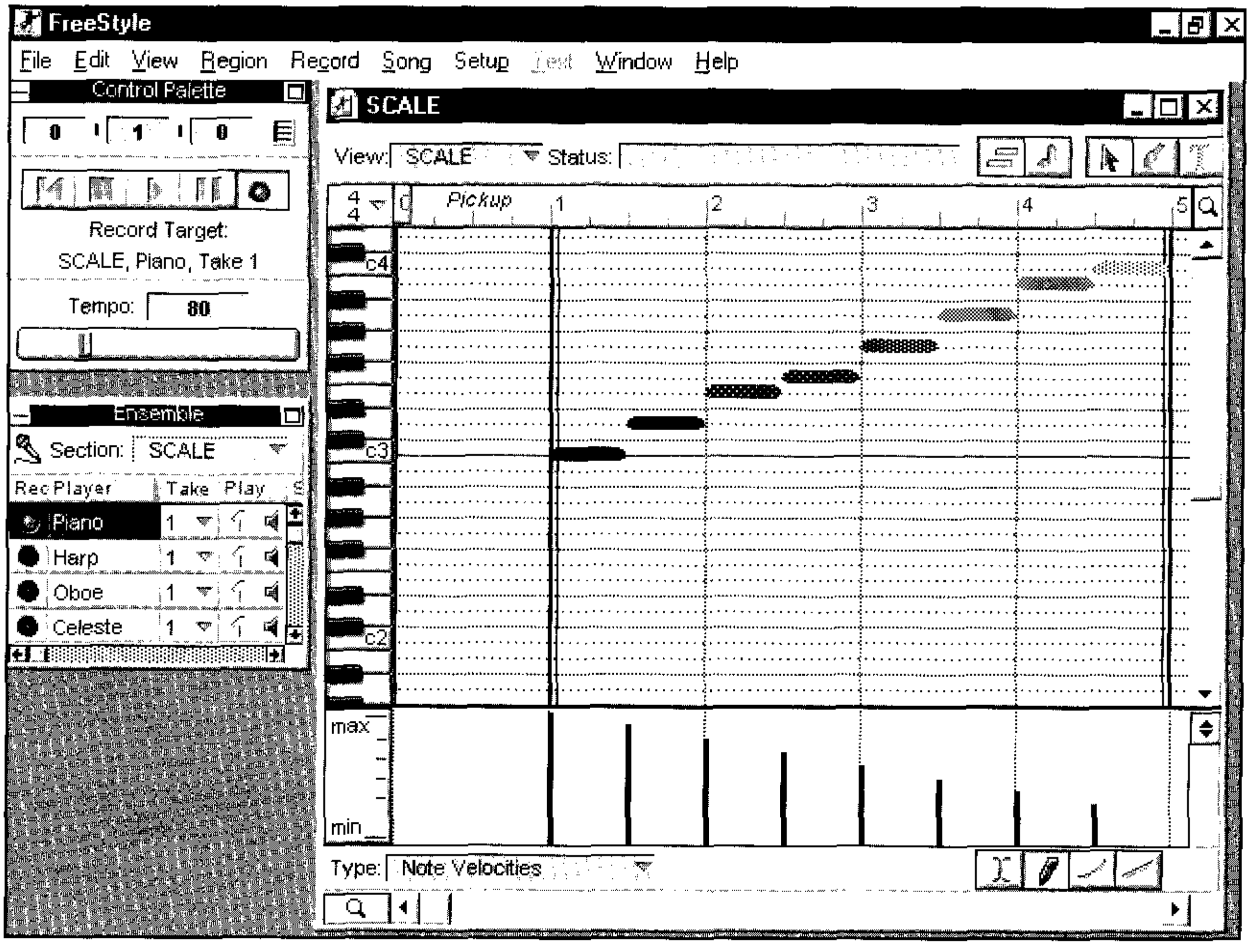


Figure 17

A graphic display showing the velocity levels for each note in a C major scale.

In this display it is very easy to adjust the velocity levels of individual notes. You can use the pencil tool (shown in the bottom right hand corner of Figure 17) to redraw the velocity level of any note. You can use other tools to create crescendo and diminuendo effects.

In addition to viewing and editing velocity levels, graphic displays can also show controller data. Controllers include pitch benders (which allow you to "bend" the pitch of a note sharp or flat), modulation wheels (which are commonly used to add vibrato], and volume pedals. Figure 18 shows a controller display for a modulation controller which is set to control vibrato amount.

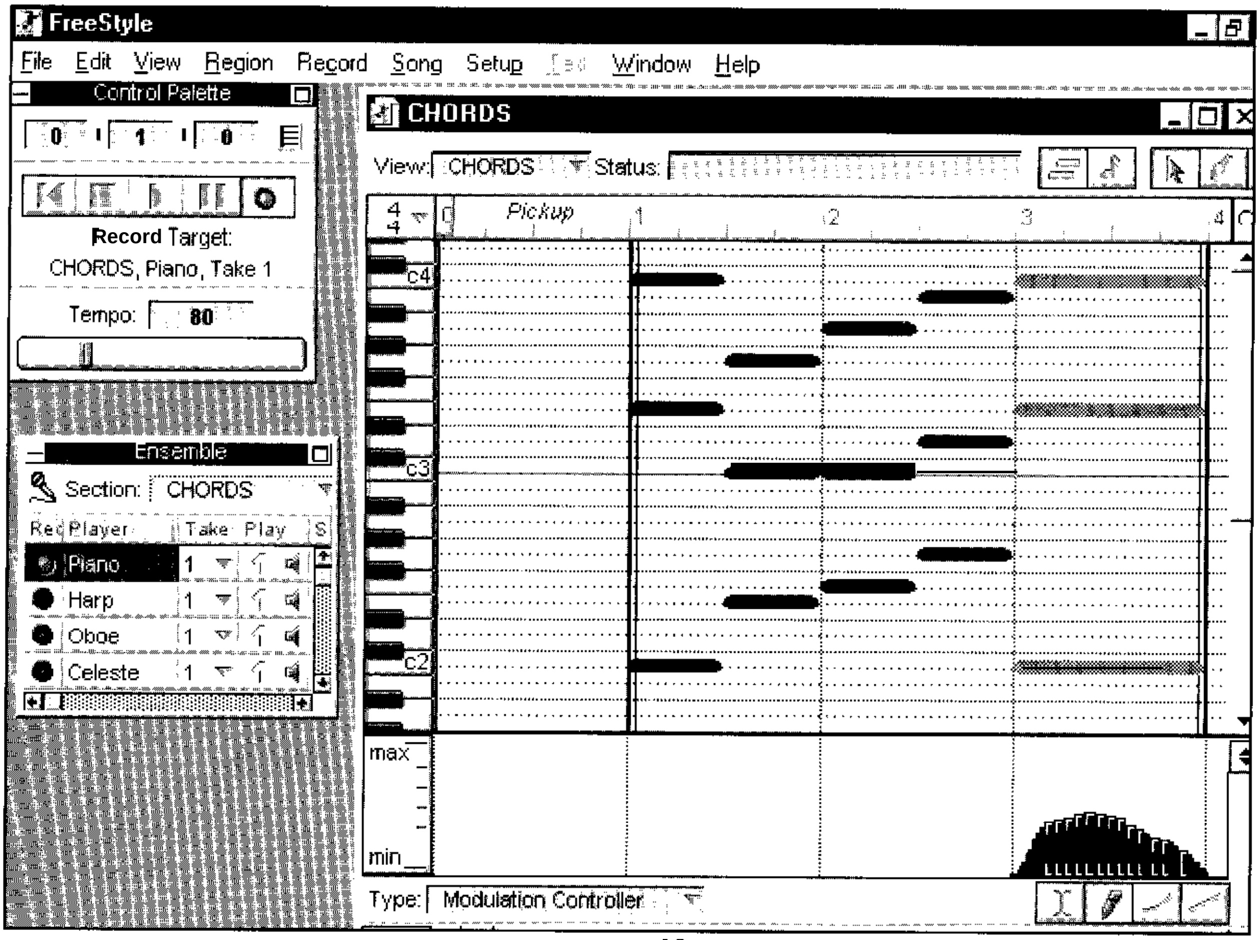


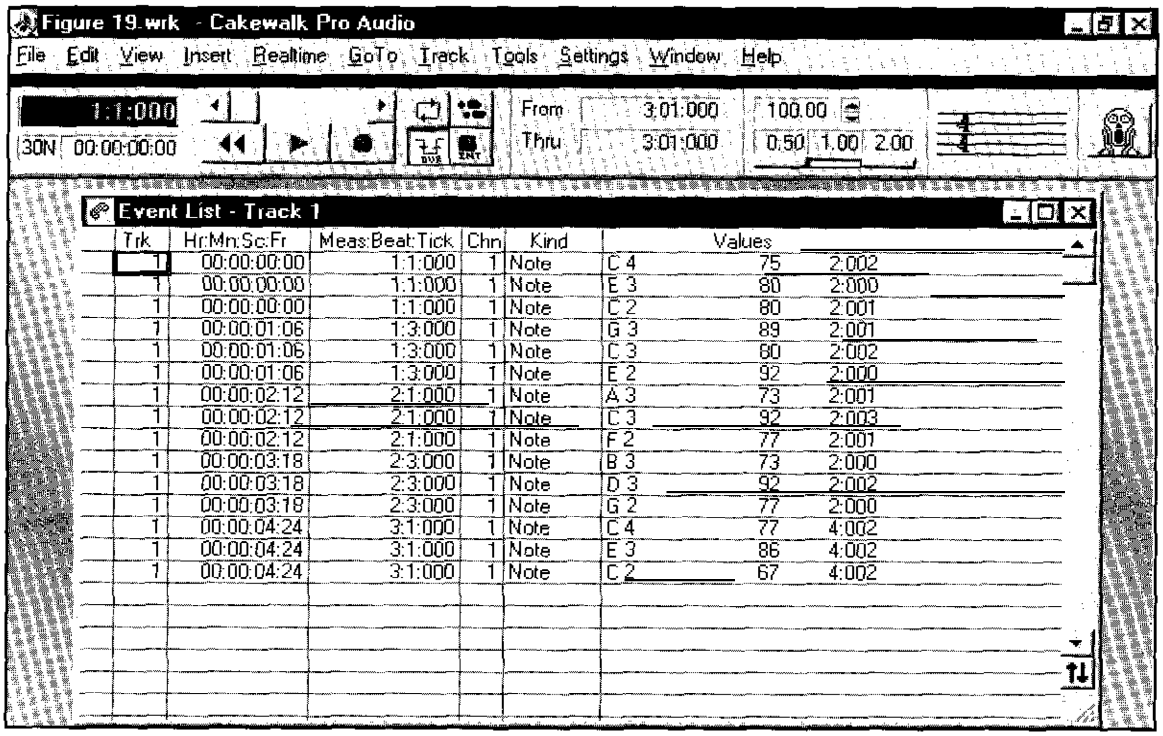
Figure 18

The screen bottom shows a controller graph for a modulation controller set to control vibrato amount. The rising block line on the right side of the screen represents an increase in the amount of vibrato: the higher the line, the greater the vibrato amount. The location of the modulation data indicates that vibrato was added to the final chord.

Controller graphs provide the easiest way to view and to edit controller data. In the example above, it would be very easy to use a mouse to redraw an increase or decrease in the amount of controller data.

Event Lists

The most precise way of viewing MIDI data in a sequencer track is to use the event list display. An event is a single MIDI message such as a note-on command or a volume change command. The event list is the most comprehensive view on a sequencer; every MIDI note and controller value in a track is listed chronologically on a separate line. This is the most overwhelming display, but it makes it possible to change anything in a track. Figure 19 shows the music used in Figures 15, 16 and 18 displayed as an event list.



Trk	Hr:Mn:Sc:Fr	Meas:Beat:Tick	Chn	Kind	Values		
1	00:00:00:00	1:1:000	1	Note	C 4	75	2:002
1	00:00:00:00	1:1:000	1	Note	E 3	80	2:000
1	00:00:00:00	1:1:000	1	Note	C 2	80	2:001
1	00:00:01:06	1:3:000	1	Note	G 3	89	2:001
1	00:00:01:06	1:3:000	1	Note	C 3	80	2:002
1	00:00:01:06	1:3:000	1	Note	E 2	92	2:000
1	00:00:02:12	2:1:000	1	Note	A 3	73	2:001
1	00:00:02:12	2:1:000	1	Note	C 3	92	2:003
1	00:00:02:12	2:1:000	1	Note	F 2	77	2:001
1	00:00:03:18	2:3:000	1	Note	B 3	73	2:000
1	00:00:03:18	2:3:000	1	Note	D 3	92	2:002
1	00:00:03:18	2:3:000	1	Note	G 2	77	2:000
1	00:00:04:24	3:1:000	1	Note	C 4	77	4:002
1	00:00:04:24	3:1:000	1	Note	E 3	86	4:002
1	00:00:04:24	3:1:000	1	Note	C 2	67	4:002

Figure 19
The music used in Figure 18 displayed as an event list. Note start times, durations, pitches and velocity levels are represented numerically. This view offers the greatest precision in editing MIDI data.

There are eight columns of event information on the left side of *Figure* 19. The first column on the left is labeled "Trk" and it displays the track location for each event. The "Hr:Mn:Sc:Fr" column stands for "Hours:Minutes:Seconds:Frames" and displays the timing location of each note measured from the beginning of the recording. ("Frames" are used for synchronization with devices such as professional video tape recorders.) The "**Meas:Beat:Tick**" column displays the measure number, the beat within the measure, and the tick [or clock pulse) for each event. The "Chn" column stands for "Channel" and displays the MIDI channel for each event. The "Kind" column displays the kind or type of MIDI event. This example displays only note events. The "Values" column displays information about each event. In this example, the values shown are the pitch ("C4," "E2," etc.], the velocity level ("75," "80," etc.) and the duration ("2:002," "2:000," etc.). Any value on the list can be modified by placing the cursor in a column and entering a new value.

Quantization

Before we leave the subject of corrective editing, I want to describe a feature called quantization. Rhythmic quantization is most often used to move note start times to the nearest beat or to the nearest subdivision of a beat. For example, if some of the notes in my C major scale were played slightly before or after the beat, I could quantize the track so that *every* note will play precisely on the beat. This can be a great help to musicians with limited performance skills. If overused, however, quantization makes music sound mechanical; the precise rhythms soon become monotonous.

While almost every sequencer has quantizotion, a few sequencers have a feature called soft quantization. This is a very musical feature which lets you adjust the amount of quantization on a track. Soft quantization can rhythmically tighten up tracks without making the tracks sound mechanical.

Creative Editing

We've seen how corrective editing can be used to correct any type of musical mistake. Creative editing can be used as a compositional tool. It can also be used to create dramatic effects which can enhance a sequence. It is beyond the scope of this book to devote much space to creative editing, but the following two examples should give you an idea of what can be done.

Creative Editing *Using an Arrangement* Window

Several sequencers include another type of display called an arrangement window (sometimes called a phrase block display). Instead of showing every detail of every event, arrangement windows can display music in large sections of song such as Intro, Verse, Chorus, Ending, and so on. Figure 20 shows how an arrangement window display can be used to create a song form.

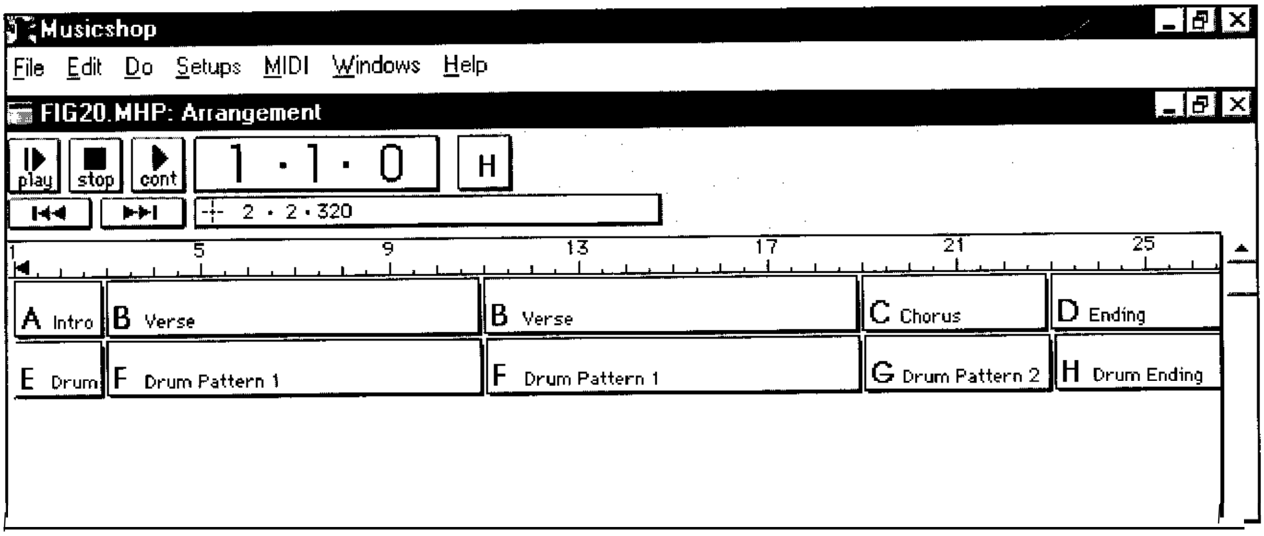


Figure 20

An arrangement window enables you to divide a sequence into separate sections and create different versions of songs The ruler line displays measure numbers. Each box under the measure line displays a section of the song. Adding or removing song sections can be done using a "cut and paste" technique similar to word processing.

Creative Editing Using Controller Curves

In this example I will describe how controller curves for volume, panning, and reverberation can be used to enhance the spatial dimension of music.

Volume

let's suppose that I record another C Major scale into the sequencer; this time I play all of the notes at roughly the same velocity level. Next, I draw a controller curve for the volume level as shown in Figure 21. This curve begins at the maximum volume level and ends at the minimum volume level.

Note: *Readers* who would *like more detailed information about* corrective editing should *consult* the author's ART OF SEQUENCING book *and* video. *These materials* include *in-depth explanations* of correcting notes, rhythms *and* dynamics. (Product numbers con be found on *page 40.)*

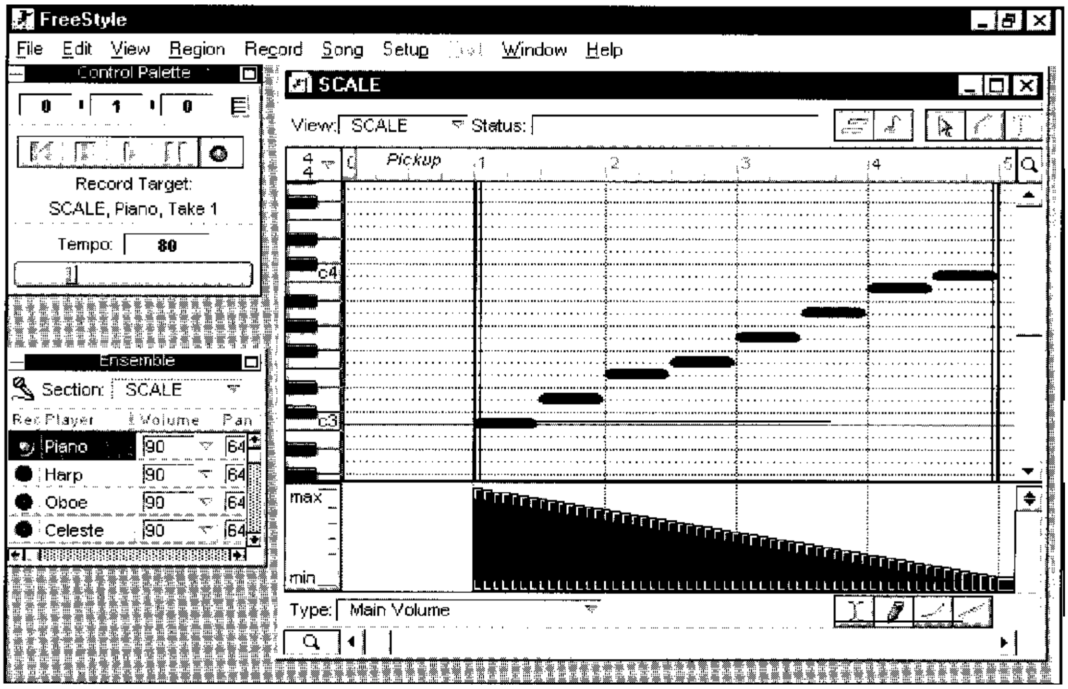


Figure 21
The bottom of the screen shows a volume curve extending through the four measures of the C Major scale
Notice the values of "Max" (for "Maximum") and "Min" (for "Minimum") on the left side of the curve.

The addition of this controller curve to the track will make the scale begin loudly and slowly fade away. We might perceive this as a movement in the location of the sound; as the sound becomes softer, it creates the illusion of moving away from us.

Panning

let's enhance this location effect by drawing another controller curve. In Figure 22 we see a controller curve for panning, which is the left/right movement of a sound between two speakers.

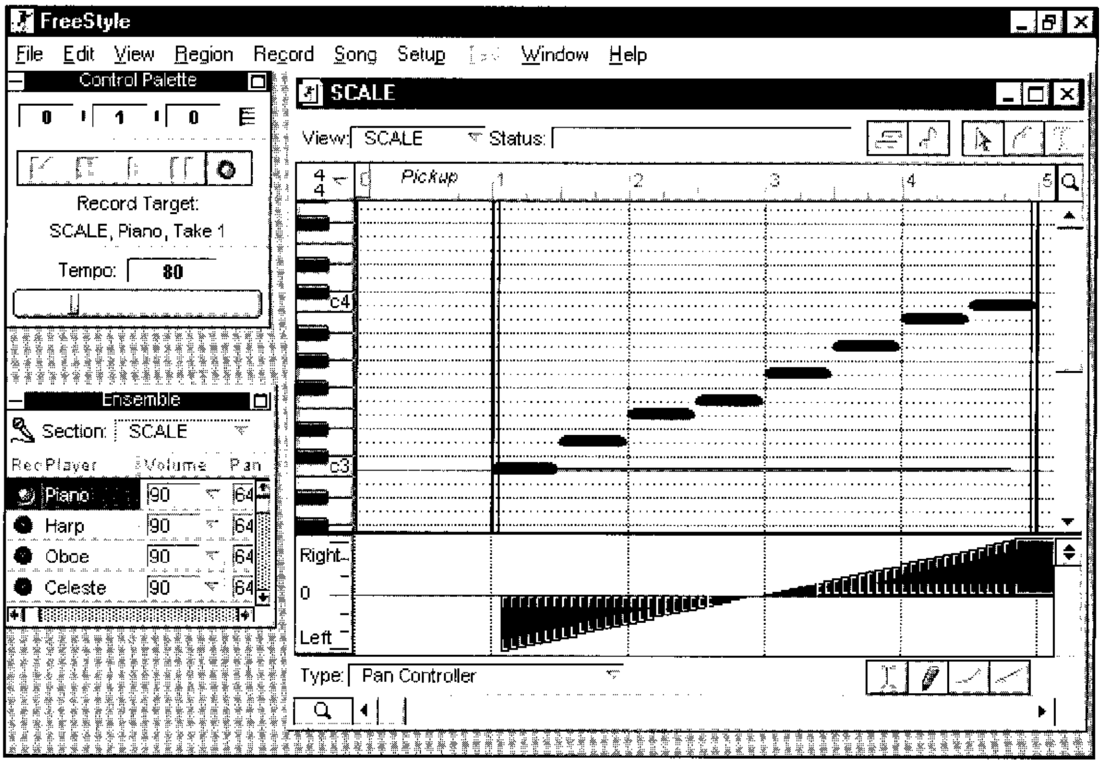


Figure 22
A pan controller curve is added to the track. Notice that the controller values "Max" and "Min" have been replaced by "Right" (speaker) and "Left" (speaker).

Now, when we now hear the track, the sound will slowly travel from the left speaker to the right speaker as it becomes softer. We might now perceive the music as moving across and away from us at the same time

Reverberation

Let's take the movement idea one step further. More and more electronic keyboards are made with internal effects processors, which can produce sonic effects such as delays (echoes) and different types of reverberation (which simulate various acoustic environments ranging from a small room to a cathedral). In Figure 23 we see a controller curve for reverberation — in this case, the amount of reverberation added to the sound.

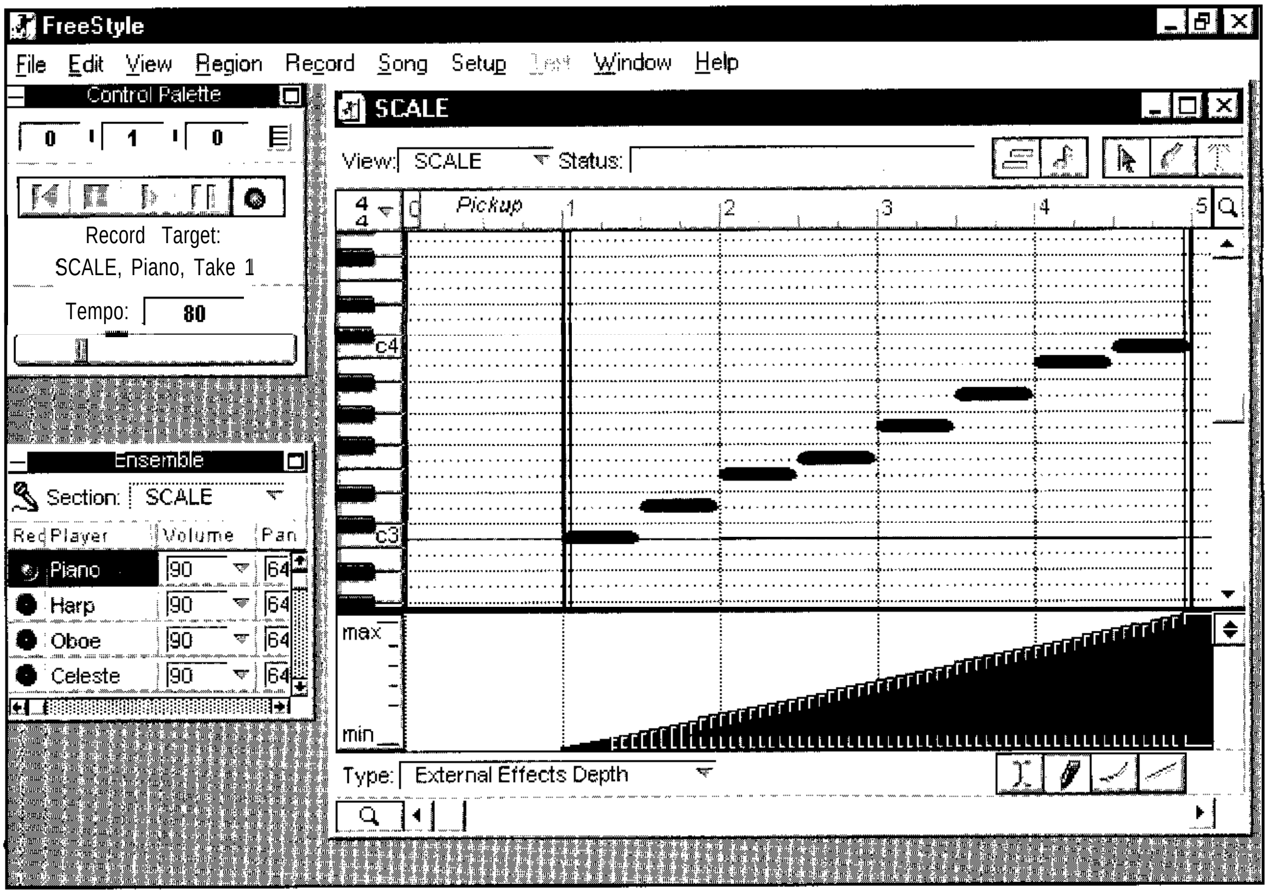


Figure 23

This curve controls the amount of reverberation. The values to the left of the curve show minimum and maximum reverberation amounts.

If we look at the curve, we can see that the track begins with no reverberation and ends with the maximum amount of reverberation. Now, when we listen to the track, the sound will start loudly in the left speaker, then gradually travel across to the right speaker while at the same time receding farther and farther away from us.

This example should give you same idea of how sequencers can be used to enhance music. When used creatively, this type of editing opens up many sonic possibilities for us as composers and listeners.

Chapter Three

Additional Information

Sequencer Power Features

Sequencers are available in a variety of packages ranging from simple MIDI recorders with no editing capabilities to powerful programs which can be used to create a complete professional recording of MIDI instruments combined with acoustic instruments and vocals. I want to describe three powerful features that are very important to many musicians: score printing, digital audio, and video synchronization.

Score Printing

In the past, notation was handled primarily by dedicated music notation software. It used to be safe to say that if the final output of your project was sound, you used a sequencer. If the final output of your project was a printed score, you used a notation program. Today, however, the line is becoming blurred, The sound playback features of notation programs hove improved dramatically, and almost every software sequencing program includes some form of notation. See Figure 24

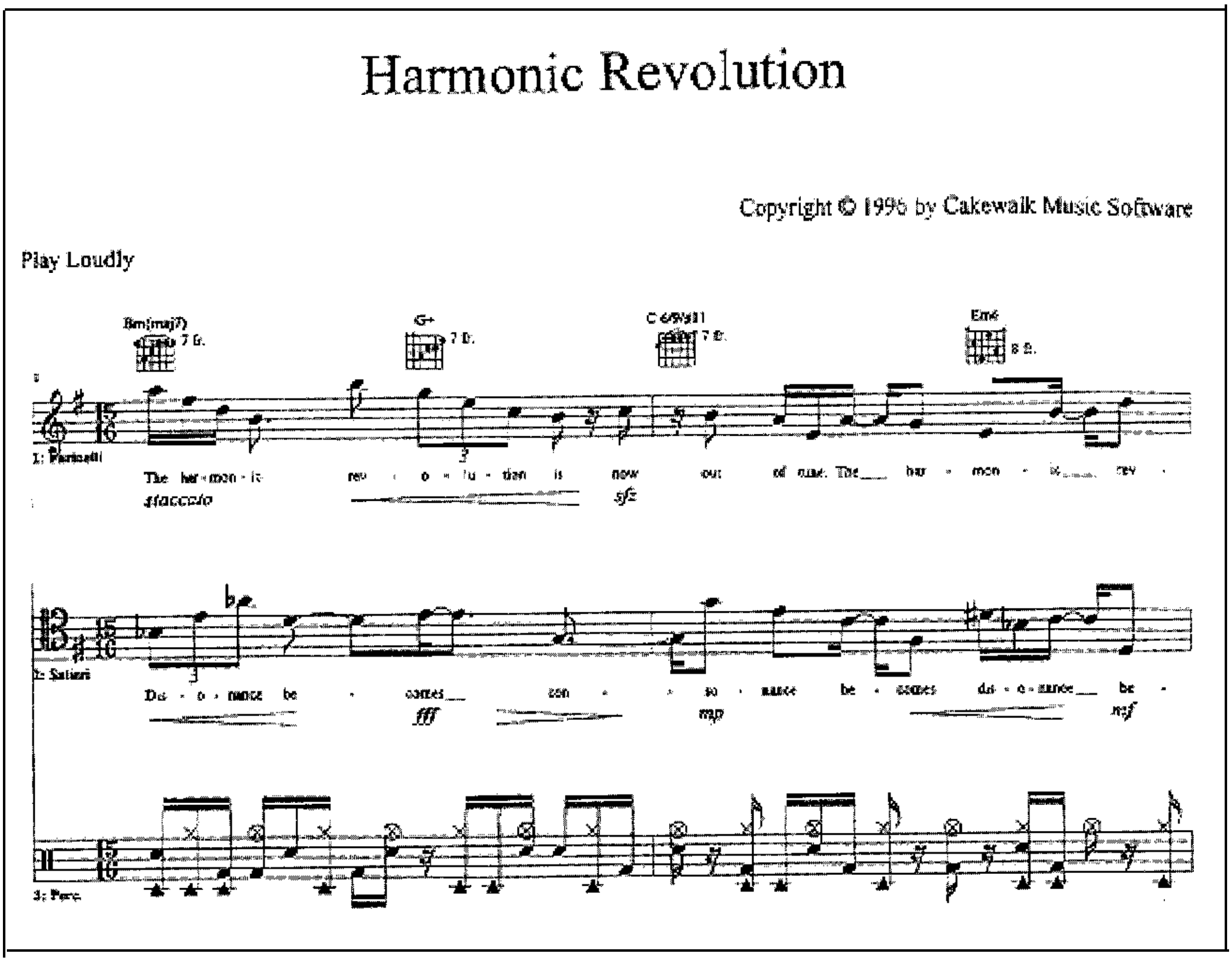


Figure 24
An example of music notation generated by a sequencer.

Some musicians prefer to use the power of o dedicated sequencer program for creating on audio recording of a song. If they later decide to create a printed score and parts from the sequence, they can save the sequence as o Standard MIDI File (SMF) and then load (or import) the SMF into a dedicated notation program. They con then use the power of the notation program to create a detailed, professional looking printed score. Although this method makes it possible to utilize the strengths of each program, it is not necessarily for everyone. The notation features on the sequencer you purchase may be more than adequate for your needs.

Digital Audio

One of the most recent developments in sequencers is the capability of recording digital oudio data as well as MIDI data. In other words, you can now connect o microphone to the computer and odd on acoustic instrument or vocal part to the sequence. Sequencers which have this feature ore called **digital audio sequencers.** With one exception, digital audio sequencers ore presently available only in the form of software programs.

Digital audio sequencers use a graphic display to represent audio waveforms in an audio track. See Figure 25.

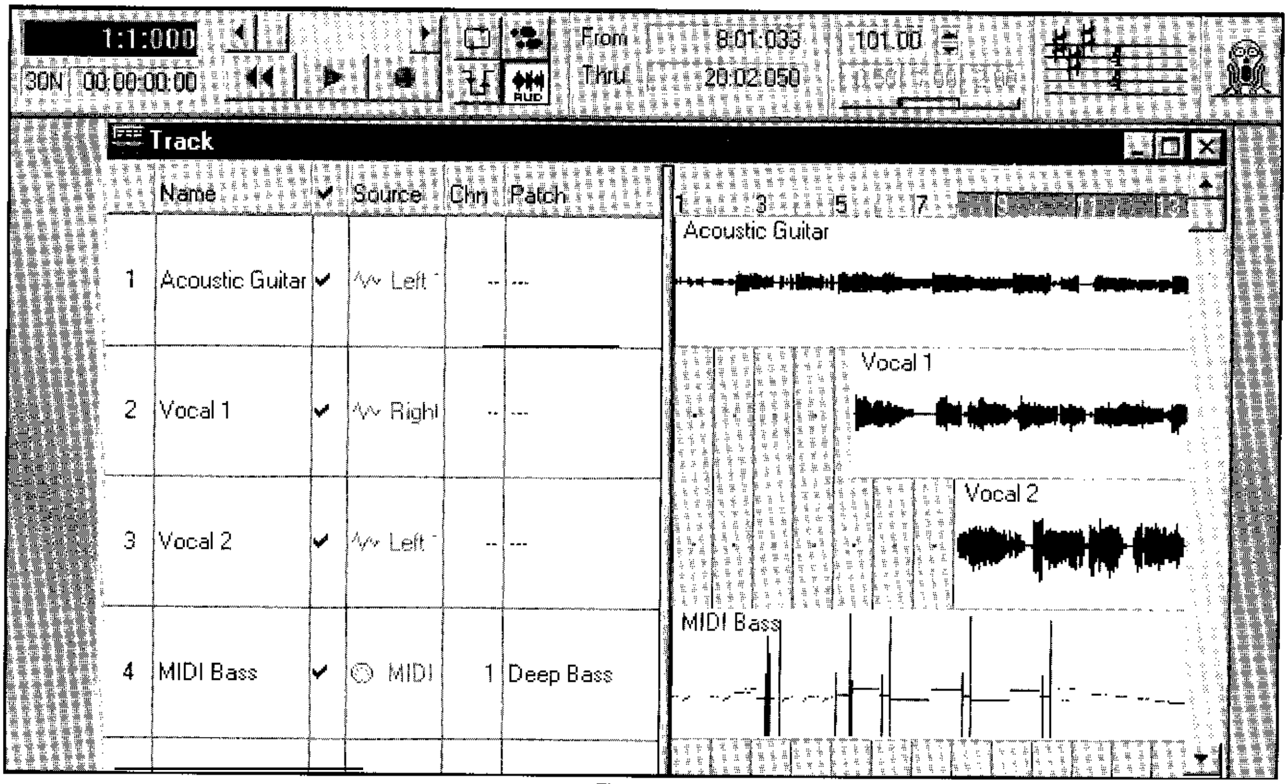


Figure 25
This display shows four tracks on a digital audio sequencer. Tracks 1-3 are audio tracks, and Track 4 is a MIDI track

A few low-end programs allow you two record only two audio tracks; more expensive programs allow you to record 8, 16, and even more tracks if your computer is powerful enough. You will need a computer with a fast microprocessor (brain), lots of memory, and a very fast and large hard drive. (One minute of a stereo digital audio file recorded at CD quality requires approximately 10 megabytes — 10 million bytes of disk storage per minute.) In addition, you may hove to purchase a high quality computer sound card if you want to get professional sound quality.

Digital audio sequencers offer a tremendous amount of creative power. You can cut and paste audio tracks as easily as with MIDI tracks. You cat- usually add effects such as reverberation and delay to audio tracks without using any external equipment. A few programs even include features such OS **pitch correction and gender bending.** Pitch correction allows you to fine tune the pitch of any portion of an audio track. For example, if a vocalist sang one note slightly flat, you could raise the pitch of that one note by as little as one cent (one one-hundredth of a semitone). **Gender bending** lets you transpose the tonal characteristics of an instrumental or vocal sound without transposing the pitch itself. For example, you can "gender bend" a male vocal part to make it sound female, or vice versa.

Video Synchronization

More and more people are becoming interested in creating their own multimedia projects. These projects can include a music video, a product demonstration, or even on edited family vacation video with added narration. In the past, these types of projects called for separate components such as video recorders, multi-track tape recorders and expensive editors. A few sequencers now allow you to record and edit sequencer tracks while viewing digital video at the same time. This makes it comparatively easy to coordinate your music with a video file. You can even imitate the house organists of the silent movie days and record tracks while viewing the video file. This type of audio/video integration will become more popular as computers become more powerful and even more affordable.

Selecting A Software Sequencer

I want to emphasize again that there is no such thing as the "best" sequencer-hardware, software, and integrated sequencers all have advantages and disadvantages. I have purposely omitted discussing the pros and cons of specific sequencing programs for the following reasons. First, such a discussion would be beyond the purpose of this book, which is to provide an overview of the most common sequencer features. Second, sequencers are continually improving and evolving. Features not found on Brand X sequencer at the time of this writing may be available on the newest version of the program. However, I am including the following information in order to give you a starting point for product features.

Sequencing software can be divided into two categories: low-end and high-end. In general, high-end programs are used by professionals for creating audio CDs, TV and movie soundtracks, and multimedia projects. The differences between low-end and high-end sequencers are not only in the number of features, but also in the level of control available with each feature. For example, you might think that digital audio sequencers are extremely expensive, but the price can range from US $85.00 to almost US $700.00. The more expensive programs offer mare audio tracks as well as more powerful editing capabilities.

The following list includes the most popular software sequencer programs available at the time of this writing. Note that several manufacturers offer different versions of a program. This makes it easy for you to start with a low-end version and upgrade to more powerful versions without having to learn another program.

PC **(Windows)** and Macintosh Seauencerg

- Micro Logic low-end program (Emagic)
- Logic Audio Discovery high-end program with notation and digital audio (Emagic)
- Logic Audio high-end program with powerful notation and powerful digital audio (Emogic)
- Freestyle - low-end program with some high end features; notation (Mark of the Unicorn)
- Musicshop - low-end program with some high-end features; limited notation (Opcode)
- Vision high-end program; Macintosh version supports digital audio (Opcode)
- Mastertracks Pro low-end program with some high end features; limited notation on PC version (no notation on Macintosh version) (Passport Designs)
- Cubasis - low-end program with limited notation (Steinberg)
- Cubase high-end program with advanced digital audio and notation (Steinberg)

PC **(Windows) Seguencers**

- Cakewalk Home Studio low-end program with limited notation, two digital audio tracks (Cakewalk)
- Cakewalk Professional - high-end program with limited notation, four digital audio tracks (Cakewalk)
- Cakewalk Pro Audio - high-end program with notation, powerful digital audio (Cakewalk)
- Master Tracks Pro Audio - high-end program with limited notation and limited digital audio (four audio tracks) (Passport Designs)
- Recording Station low-end program with ten MIDI tracks, two digital audio tracks; no notation (Voyetra)
- MIDI **Orchestrator** Plus high-end program with notation (Voyetra)
- Digital **Orchestrator** Plus - high-end program with notation and digital audio (Voyetro)

Macintosh Sequencers

- Performer high-end program with notation (Mark of the Unicorn)
- Digital Performer - high-end program with powerful digital audio and notation (Mark of the Unicorn)
- Studio Vision Pro - high-end program with notation and powerful digital audio (Opcode)

Manufacturer Addresses:

- Cakewalk Music Software, PO Box 760, Watertown, MA 02272; (800)234-l 171; www.cakewalk.com
- **Emagic**, 13348 Gross Valley Avenue, Building C, Suite 100, Grass Valley, CA 95945; (916)477-l 051; www.emagic.de
- Mark of the Unicorn, 1280 Massachusetts Avenue, Cambridge, MA 02138; (617)576-2760; www.motu.com
- Opcode Systems Inc., 3950 Fabian Way, Suite 100, Palo Alto, CA 94303; (415)369-8131; www.opcode.com
- Passport Designs, 12335 Santa Monica Blvd., #124, Los Angeles, CA 90025; (800)777-8010
- Steinberg North America, 9312 Derring Ave., Chatsworth, CA 9131 l-5857; (818)993-4161; www.steinberg-na.com

Periodicals

The following periodicals are popular sources of information about current sequencer technology. These publications include product reviews, announcements of updates, and advertisements by leading hardware and software manufacturers.

- Electronic Musician, 6400 Hollis Street, Suite 12, Emeryville, CA 94608; (510)653-3307; www.emusician.com
- Keyboard, 411 Borel Ave., Suite 100, San Mateo, CA 94402; (415)358-9500; www.keyboardmag.com
- Music and Computers, Box 56220, Boulder, CO 80322-6220; (303)678-0439; www.musicand-computers.com

GENERAL MIDI CHART OF SOUNDS

Voice Names Derived From The MIDI Manufacturers Association (MMA)

PIANO
1 Acoustic Grand Piano
2 Bright Acoustic Piano
3 Electric Grand Piano
4 Honky-Tonk Piano
5 Electric Piano
6 Chorused Piano
7 Harpsichord
8 Clavinet

BASS
33 Acoustic Boss
34 Electric Boss (finger)
35 Electric Bass (pick)
36 Fretless Bass
37 Slop Bass
38 Slap Boss 2
39 Synth Bass 1
40 Synth Boss 2

REED
65 Soprano Sax
66 Alto Sax
67 Tenor Sax
68 Baritone Sax
69 Oboe
70 English Horn
71 Bassoon
72 Clarinet

SYNTH EFX
97 FX 1 (rain)
98 FX 2 (soundtrack)
99 FX 3 (crystal)
100 FX 4 (atmosphere)
101 FX 5 (brightness)
102 FX 6 (goblins)
103 FX 7 (echoes)
104 FX 8 (xi-fi)

CHROMATIC PERCUSSION
9 Celesta
10 Glockenspiel
11 Music Box
12 Vibraphone
13 Marimba
14 Xylophone
15 Tubular Bells
16 Dulcimer

ORCHESTRA
41 Violin
42 Viola
43 Cello
44 Contrabass
45 Tremolo Strings
46 Pizzicato Strings
47 Orchestral Harp
48 Timpani

PIPE
73 Piccolo
74 Flute
75 Recorder
76 Pan Flute
77 Bottle Blow
78 Shokuhachi
79 Whistle
80 Ocarina

ETHNIC
105 Sitar
106 Banjo
107 Shomisen
108 Koto
109 Kalimba
110 Bagpipe
111 Fiddle
112 Shonoi

ORGAN
17 Hammond Organ
18 Percussive Organ
19 Rock Organ
20 Church Organ
21 Reed Organ
22 Accordion
23 Harmonica
24 Tango Accordion

ENSEMBLE
49 String Ensemble 1
50 String Ensemble 2
51 Synth Strings 1
52 Synth Strings 2
53 Choir Aahs
54 Voice Oohs
55 Synth Voice
56 Orchestra Hit

SYNTH LEAD
81 Lead 1 (square)
82 Lead 2 (sawtooth)
83 Lead 3 (calliope lead)
84 Lead 4 (chiff lead)
85 Lead 5 (charang)
86 Lead 6 (voice)
87 Lead 7 (fifths)
88 Lead 8 (boss & lead)

PERCUSSIVE
113 Tinkle Bell
114 Agogo
115 Steel Drums
116 Woodblock
117 Taiko Drum
118 Melodic Tom
119 Synth Drum
120 Reverse Cymbal

GUITAR
25 Acoustic Guitar (nylon)
26 Acoustic Guitar (steel)
27 Electric Guitar (jazz)
28 Electric Guitar (clean)
29 Electric Guitar (muted)
30 Overdriven Guitar
31 Distortion Guitar
32 Guitar Harmonics

BRASS
57 Trumpet
58 Trombone
59 Tuba
60 Muted Trumpet
61 French Horn
62 Brass Section
63 Synth Brass 1
64 Synth Brass 2

SYNTH PAD
89 Pod 1 (new age)
90 Pod 2 (warm)
91 Pad 3 (polysynth)
92 Pad 4 (choir)
93 Pad 5 (bowed]
94 Pod 6 (metallic)
95 Pad 7 (halo)
96 Pad 8 (sweep)

SPECIAL EFFECTS
121 Guitar Fret Noise
122 Breath Noise
123 Seashore
124 Bird Tweet
125 Telephone Ring
126 Helicopter
127 Applause
128 Gunshot

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Don Muro

Don Muro (donmuro.com) is a composer, performer, author, and educator in the field of electronic music. His compositions have embraced many musical styles — sacred, classical, rock and fusion. His music has been performed in settings ranging from New York's St. Patrick's Cathedral (where he presented the cathedral's first synthesizer/multimedia concert) to Disneylond. His educational music is widely used throughout the United States as well os in Europe and in Japan.

As a performer, he is recognized as a master synthesist specializing in live performance techniques for electronic keyboards. He has presented electronic music concerts, lectures, and demonstrations throughout the United States and also in Europe and Japan.

As an educator, he has published a variety of materials including THE ART OF SEQUENCING book (Warner Bros. Publications MMBK0029) and video (Warner Bros. Publications VH0198). In addition, he has presented electronic music concerts and seminars at educational institutions including the Manhattan School of Music, the Berklee College of Music, Temple University, Duquesne University and North Texas State University. He has taught the basics of music technology and sequencing to over 4,000 music educators through the Don Muro Summer Workshops, which toke place every summer at colleges and universities throughout the United States. He also served as the first Chairman of Electronic Music for the International Association of Jazz Educators (IAJE) as well os the New York State School Music Association (NYSSMA).

Don Muro is also a major spokesman for the electronic medium. For several years his column on synthesizer performance techniques appeared in Keyboard Magazine. In addition, he has written over eighty articles about music and technology for publications such as International *Musicion*, The *Instrumentolist*, and the Music Educators Journal.