SuperConductor™

Music Interpretation Software

User's Manual

Version 4.0

SuperConductor™

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Endorsements

"In his SuperConductor program, Manfred Clynes has created a unique interactive program which enables those who use it to discover the very nature of musical expression. …I believe this program marks a major breakthrough in our relationship with the essence of music! It is a revolution and a revelation."

Prof. Paul Robertson
Leader of the Medici Quartet

"Dr. Clynes' computer realized performances of the great masters of the past are unreservedly convincing. But his acutely sensitive realizations of my own music are no less than amazing. How, one asks, could a mere machine make decisions about the interpretation of my music which have eluded even the most careful, dedicated and experienced performers? …Clynes is a wizard whose important work must continue!"

Donald Martino
Walter Bigelow Rosen Professor of Music
Harvard University

"That's the beauty of these pulses.… Suddenly, there's no note that's not justified in the whole work."

Dennis Vaughan, conductor
AAAS National Meeting February 1993

"I have to concur with Maestro Simon's evaluation of the SuperConductor system…it has an unbelievably remarkable lack of artificiality to it. …I can only say, that I can't wait to have it available for my own realizations. I will finally be able to leave MIDI to mere sketching. …AI seldom delivers like this! It is, indeed, a breakthrough of monumental proportions."

Jeff Harrington
composer

"I am quite sure that SuperConductor really opens a new door to the understanding of music. My students like your work as well. It's so exciting!

Dr. Wolfgang Mastnak
Professor of Music
Hochschule für Musik und Darstellende Kunst "Mozarteum"
Salzburg, Austria

Welcome!

Congratulations on becoming part of a new revolution in music! SuperConductor is a breakthrough in music interpretation and performance giving natural, life-like expressiveness to computer generated musical performances. It is so revolutionary that it can be compared not to inventing the electric light, but to inventing the wheel in interpreting music.

As a registered user of SuperConductor, you are entitled to notification of software upgrades, technical support, and to special introductory offers on our upcoming products. We will be in contact with you to announce new opportunities and to solicit your feedback.

Printing of the original scores in perfect hardcopy is made possible by ScorePrint™, MicroSound's special inexpensive software.

Complete your masterworks collection with works available from MicroSound in the future.

We hope you discover the beauty and pleasure that is available to all through the music of the great composers. Enjoy!

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CHAPTER 1

Getting Started

Introduction

SuperConductor is radically new music interpretation and performance software that gives natural, life-like expressiveness to computer generated musical performances. Focusing on musical meaning, SuperConductor enables people of widely varying musical backgrounds to create and perfect music interpretations that are masterful in their quality and sensitivity.

SuperConductor software will operate on any high-quality Intel based computer with audio capability or Macintosh Power PC. An easy to use graphical user interface is provided which allows global control of expression functions. Through the use of the musical “microscore”, SuperConductor allows you to “conduct” the music of the masters with global control over expressive elements that create great musical interpretations.

For musicians and music students, SuperConductor provides the capability to sculpt truly satisfying performances of musical masterpieces. Individual instruments can be interchanged or deleted from a performance at will. This enables you to play with “music minus one”, but interpreted in your own way.

For composers and music producers, SuperConductor provides the ideal environment for realizing expressive music designed for “real” acoustical instruments without going to the expense and trouble of hiring and rehearsing an ensemble.

SuperConductor allows anyone to simply and easily create and enjoy truly expressive performances of great music on their computer - without needing any external device or synthesizers.

The Things You'll Need

The following items are enclosed in the shipping carton;

- **CD ROM**
- **User's Manual**
- **Information about other MicroSound International products**

System Requirements

SuperConductor requires a minimum system configuration containing the following;

- **IBM PC compatible computer**
- **500 MHz processor**
- **512 MB memory**
- **Windows 95, 98, NT, XP, Vista**
- **Sound Blaster Compatible sound card**
- **100 MB free hard disk space**
- **CD Rom Drive**
- **Audio monitoring system or head phones**

Recommended system enhancements include:

- **1 GHz or faster processor**
- **1 GB or more memory**

Owner Registration

Your purchase of SuperConductor entitles you to technical support, special introductory offers on new products from MicroSound International and notification of software updates. Software updates will be

published as the program evolves.

Please fill out and return the owner registration card. The information on the card will allow us to communicate more effectively with you and will enable us to serve you better in the future.

Installing SuperConductor

Like many other PC applications, SuperConductor is easy to install and configure. Follow the instructions below to install your software.

1. **Insert the CD-ROM in your CD ROM player**

   If the AutoRun feature in Windows 95 has been enabled, the installation will take place automatically. If this is the case, disregard the following steps. If not, go to Step 2 below.

2. **Select the "Run" item from the Windows "Start" Menu.**

3. **Type "D:SETUP", where D is the letter designating your CD ROM drive.**

   The installation continues under machine control. At several points during the installation, you will have to make choices about what gets installed and where. After selecting the desired options, all the chosen files will be copied automatically to the hard disk drive. This may take as along as five minutes if all the options are selected. The options are described below.

Install Samples to Hard Disk

Checking this option will cause all the digital audio files that are used to create the sounds SuperConductor makes to be installed on your hard drive. This will require approximately 60 MB of hard disk space.

This option should always be checked unless there is insufficient hard disk space. SuperConductor may not play at its highest sampling rate and best quality without the samples it uses being located on the hard drive.

Install Music Files to Hard Disk

This option is recommended if you don't want to insert the CD ROM each time music files need to be accessed by SuperConductor. Music files are the data that SuperConductor uses to create musical performances. This option will require approximately 108MB of hard disk space.

If this option is not chosen, music files can still be saved to the hard disk as you work with SuperConductor.

Install Score Files to Hard Disk

A musical score is a visual record of the composer's intention. Original score files are included with SuperConductor for display and for following the music. Checking this option will copy the scores for the pieces that are stored on the CD ROM to your hard disk during installation.

If this option is not chosen, SuperConductor may run slightly slower when displaying scores. The use of a quad speed or faster drive will improve performance when playing score files from the CD ROM.

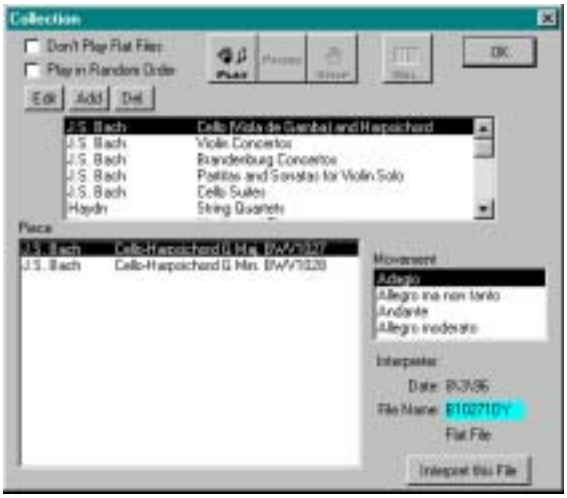
Starting SuperConductor

We think that you will find SuperConductor to be simple and easy to use. To run SuperConductor, double click on the SuperConductor icon, or choose SuperConductor from the Programs Menu. To learn the details of SuperConductor's functions, see the "How to Use SuperConductor" section of this manual.

Playing Music

To get a quick start on hearing the magic of SuperConductor,

Click on the Collection icon.



The Collection window appears.

Click on a collection of the composer you wish to audition.

The pieces in the selected collection are listed on the left. The movements of multi-movement pieces are listed on the right. Click on the piece you wish to play.

Click on the Play Icon.

The Concert Feature.

Another simple way to hear SuperConductor's amazing interpretive abilities is to use the Concert feature. When starting up the program, you will notice a large "Play Concert" pad appears in the middle of the SuperConductor window. Click on the pad to activate the Play Concert window. This window contains collections of works selected to be heard together in sequence. To find out more about the Concert feature, see "Concert" on page 90.

Technical Support

If you have some problem using SuperConductor that can't be resolved by reading the manual, contact MicroSound International at (707) 939-1566, Monday through Friday between 9 AM to 5 PM PST.

CHAPTER 2

Introduction to SuperConductor

This chapter contains a basic overview of SuperConductor; what it is and what it can do. Also introduced are the basic musical concepts that help to understand how SuperConductor works. Tutorials are included to get you started with using SuperConductor to make your own performances of great music.

The Computer Music Problem

When the subject of computer generated music comes up, many people think of the random beeps and glides that we all associate with the robotic depictions of the science fiction cinema or the early attempts of academic computer musicians in the 1960's. Those early pioneers were using instruments like main frame computers programmed with paper tape and crude analog synthesizers like the first generation Buchla and Moog instruments.

While interesting on an experimental level, these first attempts didn't come close to the emotionally expressive capabilities of even an intermediate level performer on any of the established acoustic instruments like piano, guitar, violin, flute, etc.

Acoustic instruments generate their tone by turning energy input by the performer into sound. The interface for these instruments - the fingerboard and bow, the keyboard, the reed and mouthpiece - are inherently very responsive to changes in the performer's input. So much so that even thinking differently can affect the tone quality of the instrument, the timing of the music, or the "shape" of the note being played. Skillful artists use this flexibility to express the manifold moods and emotions which are possible in the music being played. Being able

to control and then intelligently use this wide expressive range is the work of artist/performers in music. Traditionally, computer based music has been unable to achieve this level of expression or, if approaching it, required a huge amount of programming time and computer power.

In the last ten years, much progress has been made in the field of computer generated music. In 1985, it became possible to connect analog synthesizers to computers via MIDI - the Musical Instrument Digital Interface. The advent of MIDI and the availability of cheap personal computers caused an explosion of participation in computer music, which for decades, had been the reserve of the academic elite. The increase in quantity of machine made music didn't do much for the quality of its emotional expression, however. The nuances characteristic of traditional acoustic instruments were either still out of reach of digitally controlled instruments or required vast amounts of programming time.

A notable attempt at giving digital synthesizers the expressive control of acoustic instruments was the introduction of the Yamaha FM synthesis instruments. This type of digital synthesis allowed for a wide range of real time control of loudness and tone color through the use of interactive programming and human interface innovations like the breath controller. With this device, the performer could use the breath to shape the notes s/he created. These instruments were the first successful attempt by electronic instrument manufacturers to give players the tools they needed for real musical expression. FM synthesizers were particularly good at emulating plucked and struck strings, wind instruments, and percussive sounds. They were a real improvement, but still required an experienced human performer and hours of programming time to create the basic voices of the instrument.

About the same time as MIDI became available, sampling synthesizers (samplers) hit the scene. These instruments digitally recorded the sound of live instruments and played those recordings back on command. Each note in the range of an instrument could be recorded and assigned to a separate key on the sampler's keyboard. This enabled the performer to reproduce the sound of a Stradivarius or a Steinway at the touch of a switch. By loading other "samples" into the instrument, the performer could emulate the sound of any instrument including the human voice.

While better than the earlier analog simulations of real instruments, samplers were still limited by the size of their memory spaces and by the fact that they were playing back recordings - fixed musical events, not

living, breathing tones generated by the player. They could only hold a limited amount of recordings and were therefore limited in the amount of nuance they could provide. Many schemes involving audio filters and amplitude shaping envelopes were used to give the player some control, but these adjustments took large amounts of programming time to arrange and an equal amount of time to learn in performance. Skilled electronic musicians became one part programmer, one part player, one part recording engineer, and one part composer. One could argue that it would be easier (and perhaps ultimately more satisfying) to spend the time learning to play a "real" instrument!

The latest development in computer synthesis is called physical modeling synthesis. Instruments designed around this technology literally model or emulate the physical characteristics of real instruments by using huge amounts of computer power. This results in very credible imitations of real instruments and the possibility of making expressive "virtual" instruments. Unfortunately, the time necessary to master the playing of the synthesized instrument is almost as long as with the real one. Again, a high level of dedication and mastery of technique is required.

Wendy Carlos' achievement in "Switched On Bach" (1968), her landmark realization of Baroque masterpieces using analog synthesizers and multitrack tape recording techniques, can today be executed with ease using any off-the-shelf multi-timbral synthesizer / workstation without the use of recording media, external computers, or hundreds of person / hours of work. The technology of today makes the creation of computer music easier than ever before. But the critical element of musical expression is still out of reach of machine made music. That is, until now.

A New Possibility In Music Making

SuperConductor is a completely new way of making music. Using the power of today's desktop personal computers, SuperConductor removes the traditional impediments to creating satisfying musical performances of the great music of Western Culture. By using a unique and powerful technology (based on the seminal discoveries of Manfred Clynes), SuperConductor can create an artistically valid performance of any piece of music from the European Common Practice period - the time from the early 14th century to the present. It is now possible for a person who has no skill at playing an instrument to experiment with the

nuances of music interpretation - those elements of music performance normally available only to master instrumentalists, without having to learn to play.

Normally, one would have to invest at least five to ten years of practice and study to be able to play the violin at a level sufficient to enjoy the pleasures of playing chamber music or to participate in a community orchestra. With SuperConductor, anyone can create performances of famous violin pieces (or music for any other instrument or combination of instruments), vary the style and expression of the performances and record the output, without ever setting bow to string. All the instruments of the orchestra and chorus can be "played" with outstanding musicality using SuperConductor's simple controls. This freedom from the drudgery of practice allows for experimentation and discovery in the area of music interpretation - the creation of emotional content and meaning in music. It is now possible for laymen and students to develop the sensibilities of skillful artists without decades of practice and study.

SuperConductor Features

- SuperConductor requires only a fast Intel-based computer and a Sound Blaster™ compatible sound card or equivalent internal hardware to operate.

- No MIDI equipment is required. SuperConductor is completely self contained. The soundfiles that are used to "perform" the music are included with the application software.

- Allows for independent global control of the basic parameters that shape the performance of the music. Eliminates the hours of programming required to produce musically expressive results using MIDI or other computer based systems.

- The Collection feature plays programmed sequences of musical selections from SuperConductor's library. It is also the quickest way to select and play a piece from SuperConductor's music library. Hundreds of pieces are included with the program which can be arranged in an unlimited variety of sequences. Important pieces of the Great Masters which are not currently on your hard disk can be added later as you increase the size and scope of your Collection.

- The SuperConductor program and music files take up a tiny fraction (typically 1/500th) of the hard disk space of the equivalent amount of .wav files.

- The very best sound resources are used in SuperConductor, insuring the highest sonic quality. Samples include Stradivarius violins, Steinway and Boesendorfer pianos, and other instruments of the highest caliber.

- SuperConductor allows the use of custom sound samples. Include instruments of your own design - even your own voice!

- Easily enter your own musical scores into SuperConductor and let it perform them expressively with all the details of your own interpretation on your desktop.

SuperConductor is a revolution in computer generated music. For the first time, the computer can generate a truly musical and "intelligent" performance of the great music of the past, or of newly composed music, with full control of the essential expressive elements given to the "interpreter". By separating the interpretive function from the mechanics of performance, SuperConductor allows anyone to participate in the making of great music.

Basic Concepts in Music

Before you can understand how SuperConductor works and how to create your own musical interpretations, you need a basic understanding of how music itself works. The technology on which SuperConductor is based wasdeveloped by Dr. Manfred Clynes, distinguished neuroscientist and musician. It is an outgrowth of a new understanding of how emotions and emotional qualities are generated and expressed. This field of research, the study of sentic form applied to music, is highly revealing and rewarding in its implications for anyone who wishes to participate in music making. We won't be going into the details of the science of sentic forms but references to this subject can be found in Appendix C. The next section deals with the basic conceptual groundwork needed to understand how SuperConductor works.

What is Music?

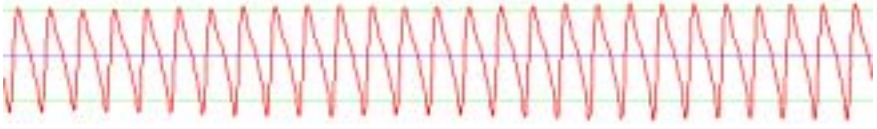
This has been an open question for hundreds of years. Many people assume they know what music is, but when they inquire thoughtfully, realize that the subject is and difficult to talk about. It has been said that music expresses that which is inexpressible in words. For the purposes of this discussion, we will consider music as organized sound which expresses and discourses about human emotion and relationship.

The Parameters of Musical Sound

Before we get into the world of emotional expression through music, there are a few basic concepts and terms which should be understood. The terms explained below will be the foundation for the discussion on how music is created and how SuperConductor works.

Pitch

Sound can be described as rapidly changing pressure waves in the air. When these pressure waves are regular and constant in wavelength, we say that the sound has a pitch. Pitch is the musical quality which gives a sound it's particular note on the musical scale. Instruments like cymbals and snare drums have little or no pitch because their sound output is largely random noise. The trumpet has a well defined pitch because almost all of its sound output is regular and coherently aligned in time.



Trombone playing a high pitch

Trombone playing a low pitch

A low pitched instrument creates sound waves with longer wavelengths and fewer vibrations per second than a high pitched instrument. Examples of low pitched instruments are tubas, basses, trombones, and male voices. Examples of high pitched instruments include piccolos, violins, flutes, and female voices. Instruments that have a wide range of pitch include the piano, the organ, the harp and harpsichord.

The human brain has the ability to think a pitch without it being sounded. This ability to imagine a tone allows us to think musically.

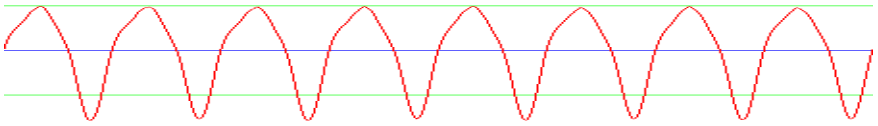
Duration

Musical sounds all have a beginning, a middle, and an end. The length of a sound from beginning to end is its duration. The duration of sounds and the silences in between sounds are used by musicians to create the most basic musical element - rhythm. Subtle adjustments in the duration of musical sounds and the silences in between them are among the materials used by musical artists to create great performances.

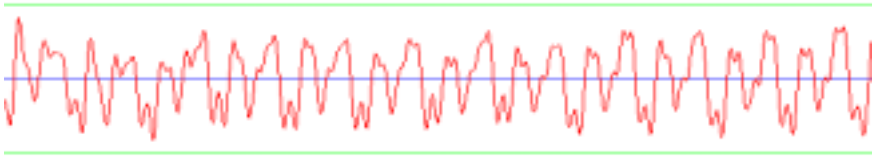
Timbre

Pronounced tám-ber, this term refers to the basic tone color of a musical sound. In the visual world, the color white is composed of all the colors of the spectrum added together in equal amounts. Tone color or timbre can be described as the spectral composition of a musical sound.

Musical sounds are composed of their basic pitch and a series of overtones and noise that are mixed in with the basic pitch. (An overtone is a pitch that is (usually) harmonically related to the fundamental pitch of the sound.) A sound that has a pure tone with few overtones or little noise added is said to have a rather less colored timbre. Examples of instruments that have a less colored timbre include the French horn, the tuba, the harp, and the flute. Instruments that can be described as having a rich timbre, in other words having many overtones and noise in the sound, include the violin, cello, trumpet, oboe, and bassoon. Described another way, the vowel sound “u” as in “flute” has a pure colored timbre. The vowel sound “ee” as in “meet” has a rich timbre.



Pure, less colored timbre: Flute playing C4



Rich, highly colored timbre: Violin playing C4

Loudness

The loudness of a sound is an obvious parameter. Music can be played loudly or softly or an infinite number of gradations between the two extremes. More importantly, the subtle differences in loudness between one tone and another in a sequence often carry important information that gives the music its meaning and structure. Even *within* one note, changes in loudness shape the expressive qualities of the music. (See Chapter 3: The Basics of Music Interpretation for a discussion of SuperConductor's predictive note shaping technology.)

Location

Location is the subjective assessment of the apparent source of the sound. Composers often use the location of various instruments as an expressive element. Examples include off stage trumpets, choirs, and marching bands, stereo pans of lead instruments in a mixdown, and any other expressive use of changes in sound source for artistic effect. Every piece of music is affected by how its various instruments are distributed in space.

Emotion and Meaning in Music

Over the centuries, all the cultures of the world have developed musical languages. In the Western cultures, as in most others, musical language developed from song and dance. These simple forms became more and more complex over the last millennium resulting in the rich palette of colors and textures that we know today. But what is it that makes the best music emotionally expressive? What are the underlying principles in the structure of the sounds musicians make that contain the essence of the emotion being communicated?

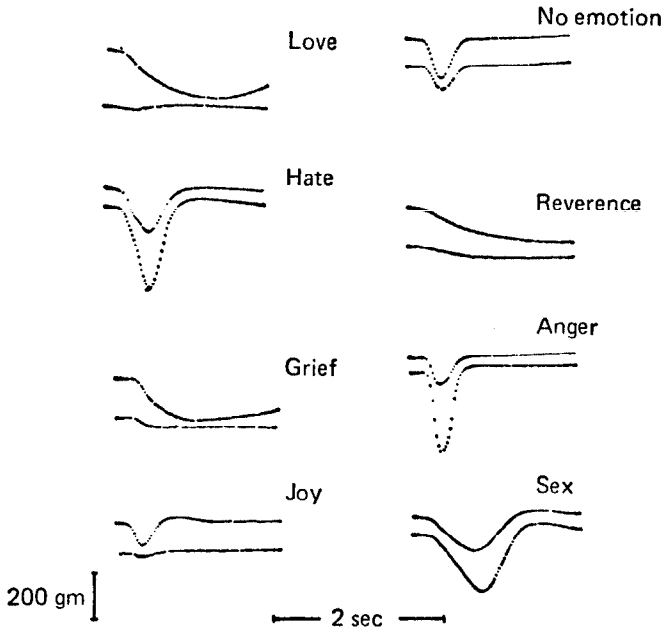
Sentic Form

Underlying all emotionally expressive actions are fundamental time based physiological entities known as sentic forms. Sentic form is a property of the central nervous system - the biologically evolved language of emotional communication. It is the unconscious precursor for the generation, perception, and communication of emotional qualities. It is common to various sensory modes (seeing, hearing, touching), and in a sense more primary than any one of them.

Sentic form is biologically given and appears to be genetically preserved. In research involving hundreds of subjects from various cultures, Clynes determined that the basic expression forms of anger, love, sex, hate, grief, reverence, etc. are common to people of many cultures. That is, the biological basis of the way people express the various emotions is the same across cultures and time. In music, dance, and art, sentic form may be represented through various culturally determined parameters. In Western music, sentic form is embodied in the sound mainly through the pitch, loudness and timing of musical tones, the fine structure of melodies as thought and performed.

This is the reason why music written four hundred years ago can move us deeply today. Great music has always been shaped by the basic forms inherent in the experience and expression of the emotions. Since the biologic basis of the experience of emotion for people is similar over time and culture, music that incorporates sentic forms in its design can truly claim the title - “the universal language”.

The illustration below shows graphic representations of various sentic forms. These forms were derived from the measurement of the finger pressure of subjects asked to generate the various emotions.



For more information about the science of sentics and how it applies to music, see "Sentics: The Touch of the Emotions" by Dr. Manfred Clynes, originally published by Doubleday and Co. Inc and now available in a new reprinting by Prism press (see Appendix C, p199).

The Double Stream of Music

There are many theories concerning the nature of musical language. The theory that underlies SuperConductor is called the *double stream theory*. It can be said that music, particularly Western classical music, is composed of a double stream or flow, simultaneously processed by the listener.

One stream is the unfolding story of the music, the second is the iterative subtle character of the beat, or the pulse. If the first stream tells us the story, the second stream tells us who is telling the story. Meaning in the music is created by combining both streams.

Different styles of music emphasize the two streams differently. Rap music is almost completely dominated by the pulse. The "feel" of different "grooves" produced by rap and rhythm and blues artists are very characteristic and identifiable. On the other extreme is Gregorian chant, an impersonal other-worldly expression of the story element in music. European music of the 18th and 19th centuries is a balanced blend of both streams.

Notably, much of the present day avant garde (academic) music has lost the pulse as a separate stream. (This tendency seems to have originated to some degree with the "impressionistic" music of Debussy.) Folk music and most ethnic music show a fine balance between the two streams. The pulse here expresses the ethnic identity, rather than the composer's, and the microstructure of the ethnic pulse appears to be related to the rhythmic fine structure of the spoken language.

Musical Structure

Working inside the definition of music as organized sound which expresses human emotion, the question arises, "How is music organized?" Sounds can be assembled in seemingly random patterns that contain no meaning or they can be composed into emotionally eloquent musical statements. What are the elemental components of musical thought and how do they relate? The next section deals with the structural issues that make up musical language in the Western tradition.

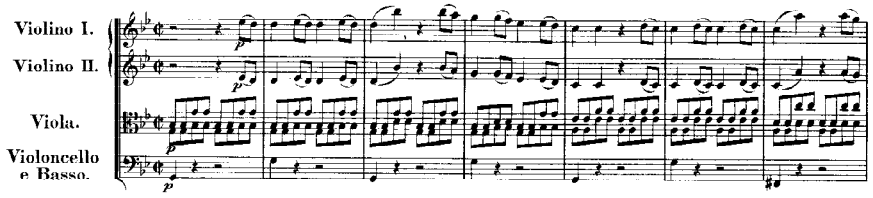
Melody and Harmony

Musical sounds are represented on paper as notes written on the musical staff. (See illustration below.) Each note represents a particular pitch sounded for a particular duration. The vertical distance between one note and the next note adjacent to it is called a melodic interval. The larger the melodic interval between notes, the greater is the difference in

their pitch. Notes that are played one after the other often form a melody.

Notes can also be stacked vertically to make chords. Chords are groups of notes which sound simultaneously. The vertical interval between notes in a chord is called a harmonic interval. Notes that sound together often form a harmony.

Simple forms of music often contain a melody which is being played over a harmony. This means that some instruments are playing a series of notes which are related to one another by melodic intervals (the melody) while other instruments are playing groups of notes sounding simultaneously with each other (a harmony). The illustration below shows the resignedly lamentful begining of the first movement of Mozart's Symphony #40, where the top two lines are the melody and the lower lines flesh out the harmony as well as create a restless anxious rhythm.



Follow the steps below to hear SuperConductor play this piece.

1. **Start SuperConductor**
2. **Click the Open icon.**

   The Open File window appears.

3. **Select the D:\MSC\MOZART directory and then the file M5501.**
4. **Click on the OK button.**

   SuperConductor loads the file.

5. **Click on the Play icon.**
6. **Click on the Start Play button.**

   SuperConductor plays this movement. The First and Second Violins play the melody, while the Violas, Cellos and Basses play the harmony.

Rhythm and Tempo

Musical rhythm is a pattern of strong and weak elements in the flow of sound and silence in music. The rhythm of a musical expression can derive from natural breathing rhythms, speech rhythms, dance rhythms, be an analog to sentic form, the wind or rain, or can be designed independent of such imaginative influence.

Underlying the flow of rhythms in music is a grid of silent time entities (repetitive initiations), called beats, upon which performers organize the beginnings and endings of notes and silences. The rate at which the beats occur is called the tempo. Tempos in music typically range from about 40 beats per minute up to 180 beats per minute.

Music as a Story

Now that the basics of melody, harmony, rhythm, and tempo are in place, the question of musical structure arises. How is music put together? What are composers thinking about when they create a piece of music?

Music is the most abstract of the arts and, as such, is perhaps the most difficult to describe. One good metaphor for music is “music as story”, the aforementioned *first stream*. Viewing music this way gives us access to the basic architectural elements of musical structure.

Consider that music is a story which is either sung or danced. Like other stories, it can be divided into chapters (movements), which are composed of sections (called exposition, development, recapitulation, coda, etc.. depending on their function). As in the written word, musical sections contain paragraphs (subsections) which are composed of sentences (themes), which contain phrases (phrases), composed of words (motives), made up of syllables (notes). The table on the next page shows this hierarchical arrangement of musical and literary structure.

Similarity of Structure in Two Linear Art Forms

In Literature	In Music
Novel	Piece
Chapter	Movement
Section	Section
Paragraph	Subsection
Sentence	Theme
Phrase	Phrase
Word	Motive
Syllable	Note

CHAPTER 3

The Basics of Musical Interpretation

Introduction

When composers create music to be played by acoustic instruments, they imagine the music in its full blown form, with all the nuance and power of the artistic expression intact. They then notate the music, using a standard form of written notation, which reduces the living sound to symbols on paper - much like writing down a spoken conversation. The result of this notation process is called the musical score. The score is the *barest skeleton* of the composer's original musical thought and intention. Like the script of a film or play, it is merely a sketch of the whole that the composer imagined when composing the piece.

The problem with notating music is that the notation cannot carry enough information to adequately record the emotional expression and its shades in the music. For example, composers have only 8 symbols to record overall loudness (ppp, pp, p, mp, mf, f, ff, fff) and 2 symbols to record changes in loudness (< and >). In digital terms, this is a 3 bit resolution and doesn't come close to the level of subtlety necessary to record all the nuances of artistically expressive playing. Even if there were a way to clearly write down the actual sound of the music moment to moment, the mental investment it would take to learn and play from that notation would overwhelm the performer.

The job of the performer, then, is to turn the musical score back into the original musical expression. How do performers turn lifeless dots of black ink on paper into the living sound that the composer intended? They add their own interpretation to the basic facts of the music sketched by the composer. Training in the art of "correct" musical interpretation is the work of the music conservatories around

the world. The essence of what is individually rediscovered by each student is (hopefully) the "right stuff", which when applied to the raw score, results in an authentic re-creation of the composer's original intentions, his musical thought and brings the music to life.

What is it that is added to the notated music that makes the difference between the wooden performance of a beginner and the eloquent performance of a master? What the performer adds to the written score to reconstitute the living music is called the microscore.

The Microscore

When we speak, we add inflections of pitch, loudness, duration, and tempo to our speaking to bring out certain emotional qualities and communicate a context which shapes how the listener hears our words. Consider the sentence:

"I told you so."

There is a broad range of ways in which these words could be spoken. In the hands of a great actor anything from playful sarcasm to damning self-righteousness can be expressed using these words. It could be said that the difference between the various readings is the actor's interpretation or the meaning he/she is assigning to the basic script. How these differences in meaning are communicated is through changing the rhythm and tempo of the speech, adding inflections in pitch while speaking, and creating variations in loudness while delivering the line.

These are the same parameters which are varied in interpreting a musical phrase or sentence. In playing a piece of music, an expert performer introduces slight variations in the speed, duration, and loudness of the notes, depending on which beat they are played and in which section of the phrase or theme they belong. With a master performer, these variations are intentional and are different for each composer and musical style. This subtle rhythmic framework encompasses the hierarchical pulse of the music and gives the music its characteristic feel.

In addition to rhythmic variations, good performers shape the notes they play by changing the loudness of the beginning, middle, and end of the notes to give them meaning. The phrase, "He can make that instrument talk." is a reaction to a great performer's abilities to shape the notes in meaningful ways.

Finally, a master interpreter of music uses various other effects to add meaning to musical expressions. These effects involve controlling the placement, speed and contour of vibrato (periodic modulations of pitch and loudness to add conviction and "warmth" to a note), the contour of crescendo or diminuendo (the increase or decrease in loudness over the length of a musical phrase, sentence) or section), and the speed and contour of ritardando or accelerando (the increase or decrease of tempo over the length of a musical phrase or sentence).

The next sections of this chapter explain each of these parameters in detail.

Hierarchical Pulse

To understand how hierarchical pulse operates in music, we need to draw a distinction between the notion of absolute time and musical time. The kind of time that physicists talk about flows smoothly and continuously from the past into the present towards the future. It is the paradigm of time that we use to organize our activities and measure physical reality.

Musical time is subjective. Our personal perceptions vary with our internal states. Tempo and "feel" in the music require fluidity of flow. Master musicians intentionally warp the musical flow of time - that is, they change, moment to moment, the length of otherwise equal notes, motives, and phrases to add emphasis or create mood. In addition to stretching and compressing time, they also play some notes and phrases louder than others in the same sentence. This particular time/amplitude warp is what is referred to as the hierarchical pulse.

It has been demonstrated that the musical "presence" of the personality of a composer can be evoked through the masterful shaping of the flow of time and amplitude in a piece of music. (See the research references in Appendix C.) The illustration below is designed to demonstrate this. It is an excerpt from the Bach Cello Suite in G Major composed of continuously flowing notes of the same written duration. Follow the steps below to hear how this excerpt sounds when played precisely as it is written.

1. **Start SuperConductor.**
2. **Click on the Open icon.**

3. **Click on the D:\MSC\BACHCELL directory and then double click on the B10071 file in the display area in the bottom half of the window.**
4. **Pull down the Edit menu and select Flatten File.**
5. **Click on the Play icon and the Start Play button to begin play.**

This "performance" could be characterized as wooden or mechanical sounding. Each of the time units (sixteenth notes) in the piece were played with precisely equal length and emphasis. All the notes were also played with the same level of loudness as well.

To hear the effect of Bach's hierarchical pulse on the interpretation of this piece, do the following steps.

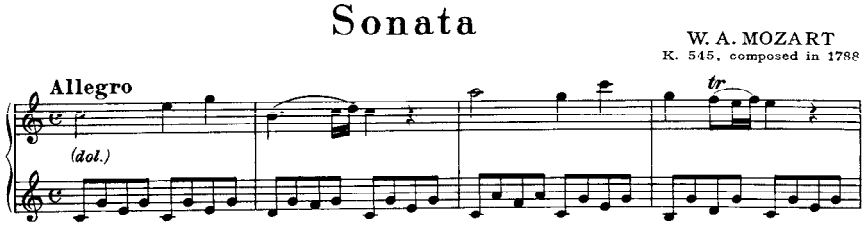
6. **Click on the Stop Play button.**
7. **Click Cancel to dismiss the window.**
8. **Pull down the Edit Menu and select Unflatten File.**
9. **Click on the Play icon and begin play again.**

In this performance, the music comes alive. The natural ebb and flow of time and amplitude give the cello line an expressive and emotive character consistent with the aesthetics of Bach. Adding the composer's characteristic pulse allows the music to take on most of the characteristics of a live performance.

10. **Click on the Stop Play button.**
11. **Click Cancel to dismiss the window.**

How does hierarchical pulse work?

In the last chapter, musical structure was explained in literary terms. Each section of a piece of music can be divided into paragraphs, sentences, phrases, words and syllables. Since these elements occur in time and in meter, we can divide the music up into blocks of time called bars. In other words, a musical sentence could contain eight bars of music, divided into two phrases of four bars each. (Another word for bar is measure. The two terms are used interchangeably.) Each bar of music contains a fixed number of beats, usually two, three or four beats per bar. The illustration below shows a musical sentence of four bars in length divided into two equal phrases of two bars each.



The hierarchical pulse is often long enough to contain a whole four or eight bar phrase. Some bars are emphasized and others are weak. This level of the pulse is called Level 1 and its basic organizing unit is on the scale of one half to several bars.

A typical Bach pulse containing 8 bars in Level 1.

Inside or underneath this level is Level 2. This level of the pulse deals with the beats inside each bar. In most music, some beats are stronger than others in the bar. In the waltz, which has three beats in each bar, the first beat is strong and the next two are relatively weak. This accounts for the "oom-pah-pah, oom-pah-pah" feel of that dance. In contrast, the polka has two beats per bar, the first being stronger than the second. Most music typically has from two up to twelve beats per bar.
The lowest level of the hierarchy is Level 3 which deals with the notes *inside* each beat. Typically each beat is divided into three or four sub-divisions. As before, each note gets a different emphasis depending on

its order inside the beat. Notes in the score which are shorter in duration than one third or one fourth of a beat are played inside the time warp for the basic unit of Level 3.

In the finished pulse setting for a composer, all three levels are functioning simultaneously. Starting on the first sub-division of the first beat of the first bar, and proceeding sub-division by sub-division through the music, time and amplitude are warped to a greater or lesser extent as a function of the combined effect of the three levels at the current instant. The details of how to configure your own pulse settings is discussed in the next chapter "How to use SuperConductor".

Predictive Note Shaping

Another aspect of the microscore which is critical to fulfilling the potential locked within the score is note shaping. While playing a melody, master performers vary the loudness contour within each note to bring out the emotional meaning they are expressing. They are creating an amplitude envelope for each note. This shaping of the notes in a meaningful way greatly helps to achieve musicality, the subtleties of which musicians refer to as good "phrasing and articulation".

To hear the effect of removing SuperConductor's predictive amplitude shaping, follow the steps below.

1. **Click on the Open icon.**
2. **Choose the D:\MSC\BACHCELL directory and then double click on the B10071 file in the file window to open it.**
3. **Click on the Shaping Icon.**

   The Note Shaping window appears. Select the first item.

4. **Click on the Modify command button.**
5. **Check the Show Notes check box.**

   The window now displays the shapes of the notes in the piece. Note how each note is shaped differently.

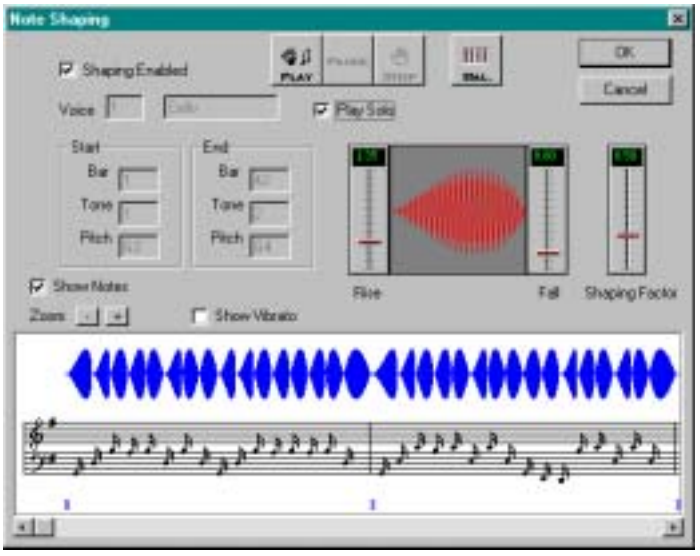
6. **Adjust the Rise and Fall sliders to read 0.00.**

   This causes each note to be played without shaping. Note the change in the note display.

7. Click on the Play button to begin play.

In this example, the absence of note shaping produces a "computerized" character to the melody reminiscent of MIDI performances.

8. When you've heard enough, click Cancel to stop the music and return the settings to their original values.



In SuperConductor, predictive amplitude shaping of notes works by causing the amplitude envelope of a note to be altered depending on what tone follows it, and when. Note shaping alters the meaning of the music and the listener's experience of the emotional and intellectual content in the music. The shape of the note is skewed to an extent that is determined by the slope of the pitch-time curve, drawn from the present note *to the next note.* In other words, SuperConductor measures the melodic interval between the notes and the amount of time between the notes and calculates the rate of change. This figure is then used to alter the shape of the envelope which shapes the present note. Because this pitch / time slope is constantly changing as the music unfolds, the shape of the notes is forever new. This process empowers one to realize the composer's original design for "phrasing and articulation", in subtlety and organic variety, as understood by master performers.

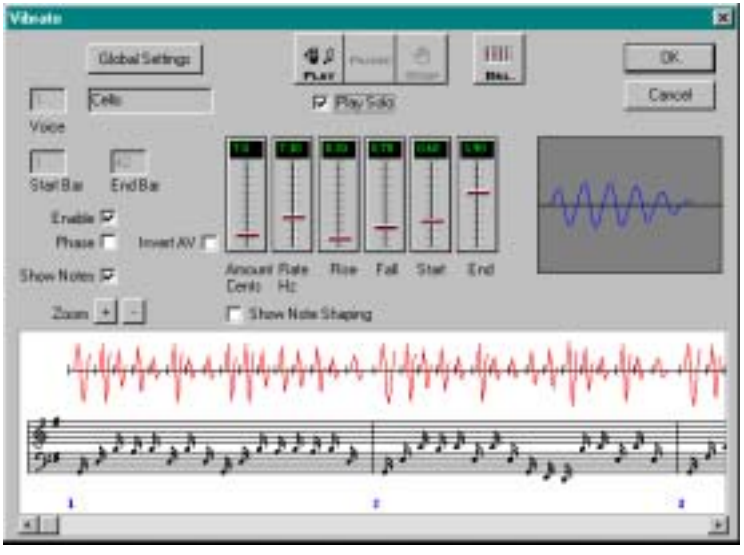
Vibrato

On many instruments, playing a long perfectly stable tone produces an unattractive result. Players often add a touch of vibrato (vih-bráh-to) to provide warmth and eloquence. Vibrato is a relatively quick (5 to 8 times per second) modulation of either the pitch or the amplitude of the note being sounded. Vibrato is often applied after a note starts and has sounded for a time and may end before the note ends. Vibrato is usually introduced gradually, in coordination with the shape of the note and has an envelope different from the note shaping envelope of a note. Especially effective on longer melodic notes, it is used judiciously by the best players to create warmth and persuasion and to bring out the line they are playing from the general texture of the music.

Like the other interpretive elements, vibrato can create and enhance, or destroy musical meaning depending on how it is applied: with SuperConductor it can be globally and organically applied, giving it appropriate organic variety suited to the particular music.

Play this example to demonstrate the use of vibrato.

1. **Open the D:\MSC\MOZART\M3701 file.**
2. **Click on the Vibrato Icon.**
3. **Select Voice 1 and click on the Modify button.**



4. **Click on the Bal. icon.**

   This causes the Instrumentation, Balance and Panning window to appear.

5. **Click on the word "Oboe" in the Instrument field for Voice 1.**

   A menu of instruments appears.

6. **Click on Trumpet.**

   You have just changed Voice 1 from an oboe to a trumpet. We are using the trumpet for this example because it has absolutely no vibrato in the raw sample.

7. **Click OK to dismiss the window.**

8. **Check the Play Solo check box under the Play icon.**

   This solos Voice 1 and mutes all the other voices.

9. **Click the Play icon and begin play.**

   Notice the use of vibrato, especially on the longer notes.

10. **Stop play and uncheck the Enable checkbox at the lower left of the window.**

    This disables all vibrato on Voice 1.

11. **Click on the Play icon to hear the result.**

    The trumpet sound takes on a mechanical quality.

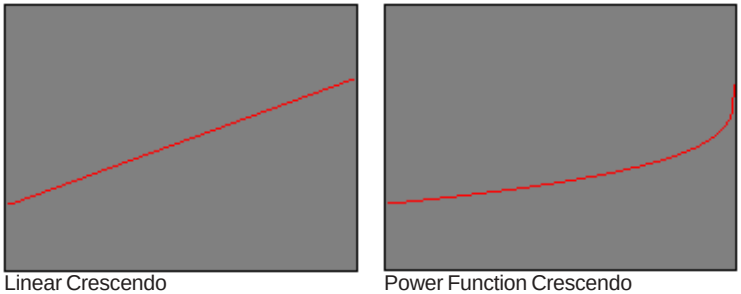
12. **Check the Enable check box.**

    After a short time, vibrato is added to the tone making it sound more lifelike.

13. **Click OK to dismiss the Vibrato window.**

Crescendo/Diminuendo

These Italian terms refer to the gradual increase and decrease of loudness of music. A crescendo (creh-shén-doh) is a gradual increase in the loudness of a part or all of the music and is often used to increase the intensity of expression. A diminuendo (dih-mih-nu-én-do) is a gradual decrease in the loudness of the music. Both crescendos and diminuendos have a contour to them. The illustration below shows the difference between a linear contour and a power function contour in a crescendo. The audible effect is quite different.



Linear Crescendo

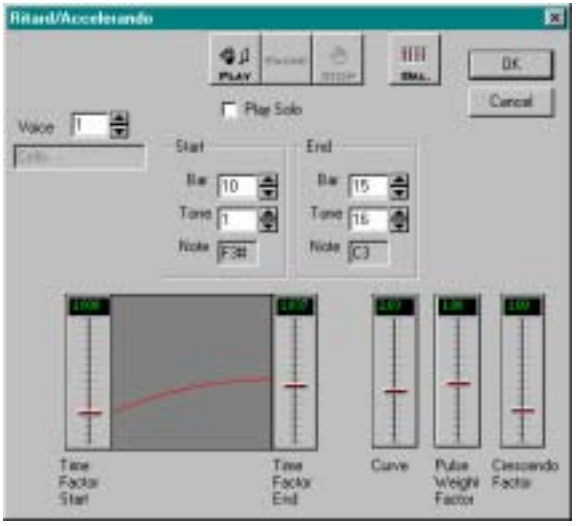
Power Function Crescendo

Crescendos and diminuendos can be applied to one instrument's part or to the whole musical texture. Details of using SuperConductor's crescendo / diminuendo functions are discussed in the reference section of this manual.

Accelerando/Ritardando

Also Italian terms, these refer to the gradual increase and decrease in speed of the music's tempo. Pronounced (ack-ceh-ler-áhn-doh) and (ree-tar-dáhn-do), they can be used to increase and decrease the excitement of the music and for structural demarcation, such as slowing down at the end of a piece or section. Like crescendos and diminuendos, accelerandos and ritardandos have a contour. Ritards and accelerandos can be composer specific; that is their shape and "weight" are often a function of the style of music in which they are used.

The illustration below shows SuperConductor's Ritardando / Accelerando window. It is virtually the same as the Crescendo / Diminuendo window because what is being controlled is the contour or envelope of a gradually changing parameter - tempo in the former case, loudness in the latter.



What is the "right" interpretation?

Throughout history, teachers have tried to pass down to their students "true" methods of interpreting the great music of our culture. Until recently, it was unclear what was being taught or not taught that could give access to deeply musical performances of the great composers. Every great performer finds his own insights into those "secrets" to musical meaning. Authentic performances cannot be derived by copying what others do or have done. With the discovery of the microscore functions, it is now possible to distinguish elements of meaningful interpretation and teach them consciously.

In 1989 - 1993, Dr. Clynes conducted research on his landmark discovery of the hierarchical pulse. Through this research, it was demonstrated that recognized masters of the art of musical interpretation found the composer's pulse more true to their ideal of the music than other composers' pulses. (See references in Appendix C.) This confirms that the imprimatur of the composer can be sought in the hierarchical pulse

as well as the technical elements of the music composition. Having the composer's pulses available as a resource in SuperConductor allows for easily zeroing in on an optimum personalized interpretation, and allows for manifold valid and authentic interpretations using the many parameters available in SuperConductor for interpretation, each bringing out different aspects of meaning.

How is the composer's pulse determined?

Since the combined warping of time and amplitude in the pulse is subtle, it is not possible in effect to simply analyze the performance of a great artist to determine the pulse used in the performance. The existence of the composers' pulses included in SuperConductor were discovered with the aid of sentographic input from artists Rudolf Serkin, Pablo Casals, Murray Perahia, Yehudi Menuhin and others of world class stature. The numerical values were determined by starting with a general approach to a composer's music and gradually refining the settings by ear to fit several examples of that composer's music. This process, if done by a person with deep understanding of the composer in question, is convergent and results in pulse settings which apply generally to that composer's music.

It should be noted that some composers do not appear to have a characteristic pulse at all. That is, their music is not based on the same kind of lyric and rhythmic premises as composers whose music have a clearly definable pulse. Music which is based primarily on tone color and sound effect rather than regular structures of melody and harmony may not have a hierarchical pulse per se. In SuperConductor, the user is free to change all suggested pulse parameters to his own liking. Future versions will contain updates of suggested composer's pulses, refinements of existing pulses and new composer's pulses.

To hear the results of applying the wrong pulse to a composition, follow the steps below.

Open the file named D:\MSC\MOZART\M3701.

Click on the Pulse button.

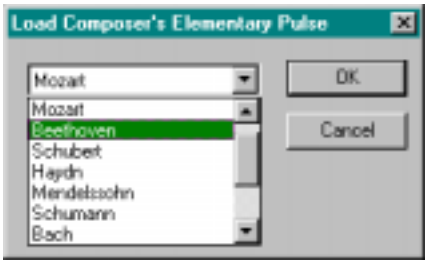
The Current Pulse Settings window appears.

Click on Play. Listen for the characteristic feel of the music.

Click on the Config. Pulse button.

Click on the Load Composer's Basic Pulse button.

This brings up a menu of composer's pulses which come preset with SuperConductor.



Click on the popup menu and choose Beethoven.

Click OK and then click OK on the Pulse Configuration window.

The new pulse is applied to the piece.

Click on the Play button.

Notice the distinctively different feel of the music. The application of a foreign composer's pulse gives the piece an almost ridiculous quality.

This concludes the chapter on the Basics of Music Interpretation.

CHAPTER 4

How To Use SuperConductor

This chapter describes how to use SuperConductor to create your own interpretations of the great composers' music. More than one hundred works are included with SuperConductor. You can also input your own music. The topics covered include basic information about the interface, a tutorial on making an interpretation from scratch, and a description of all the menu functions.

The Basics

Using Commands

Commands in SuperConductor are chosen in the same way as in other Windows applications: by using a menu in the menu bar, clicking on an icon or button, or using keyboard command equivalents.

Using a Dialog Box

As in other Windows applications, a dialog box can contain scroll lists, pop-up menus, radio buttons, command buttons, check boxes, and text boxes. This section describes features of various dialog boxes with which you might not be familiar.

Pop-up Menus

To choose from a pop-up menu, click on the menu, hold down the left mouse button and point at your choice. When you release the mouse, your choice will be showing in the menu. Alternately, you can click on the menu and then click again on your choice. If your choice is not showing in the menu because it isn't fully displayed, drag the mouse down through the menu while holding down the mouse button. This will cause the menu to scroll. If you change your mind about choosing from the menu, drag outside the menu before releasing the mouse button.

Sliders

To use a slider, drag the thumbwheel (the actuator handle) with the mouse, or click in the scale of the slider. The thumbwheel will move to the location where you clicked. As the thumbwheel moves, the numbers in the text box will change accordingly. You can also type in the text box by selecting the text using the mouse cursor as in a word processing program. When the text is selected, type in the new value.

Spin Controls

To use a spin control, click the mouse on the up or down spin arrows to increase or decrease the value in the text box. If you hold down on the arrow, the value will increase or decrease repetitively. You can also type in the text box in some spin controls.

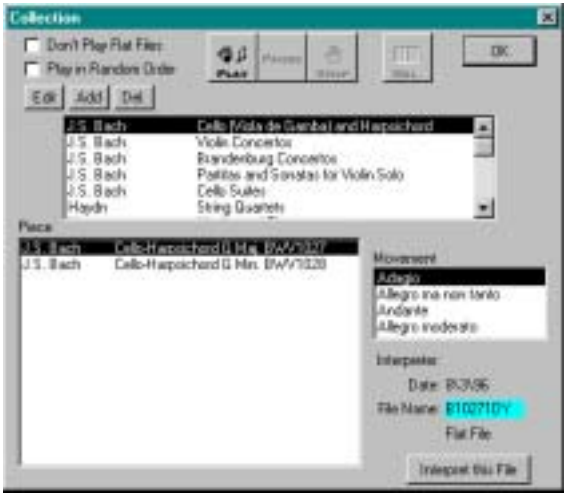
Playing from the Collection

The Collection contains a library of many of the greatest examples of Western Music by major composers already entered in SuperConductor format, interpreted and ready to enjoy. It also has locations for other important pieces of the Great Masters which can be added later. Hundreds of pieces can be stored on your hard disk. The Collection is the easiest and most accessible way to enjoy using SuperConductor.

To use the Collection feature,

- **Click on the Collection icon.**

  The Collection window opens. This window displays the list of files in the collection directory.



- **Click on the collection, piece and movement you wish to play.**
- **Click on the Play button or double-click on the title of a piece.**

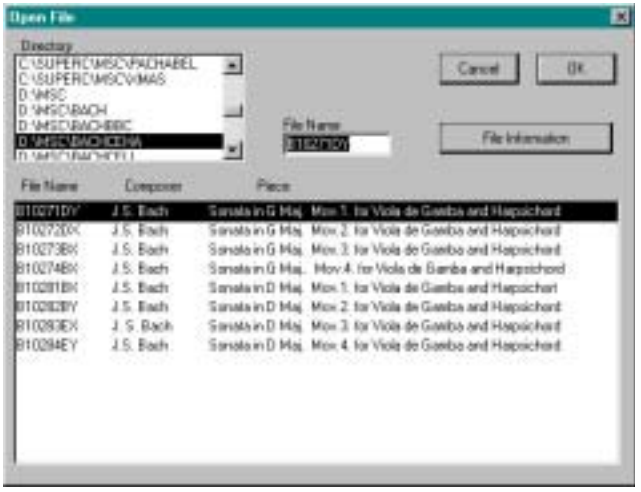
  SuperConductor plays the collection from the selected piece and movement.

For more detailed information on using the collection, see the “Reference” section of this manual.

Playing from the Play Window

To open an existing music file,

- **Choose Open… from the File menu or click on the Open icon in the SuperConductor window.**



- **Double-click on the music file name you choose in the scroll list.**

  If the file you want is not visible,

- **Use the scroll bar arrows to scroll down until it is visible then double-click.**

  Alternately, you can click on the OK button after selecting the music file you want. The file is opened and its name appears in the status window at the bottom of the SuperConductor window.

To display information about the file and music, click on the File Information command button while the file is selected. To change the directory that is displayed in the Open Window, click on the name of the desired directory in the directory display in the upper left corner of the window. If you want to dismiss the dialog, click the Cancel command button or hit the <esc> key.

Playing a File

A file may be played only after it is opened. To play a file,

- **Click on the Play Icon or choose Play from the Menu Bar.**

  The Play window appears.

- **Click on the Start Play command Button.**

  After a moment, the music begins to play.

- **To stop play, click on the Stop Play command button.**

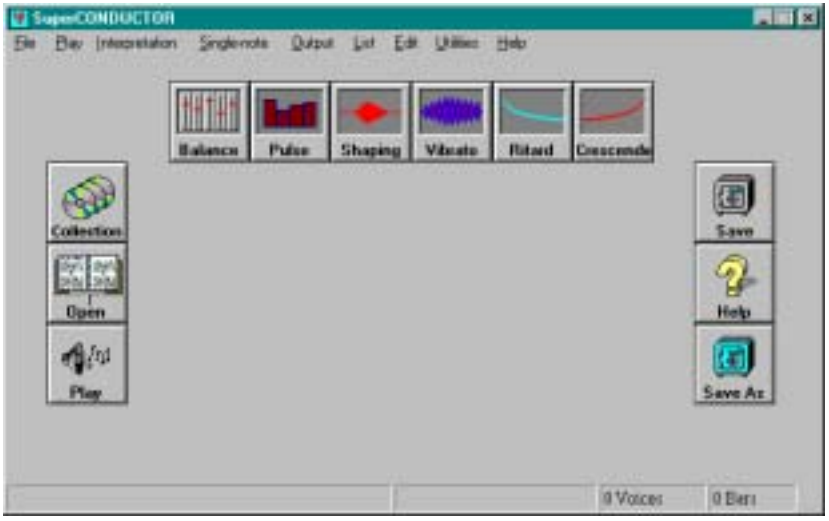
  To pause play, click on the Pause command button. The button's label changes to Resume. Clicking again will resume play.

The tempo and overall loudness of the play can be adjusted using the Tempo and Volume sliders respectively. To dismiss the window, click on the Cancel command button or hit the <esc> key. Dismissing the window will automatically stop play. The details of the Play Window interface and functions are documented in "Play Music" in the reference section of this manual.

If you want to hear only a few selected instruments, you can click on the Balance icon and use the Mute check boxes as described in "Voice Balancing" in the reference section of this manual.

Making your Own Interpretations

The first step to creating your own interpretations with SuperConductor is to know your way around the user interface. The next section describes the various screen objects, menu items and their functions.



The Icons and Their Functions

The SuperConductor window is dominated by a set of 6 large icons which give you access to the main functions used in creating an interpretation.

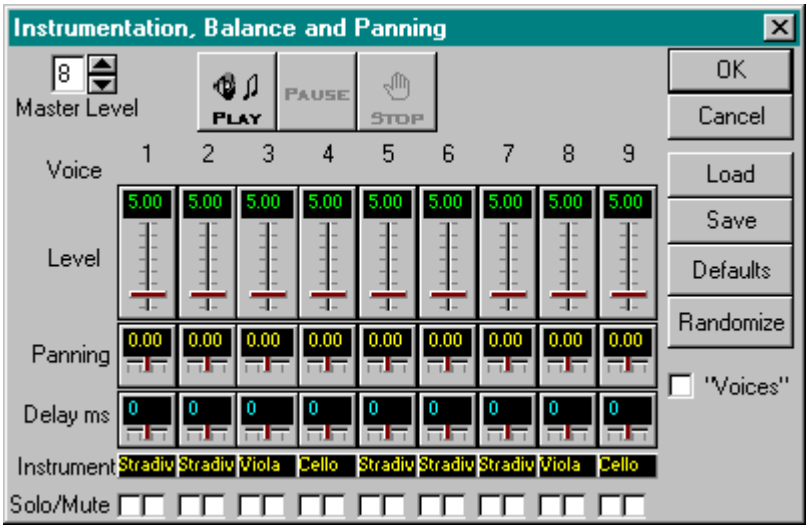
Clicking on the icons on the left side of the screen will instantiate the Collection, Open and Play windows respectively. These functions have been described above. The icons on the right side of the screen, Help, Save and Save As, serve the same function as their respective menu items.

The icons arranged across *the top of the screen* give access to the main tools of SuperConductor.

When starting to interpret a new piece, it is best to begin with the first of these, the Balance Icon, and then continue in left-to-right order.

Balance

Clicking on the Balance icon causes the Instrumentation window to appear.



The Instrumentation window is used to adjust the relative loudness and spatial mapping of each of the instruments in the piece you are working with. The tutorial in the next section describes how to use this window.

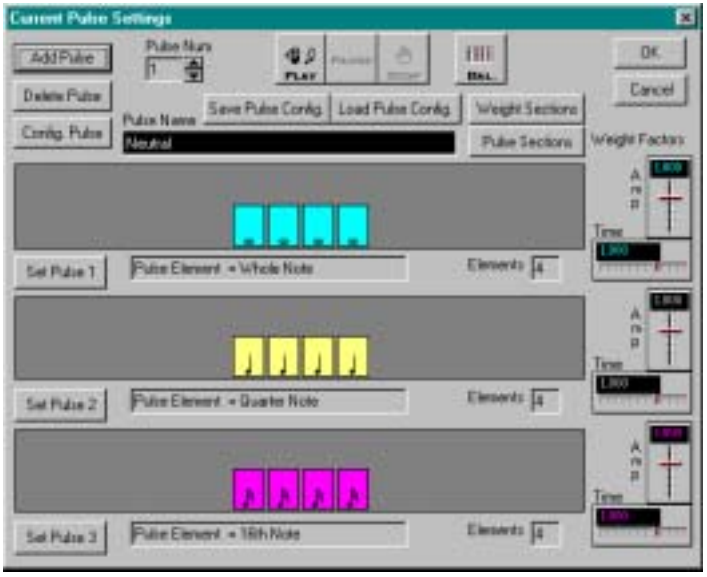
The Solo and Mute checkboxes allow for singling out voices or groups of voices from the overall mix.

The Save and Load functions allow you to save and retrieve common level, panning and delay values in the balance database.

Pulse

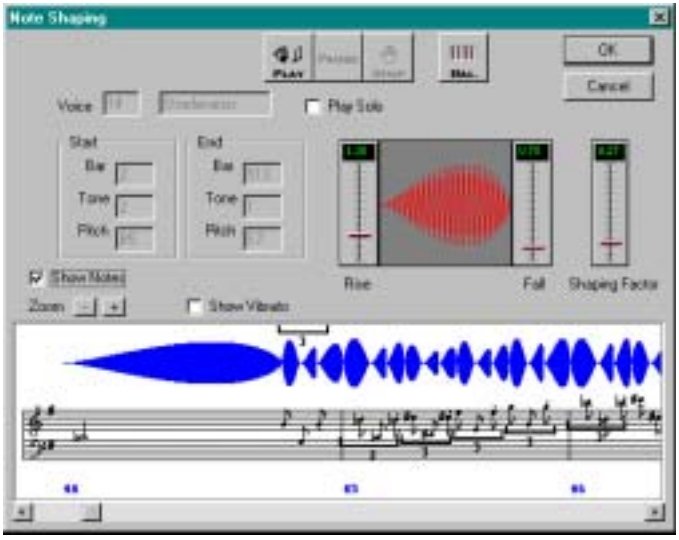
Clicking on the Pulse icon makes the Current Pulse Settings window appear.

This window is used to program and adjust the hierarchical pulse that is used in the piece you're working on. The Pulse Displays show the relationships between the various elements of the pulse and their relative amplitudes and durations.



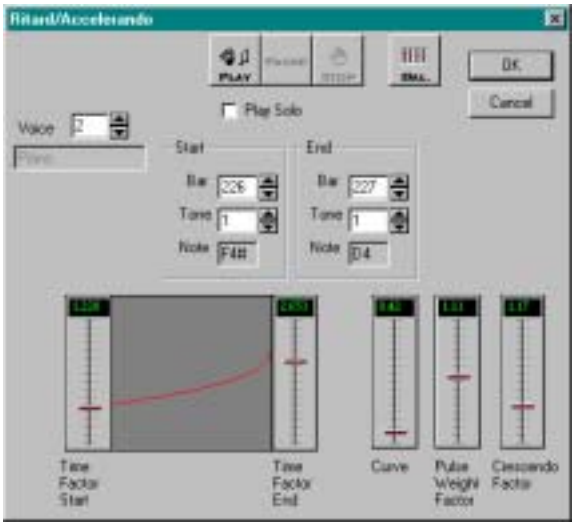
Shaping

Clicking on the Shaping icon calls the Note Shaping window. The window shown below is the one used to modify the note shaping that has been programmed.



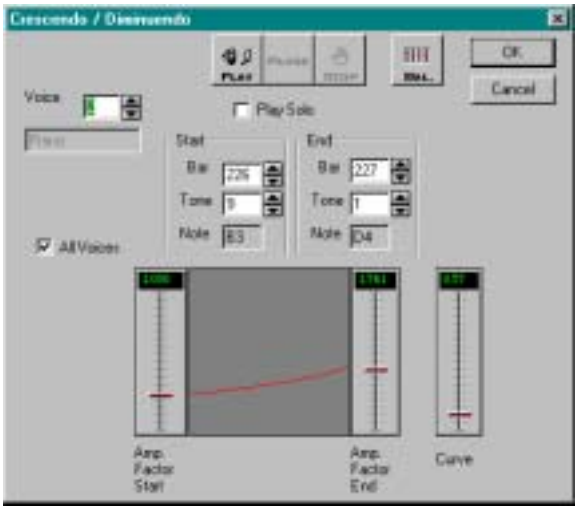
This control window allows you to adjust the attacks, releases and shapes of the swell of notes for each voice individually. The graphic display shows shapes of the amplitude envelopes that are used to shape the notes which vary individually with each note, unlike MIDI realizations which require note-by-note adjustment. The tutorial includes instructions on how to modify note shaping.

Ritard



The Ritard icon calls the Ritardando / Accelerando window. This window allows you to shape local or sectional changes in tempo over particular regions of the music. For example, you could use a ritardando near the end of a piece to bring it to a satisfying close. The controls in the window allow you specify when the ritardando starts and ends, and how it progresses

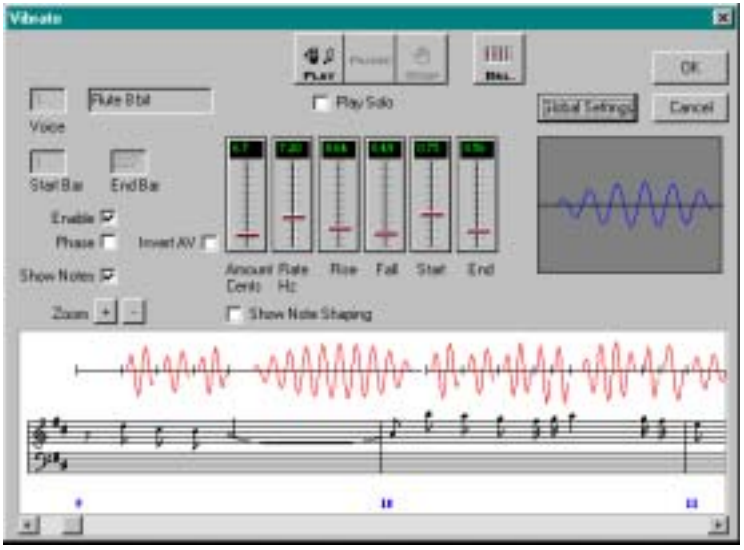
Crescendo



Clicking on the Crescendo icon causes the Crescendo / Diminuendo window to appear. The window allows you to control local or sectional changes in loudness. It functions almost exactly like the Ritardando / Accelerando window described above.

Vibrato

Clicking on the Vibrato icon calls the Vibrato window.



This window allows you to globally shape the characteristics of the vibrato used on each individual voice. You can control the mean vibrato depth, speed, attack, attack delay, swell shape, decay, decay delay, and the ratio between the amplitude component of the vibrato and its pitch component. For every global setting, the individual notes of the voice are provided with a different customized vibrato.

The Menus

The following section is a short description of each of the menu functions described in the order they appear on the menus. In-depth explanations of these functions can be found in the SuperConductor Reference later in this manual.

The File Menu

New

Choosing this item opens the New File window and allows you to create a new music file in the dirtectory of your choice.

Open...

Selecting this item calls the Open window. It allows you to search for an existing music file and load it.

Save As...

The Save As... command allows you to save the current file under a new name or in a new directory.

Save

The Save command writes the current file to the hard disk in the directory where it currently resides. Changes over-write the previously saved file.

Collection

Selecting this menu item has the same effect as clicking on the Collection icon.

Concert

Choosing the Concert menu item calls the Play Concert window. In this window you can arrange one or more concert programs of pieces to be played in the order you choose.

File Information

This command calls the Music Information window. Data about the current file and piece and comments about the interpretation can be recorded here.

Set Directories

This function allows you to change the name and location of the directories where SuperConductor files are stored.

Import MIDI File

Import a standard MIDI file into the SuperConductor format.

Export MIDI File

Export SuperConductor to a standard MIDI file.

Rename a File

This function allows you to rename an existing file without making a copy of it.

Delete a File

Choosing this menu item displays a list of the files stored in the music directory and allows you to delete one at a time.

List of Recent Documents

This list contains the file names of the four last music pieces that were opened by SuperConductor.

Exit

This item quits SuperConductor. You are asked to confirm the command before the program quits.

The Play Menu

Selecting this item is equivalent to clicking on the Play icon.

The Interpretation Menu

Voice Balancing

Selecting this item has the same effect as clicking on the Balance icon.

Pulse

Choosing this item is equivalent to clicking on the Pulse icon.

Note Shaping

Choosing this item has the same effect as clicking on the Shaping icon.

Vibrato

This item duplicates the function of the Vibrato icon.

Reverb

This function allows you to set the current music file's reverberation qualities.

Piano Tails

Choosing this item allows you to set how SuperConductor handles articulation and legato of notes in multiple voice instruments like piano, harpsichord, harp and guitar. SuperConductor uses predictive note shaping technology to vary the amount of legato and the damper action that is used to connect notes, and also how that varies with different registers of the instrument.

Crescendo/Diminuendo

This item duplicates the function of the Crescendo icon.

Ritard/Accelerando

This function duplicates the function of the Ritard icon.

Pitch Crescendo

The Pitch Crescendo function allows you to set the amount of increase in loudness as a function of pitch for each voice individually. This is primarily a musical function, but also many instruments naturally change loudness with pitch level. Examples of instruments that get louder with an increase in pitch are the flute, trumpet, and the human voice. Other instruments like the oboe and bassoon get quieter as they go up in pitch. Overall phrasing sounds more natural when Pitch Crescendo is applied.

This function is commonly called pitch / amplitude tracking in synthesizer parlance.

Long Note Parameters

Notes that are longer than one or two seconds in music mostly do not function as melodic elements. They are textural and sustain harmonies. Therefore, the note shaping parameters used in the normal melodic setting are not appropriate. With this function, you can direct SuperConductor to apply different shaping parameters to notes that have durations longer than the threshold you specify, and produce suitable attacks and decays for those notes.

Short Note Loudness Parameter

Similar to the function described above, very short notes, like those of trills and ornaments often need to sound quieter than normal melodic notes. With this function, you can tell SuperConductor how to handle the relative loudness of notes that are shorter in duration than the threshold you specify.

Expressive Intonation

Add the humanizing effect of very small variations in the pitch off each note using special Patented algorithms invented by Dr. Manfred Clynes.

Expansion/Compression

Increase or decrease the dynamic range of the entire piece.

Meter/Tempo

This function lets you specify a range of bars that have a meter and tempo different from that of the general piece. The change that you enter will stay in effect until the next Meter / Tempo reset.

The Single Note Menu

This menu contains functions which control the parameters of single notes. These functions are used in addition to the expressive nuances that are applied globally through pulse and note shaping.

Edit Note

Choosing this item calls the Single Note Editor window. The pitch, loudness and shaping of a single note in a single voice can be edited from here.

Micropause

In some music, master players will take short pauses in the flow of the music to separate sections or, occasionally, to create momentary hesitation. The Micropause function allows you to add a short silence after a specific note or chord. The pause is the equivalent of adding a short rest to the melodic line, so it is important to add the same length pause to all the voices in the music so that they stay synchronized. This is done automatically.

Staccato

This function shortens the *sounding length* of a particular note. That is, the written duration of the note remains the same, so that it remains in synch with the other voices, but the length of time the note *sounds* during that duration is shortened.

Legato

With some instruments, especially keyboards and harp, players sometimes overlap adjacent notes to create a smoothly flowing melody. The Legato function allows you to lengthen the sounding length of a note without changing its written duration. This has the effect of slightly overlapping or smearing the end of one note with the beginning of the next. It can be used

effectively in SuperConductor for violins, string instruments and woodwinds as well. It is also used for pedal effects in pianos, particularly for bass notes which can be considerably sustained with this function.

Note Length

With the Staccato and Legato functions, you can change the sounding length of a particular note. The Note Length function allows you to change the actual written length of a note. This would be dangerous because this has the effect of lengthening or shortening the music for a whole voice, thus putting it out of synch with the other voices. This function is mostly applied to all the voices simultaneously as a result. Alternately, you can also change the length of another note or notes in the same bar or later bar of that voice so that the net length of the voice part is the same.

The Output Menu

The Output Menu allows you to select how SuperConductor will generate audio output.

44 KHz, 33 KHz, 22KHz, 11KHz

These items allow you to choose the sample play rate of the sound that is generated by SuperConductor. In complex pieces of music containing many voices it may be necessary to choose a lower sample rate to maintain real time play. For the highest play quality, choose the highest setting that will allow play in real time.

Stereo, Mono

These choices let you choose whether SuperConductor will output in stereo or mono. Choose mono if your machine is slow.

16 bits, 8 bits

These items switch SuperConductor's output resolution. Choose 8 bit resolution if your machine is slow or 16 bits for the highest quality.

Virtual Sample Memory

Checking this item will direct SuperConductor to read sound samples from the hard disk files or CD ROM files (if installed) rather than loading the samples into program memory. This should be checked whenever possible.

Set Sound Buffer

Choosing this item calls the Sound Buffer Time window where you can set the length of SuperConductor's sound buffer.

The List Menu

SuperConductor can output the result of applying the microscore to the music in the form of lists. This menu contains various destinations for this output.

View Original Score

Choosing this item displays the score of the current piece (if present on the hard disk).

Music (Notes with MicroScore)

This item displays a list of all the notes in a piece by bar number, including major parameters of the microscore.

Statistics

Choosing this menu item lists the number of voices, the maximum and minimum amplitudes for each voice, the number notes in each voice and other pertinent information regarding the quantitative aspects of a piece. The list can be printed out by clicking on the Print command button.

Compare to Another Microscore

This feature allows you to compare the major interpretive features of the current music file with a second version of that file. This comparison will be displayed in a list window which can be printed.

The Edit Menu

This menu contains many of the normal Edit functions found in Windows programs.

Undo

Choosing this menu item reverses the last action taken while modifying a file.

Cut

Choosing Cut, deletes the selected contents of the file and places them on the Clipboard. From here they can be pasted into another file or a different location in the current file.

Copy

Choosing Copy makes a copy of the selected data on the Clipboard for use elsewhere.

Paste

The Paste command places the contents of the Clipboard at the specified bar.

Copy To

The Copy To command places the specified range of bars in the file you select.

Paste From

The paste From command allows you to paste data from another music file into the file you are currently working with.

Editor

Clicking on this menu item initializes the Music Editor application. You can use the Music editor to change notes and values for those notes in each voice of a piece. New Pieces are also entered into SuperConductor using

the Music Editor. See Appendix B "The Music Editor" for more information.

Flatten File

Choosing Flatten File will neutralize the parameters of the microscore *except for default note shapes, vibrato, and balance*. The resulting performance will be what the score would sound like if it were performed exactly as written with those default settings. When a file has been flattened, the menu item reads "Unflatten File". Choosing this item will restore the microscore to the file.

Points Per Unit

This item allows you to choose the number of time units used in the minimum pulse unit. Default setting is 200 points per unit.

Transpose Voice

This item allows you to transpose a voice up or down in semitones. It is useful for entering transposed instrument parts as written in the score, and transposing them "on the fly" during play.

Transpose Piece

This command allows you to raise or lower a whole piece in single semitone increments.

Add a Voice

Choosing this item, adds an additional voice to the music file.

Delete a Voice

This function allows you to choose which voice to delete in total.

The Utilities Menu

This menu contains utility functions which facilitate working with SuperConductor files as a whole.

Clipping Check

When this item is checked, SuperConductor indicates when clipping occurs in the digital audio output during play.

Signal Display

The Signal Display is similar to the Play window except that the stereo sound output is plotted to the display.

Import MIDI File

This function allows you import a standard MIDI file into SuperConductor.

Export MIDI File

Choosing this item opens the Export File window, which is similar to the Save File window. After giving the exported file a name, SuperConductor will write a MIDI file to the chosen directory using the currently opened music file.

The Help Menu

Contents

Choosing this item starts the SuperConductor Help System.

About SuperConductor

Choosing this command brings up a window which contains information about SuperConductor and MicroSound International.

Tutorial: Adjusting the Microscore

The following tutorial is a guided tour through the steps of modifying an existing interpretation using SuperConductor's tools.

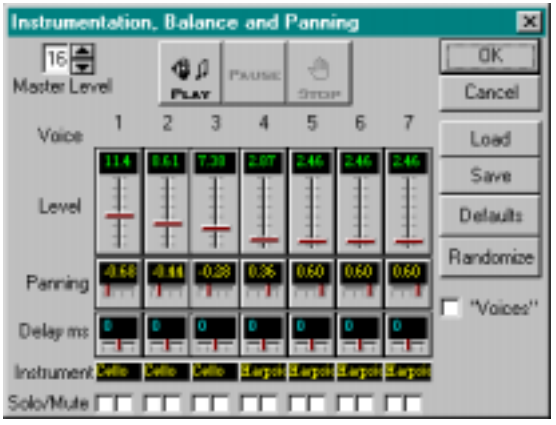
- **Click on the Open icon.**
- **Select a file named D:\MSC\BACHCELL\B10283 and click OK.**

Balance

The first step to take in creating your own interpretation is to adjust the balance of the instruments. To begin,

- **Click on the Balance icon.**

  The Instrumentation window appears. You will adjust the balance of the instruments in this window.



Voices

Even though this piece uses two instruments, it contains seven voices. In SuperConductor, the number of voices that an instrument must have is equal to the maximum number of notes that the instrument must sound simultaneously. For example, a flute or a trumpet only require one voice, since they can only sound a maximum of one note. The cello or violin can

require up to 4 voices since they have four separate strings and can sound that number of notes simultaneously. Instruments like harpsichord, guitar or piano usually require from 6 to 10 voices to reproduce accurately. The maximum number of voices that SuperConductor can reproduce in real time is dependent on the speed of your computer, the sample rate and bit resolution.

Voices one through three are used for the cello.

- **Adjust the level of voice one to 8.20, voice two to 5.30 and voice three to 6.20 by using the Level sliders.**

  Voice one is usually louder than voices two and three.

  Voice one is used most often because the cello is usually playing only one note. Voices two and three are used occasionally as needed.

Voices four through seven are used for the harpsichord.

- **Set the level for voice 4 to1.6, voice 7 to 1.6 and voices 5 and 6 to 1.2.**

  Voices for a multi-voice instrument should be set so that the top voice is loudest, the lowest voice, next loudest and the middle voices set least loud. This will make chords sound better balanced and less harsh, especially for the piano.

- **Click on the Play icon to hear the effects of setting the Instrument Balance. Click on Stop when you are finished.**

Delay

Different instruments audibly sound later or sooner depending upon the shape of their attacks. Some instruments are meant to "lead" and some to follow. The Delay function allows you to make fine adjustments in the relationships between the timing of each instrument.

- **Set the delay for voice 1, 2, and 3 to -25, -15, -10 respectively.**
- **Set the delay for voice 4, 5, 6 and 7 to 10, 20, 20 and 20 respectively.**
- **Click on the Play icon to hear the effects of setting the Instrument Delay. Click on Stop when you are finished.**

Panning

The set of sliders below the Level sliders are called the Panning sliders. Pan is short for "panorama" and refers to the apparent location of the voice in stereo space.

- **Drag the panning slider for Voice 1 all the way to the right.**
- **Click on the Play icon.**

  Make the following adjustments while the music is playing. The effects of these changes will take from 1 to 16 seconds to become audible depending upon the buffer length setting.

  The sound of the cello will be to the right of the stereo image. Notice that the number in the text box is positive. Positive numbers designate pan positions to the right of center, negative numbers to the left. A panning value of zero will put the voice dead center in the stereo image.

- **Drag the panning slider for Voice 1 back to -0.70.**

  The cello sounds like it is coming from the left of the stereo image.

Below the panning sliders are the Instrument indicators. As you pass the cursor over an instrument indicator, it expands to show the name of the sample that is played when that voice is activated. Instruments can only be changes when the piece is not playing.

Below the Instrument indicators are the Solo / Mute check boxes.

- **Click on the Solo check box for Voice one. It is the left box of the pair.**

  All voices except that of the cello are silenced. This allows you to hear precisely what is happening with that part of the music.

- **Uncheck the Voice one Solo check box and check the Mute check box.**

  Now, all the music is playing except the cello. This is useful for "music minus one" practicing of solo pieces.

To save the changes you've made, click OK.

Reverb

As you listen to the Bach Cello Sonata, you may find that the music sounds rather dry and artificial. This is mostly because the sound of the instruments is not accompanied by any room acoustics. This is the equivalent of playing this music outdoors.

Reverberation (reverb) is a complex set of reflections caused by the random diffusion of the sound in a room. It is what gives a sense of the size of the room the music is being performed in and has a very salutary effect on the sound of most instruments. It is the most widely used effect in recording studios.

To add reverb to the performance,

- **Click on the Play icon.**
- **Click on the Start Play button.**
- **After the music has begun playing, click on the Reverb button.**

The Reverb Parameters window appears.

- **Uncheck the Enable Reverb check box.**

In a few moments, the reverb stops. Recheck the box to enable reverb.

- **Click OK to dismiss the Reverb Parameters window.**

  The details of all the reverb parameters are discussed in the "Reverb" reference section of this manual.

- **Click the Cancel command button to discontinue play and dismiss the Play window.**

Pulse

The next step in creating an interpretation is to apply the correct hierarchical pulse to the music. In the following example, you will adjust Beethoven's pulse as applied to the third movement of the Violin Sonata in A major Opus 47.

- **Click the Open icon.**

  The Open File window appears.

- **Scroll down to the file named D:\MSC\BEETHOVN\BE473. Double click on this file.**

- **After the file is completely loaded, click on the Pulse icon.**

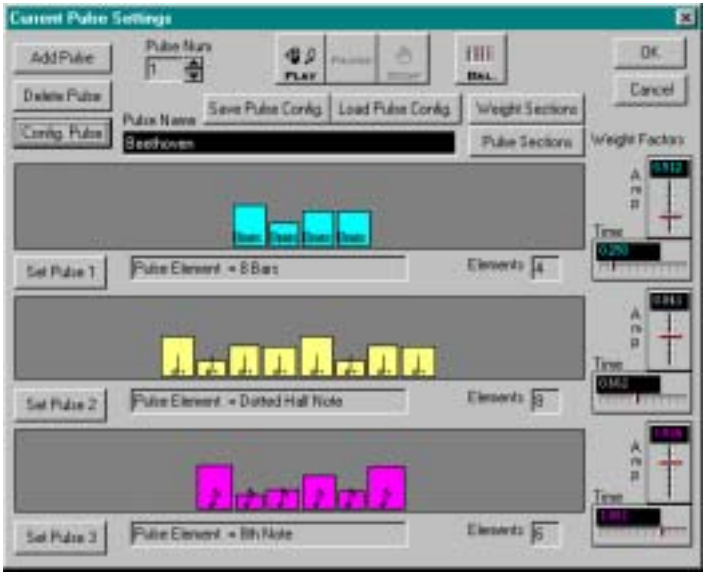
  The Current Pulse Settings window appears.

Beethoven's hierarchical pulse has three layers. They are represented by the three sets of colored rectangles displayed in this window. The top pulse level has a length of 32 bars divided into four groups of eight bars. Under it is middle pulse level, which has the length of eight bars, and is divided into one bar units. The bottom pulse level divides each bar into six "eighth notes" per bar.

Note that in top level, the four units of three bars are of almost equal width but have unequal heights. This means that they occupy virtually equal amounts of time but have unequal loudness. In the case of the Beethoven pulse, the third and fourth groups are quieter than the first group and the second group of bars is much quieter than first group. This same relationship is true for the middle level pulse, but the bars are more unequal in length as well as in loudness. In the bottom level pulse, the first, fourth and sixth eighth note in each bar are emphasized. It is interesting to note that

the last eighth note in the bar is the loudest and the longest in the Beethoven 6/8 pulse.

Note: Time in music can be divided into two, three, four, six and other divisions. The way it is divided is called its *meter*. This piece is divided into six eighth notes per bar or 6/8 meter. The pulse for this piece is set up to take this into account. A piece that was conceived in four eighth notes per bar would have a different pulse setting even though it is composed by the same composer.



Weight Factor Sliders

To the right of each pulse level display are a set of two sliders, one labeled Time, the other labeled Amp (for Amplitude). These sliders are called the Weight Factor sliders. They control the intensity with which the pulse settings are applied to the music. The steps below demonstrate their use.

- **Click on the Play icon.**

Notice the flow of the music and the regularity of the tempo. If you listen carefully, you will hear that the second bar of each phrase is quieter than the others.

- **Click on the Stop icon.**
- **Adjust the "Amp" slider for the middle level to 1.5.**

  This vertical slider is located to the right of the middle level pulse display. This adjustment increases the difference in loudness between the bars in this pulse level, hence "weighting" the differences. The display adjusts to show the difference in weighting. A value of 1.0 gives loudness ratios that are exactly equal to those set in the composer's pulse setting.

- **Click the Play icon.**

  Notice that the second bar of each phrase is now far quieter in relation to the other parts of the phrase. SuperConductor has exaggerated the differences in loudness between the bars.

- **Stop Play.**
- **Change the value of the middle level Amp slider to 0.00.**

  This change will nullify any difference in loudness between the bars. Notice that the display adjusts to illustrate this difference.

- **Start play.**

  This time, each bar of the phrase is equally loud. The sense of "dancing" and "lightness" that was present in the first play is now missing.

- **Stop play.**
- **Set the middel level Amp slider to 1.0.**

  This will restore the amplitude weighting to its original state.

To demonstrate the effect of the Time weighting sliders, follow the steps below.

- **Adjust the middle level Time slider to a value of 1.5.**

  This setting exaggerates the differences in duration between the bars at this level of the hierarchy.

- **Start play.**

  The speed of the music varies obviously and the sense of flow is missing. This is because in the Beethoven pulse, bar two and three are shorter than the bars one and four. With exaggerated weighting, this difference translates into obvious changes in tempo that are not musical.

- **Stop play.**
- **Set both the top level and the middle level Time slider to 0.00.**

  This will null out any differences in the duration of the bars.

- **Start play.**

  Notice that the music sounds less flexible and expressive. This is a result of removing the effect of the top two layers of the pulse.

- **Stop play.**
- **Set the top level Time slider to 1.0. Set the middle level Time slider to 0.2.**

  These settings return the weighting to the proper balance for this piece.

- **Click OK to dismiss the Pulse window.**

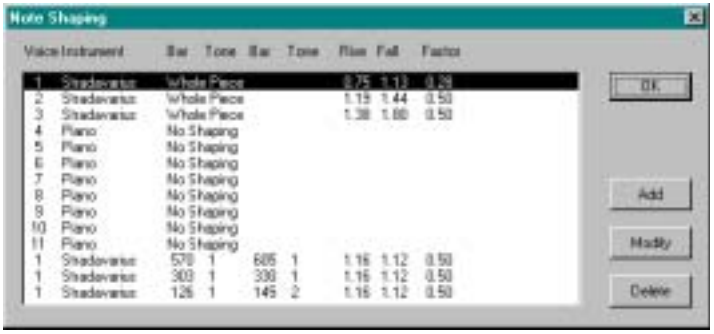
You now have a basic understanding of SuperConductor's hierarchical pulse controls. The details of the pulse function can be found in the "Pulse" reference section of this manual.

Note Shaping

The tutorial section above introduced you to the basics of applying the hierarchical pulse to a piece of music. In the following section, you will learn how to use the Note Shaping window to control the expressive qualities of phrasing and line in the music.

The Beethoven Violin Sonata in A major Opus 47 (D:\MSC\BEETHOVN\BE473) should still be open. If it is not, open it now.

- **Click on the Shaping icon.**

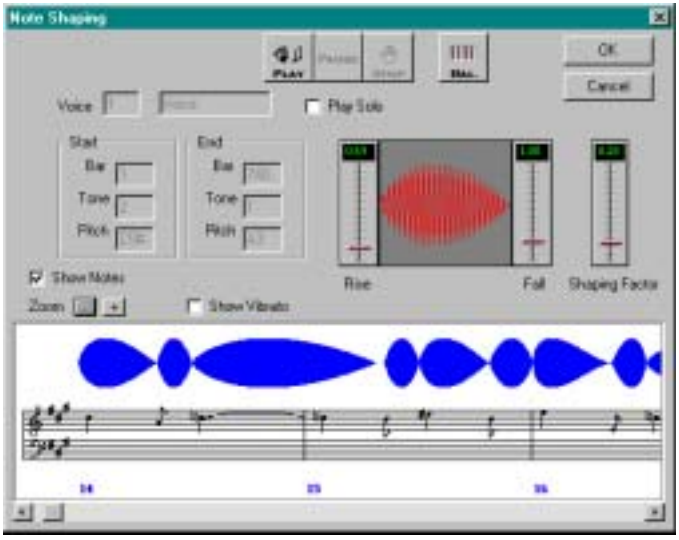


The Note Shaping list appears. It contains a list of voices and their note shaping parameters. A detailed description of the elements in this window can be found in the "Note Shaping" reference section of this manual.

- **Select the top line (Voice 1, the violin) by clicking on the line, then click on the Modify command button.**

The Note Shaping window appears. It contains a graphic display of the basic amplitude envelope that will be used for shaping the notes.

On either side of the envelope display is a slider. They are labeled Rise and Fall . The Envelope Rise slider controls the shape of the rise of the note. Envelope Fall controls the shape of the note fall. These parameters are interactive and are, in effect mirror images of each other.



- **Set the Envelope Rise and Envelope Fall sliders to 0.06.**

  The envelope display changes to reflect the new settings. These settings provide almost no envelope for the violin.

- **Click on the Play icon.**

  Notice the flat expressionless quality of the violin notes. This resembles the sound of a MIDI controlled violin sample. The mechanical quality of this "performance" is directly correlated to the lack of expressive note shaping.

- **Click on the Stop icon.**

- **Change the Rise slider setting to 3.5. Change the Fall slider setting to 0.50.**

  These settings will cause the violin notes to have a slow swell to their attack and, in longer notes, to crescendo over most of the length of the note.

- **Click on the Play icon.**

  Notice that the violin sounds like it starts late on the fast notes and swells into the longer notes. This is the result of an Envelope Rise shape that is too long for the style of music being played.

- **Click on the Stop icon.**
- **Change the Envelope Rise slider back to 1.0.**

  This returns the note shaping to the correct setting for this piece.

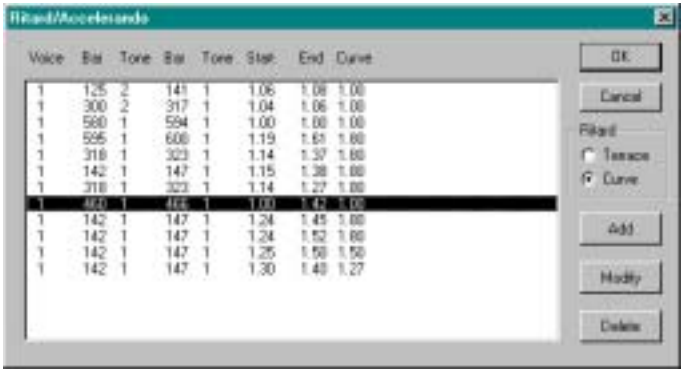
- **Click OK and dismiss the Note Shaping window.**

You now have a basic understanding of SuperConductor's pulse and note shaping tools. An in-depth discussion of this function is found on page 115.

Ritardando/Accelerando

The following demonstration shows how to modify an existing ritardando in a piece of music. You will alter the shape and speed of the ritardando and, in the process, learn how to operate the controls for the Crescendo / Diminuendo editor as well.

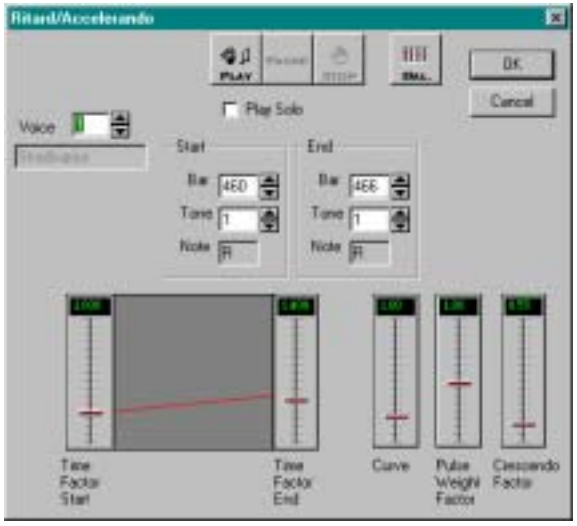
- **Click on the Ritard icon.**
  The Ritardando / Accelerando window appears. It contains a list of ritardandos that are used throughout the piece.



- **Select the eighth line down as shown in the illustration.**
- **Click on the Modify command button.**

The Ritardando / Accelerando Editor appears. It contains a graphic display showing the relationship of tempo from the beginning of the ritard to the end. The sliders on either side of the graphic display control the tempo setting at the beginning of the ritard and at the end respectively.

Note that the Start time of the ritardando is at bar 460, note 1 and ends at bar 466, note 1.



- **Click on the Play icon.**

  Listen for the tempo of the music slowing down to the end of the phrase, and then resuming in the original tempo.

- **Click on the Stop icon.**
- **Set the Time Factor End slider to 2.5.**

  This will cause the final tempo in the ritard to be 2.5 times slower than the overall tempo of the piece.

- **Start Play.**

  Starting at bar 460, the tempo gradually slows to 2.5 times slower than the overall tempo of the piece, resuming at normal tempo at bar 467.

- **Stop play.**

- **Set the Curve slider to 0.23.**

  The graph indicates a change in the shape of the ritardando. This value places most of the tempo change near the end of the six bar passage.

- **Start Play.**

  Notice how the tempo at bars 460 and 461 is almost the same as the normal tempo. Most of the ritardando is applied at the end of the passage. This interpretation, while still extreme, is more acceptable musically.

To change the ritardando, into an accelerando, follow the steps below.

- **Stop play.**
- **Set the Time Factor End slider to 0.5.**

  This will cause the tempo to double by the end of the passage.

- **Set the Curve slider to 1.0.**
- **Start Play.**

  Notice how the tempo increases in speed over the length of the phrase.

- **Stop play.**
- **Return the Time Factor End slider to its original setting of 1.5.**
- **Click OK to fix the setting and dismiss the Ritardando/ Accelerando window.**

This concludes the tutorial on Ritardando / Accelerando functions. You now know the basics of how to modify existing tempo adjustments. The details of all the features of this function are described in the "Ritardando / Accelerando" reference section of this manual (p.137).

Crescendo/Diminuendo

The Crescendo / Diminuendo window is configured with the same controls as the Ritardando / Accelerando window with the exception that the parameter that is being controlled is loudness, not tempo. An in-depth

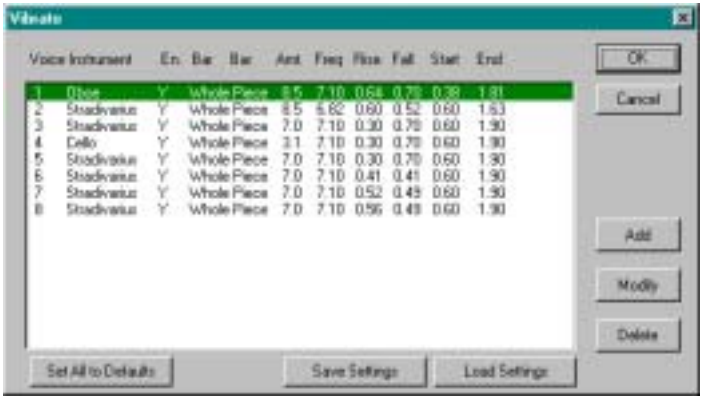
explanation of the controls in this window can be found in the "Crescendo / Diminuendo" reference section of this manual (p.92).

Vibrato

The following tutorial section will illustrate the use of the Vibrato features of SuperConductor. Vibrato is used to color and add warmth to a singing line.

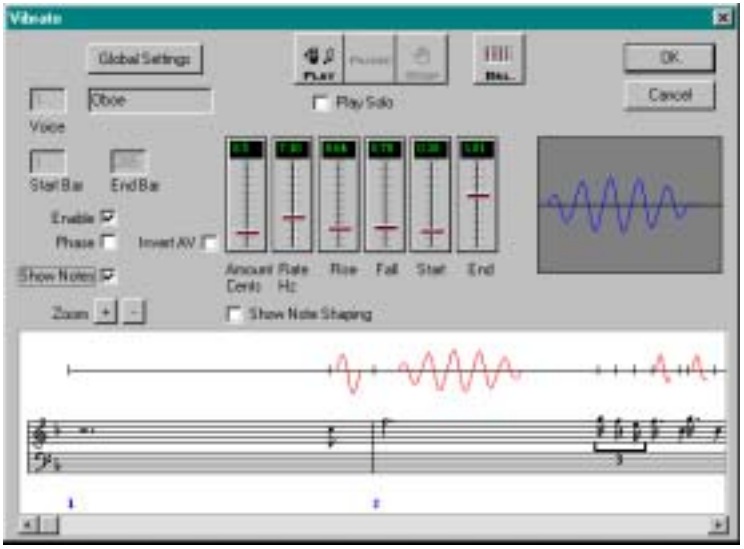
- **Open the file D:\MSC\MOZART\M3701.**
- **Click on the Vibrato icon.**

  The Vibrato list appears.



- **Select the first item in the list for voice 1 and click the Modify button.**

  This causes the Vibrato window to appear.



- **Check the Play Solo check box beneath the Play icon.**
- **Click on the Play icon to begin play.**

  You will notice that the melody is played with vibrato.

- **Change the depth of the vibrato by increasing the Amount Cents slider to 30 cents.**

  Notice how wide the vibrato sounds.

- **Adjust the speed of the vibrato by decreasing the Rate Hz slider to 3.0.**

  The vibrato becomes slower.

- **Check the Show Notes checkbox.**

  The score of the part being played is displayed. The line above the score shows the vibrato applied to each note. Short notes don't normally receive vibrato. The minimum note time can be adjusted in the Global Settings dialog.

- **Use the Rise, Fall, Start and End sliders to modify the vibrato.**

These modifications can be observed on the Show Notes display.

- **Click Cancel to return the file to its original condition and dismiss the Vibrato window.**

For the details of all the Vibrato window's functions see page 148.

Saving the Current Microscore

The tutorial above has been a guided tour that introduced you to the basics of the microscore. As you progressed through the tutorial, you may have discovered various settings that you liked. These discoveries are the essence of what SuperConductor provides - direct access to the heart of music interpretation. To preserve these settings as new interpretations, use the Save As… command in the File menu. Give a new name to each file as you create it that will allow you to compare the various interpretations.

Saving and Closing a File

Using the Save command in the File menu or clicking on the Save icon will write the current settings in the micro score to the currently open file on disk.

There is no need to close a file before opening another. SuperConductor will replace the current microscore settings with ones from the file being opened when you initiate the Open command. You will be prompted to save any changes you made to the current file before opening a new file or exiting SuperConductor.

CHAPTER 5

SuperConductor Reference

This section of the manual contains detailed information on all the windows, menus, controls and other screen objects in SuperConductor. It is organized in alphabetical order by subject.

Add a Voice of Rests

Choosing this item, adds an additional empty voice to the music file.

Clipping Check

When this item is checked, SuperConductor indicates when clipping occurs in the digital audio output during play.

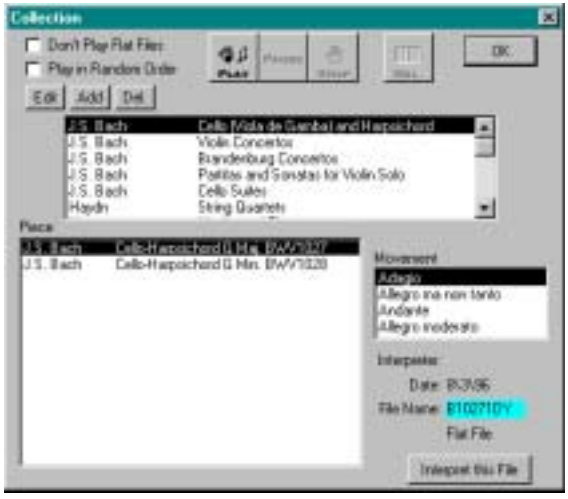
Copy

Choosing Copy makes a copy of the selected bar range on the Clipboard for use elsewhere.

Copy To

The Copy To command places the contents of the selected bar range in the file you select.

Collection



The Collection feature of SuperConductor allows you to play a sequence of music files back to back without stopping to load the files individually. This sequence is saved in the Collection list. The list contains a list of the music files currently on the hard disk plus a list of other important pieces which can be added to the collection at a later time

Playing Music from the Collection

Click on the Play button to begin playing from the piece currently highlighted, or double click on any piece or movement to begin playing immediately from that point.

Check the “Play in Random Order” checkbox to play entire music pieces in a random sequence.

Check the “Don’t Play Flat Files” checkbox to bypass files which are not interpreted.

Adding to or Editing the Collection

- **Click on the Add or Edit button in the Collection window.**

  "Add" adds a new group to the collection. "Edit" makes changes to an existing group.

- **Choose the composer of the piece you wish to add using the composer pop-up menu.**
- **Click the Add or Insert button below the Movement window.**

  "Add" adds the movement to the end of the list and "Insert" adds it before the currently highlighted movement.

- **Select the piece you want to add to the collection from the list of files that appears.**

  The name of piece you select will automatically be added to the Piece window for the first movement selected.

- **Repeat the previous step for each piece or movement you want to add to the collection.**
- **Type a description for the new group in the "Description" text box.**
- **Click on OK.**

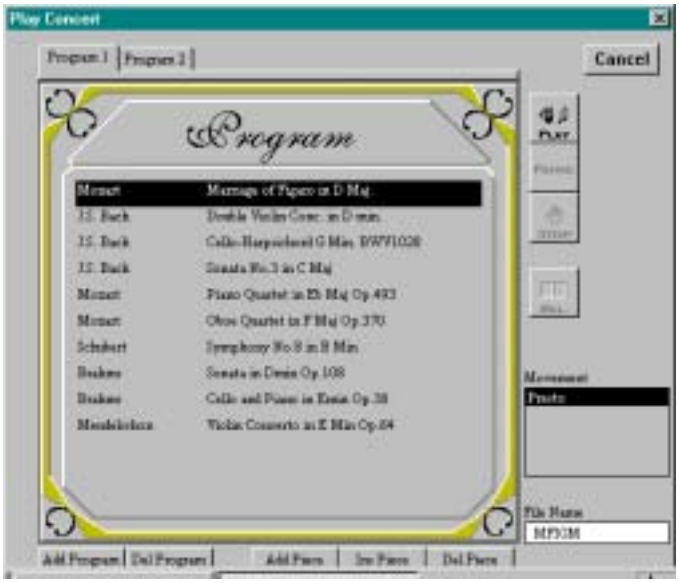
  The new or edited group now appears in the Collection Group Window.

Deleting a Collection

- **Highlight the collection you wish to delete using the mouse and then click on the Delete button.**

  The file name disappears from the list.

Concert



The Concert feature is activated by choosing Concert from the File menu or by clicking on the "Play Concert" pad which appears in the center of the SuperConductor window upon start-up.

The Concert feature allows you to easily play a sequence of pieces designed to be heard together as a program. New programs can be created from music files in your collection.

Playing a Program

- **Click on the tab of the program you want to play**
- **Click on the Play button or double click on the piece you wish to play.**

Adding a New Program

- **Click on the “Add Program” button.**

  A blank Program form is displayed

- **Click on the “Add Piece” or “Ins.Piece” button.**

  “Add” adds a piece to the bottom of the list. “Insert” adds a piece before the highlighted piece.

- **Choose the piece you want to add from the Collection list, then click OK.**

Deleting a Program or Piece

- **Click on the “Del.” button to delete the currently selected program.**
- **Click on the “Del. Piece” button to delete the currently selected piece.**

Conducting in Real Time

(see Conducting Using a Joystick on page 106)

Crescendo

Choosing the Crescendo item in the Interpretation menu or clicking on the Crescendo icon causes the Crescendo / Diminuendo window to appear. This window allows you to enter bar ranges in the piece where a gradually changing increase or decrease in loudness is desired. The window's display shows a list of ranges where a crescendo or diminuendo over a particular voice or range of voices has been specified.

Adding a New Crescendo or Diminuendo

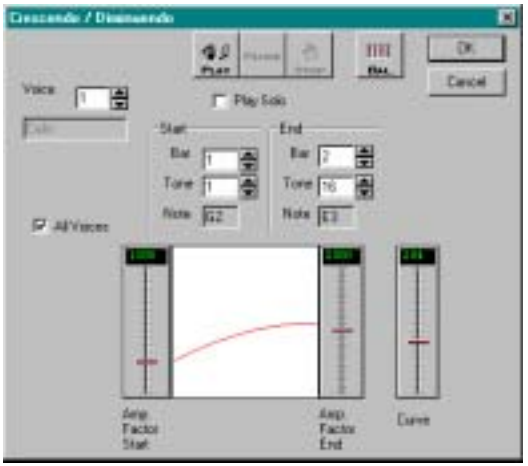
To specify a crescendo or diminuendo, click the Add button. The Crescendo / Diminuendo Editor window appears. It contains a graphic display of the parameters that will be applied to the bar range you specify.

Editing an Existing Crescendo or Diminuendo

To modify an existing Crescendo or Diminuendo section, click on the section to be modified and then click on the Modify button.

Delete a Crescendo or Diminuendo

To delete a Crescendo or Diminuendo section from the list, select the section by clicking on it. Then click on the Delete button. The section disappears from the list.



Voice(s)

The Voice number box indicates the number of the voice or a range of consecutively numbered voices to which the current settings apply.

Start and End Bar and Tone

These boxes specify the starting bar and note and the ending bar and note over which the crescendo / diminuendo will take effect.

All Voices

Checking All Voices will apply the dynamic change to all the voices playing in the bar range specified.

Amp. Factor Start and End

These sliders controls the multiplier which will be applied to the loudness at the beginning and end of the crescendo / diminuendo. The range is from 0.00 (inf. dB) to 4.0 (+12 dB).

Curve

This slider controls the power function variable that determines the contour of the crescendo / diminuendo. When the value equals 1.0, the rate of amplitude change over time is linear. Generally use values greater than 1 for diminuendos, less than 1 for crescendos.

Cut

Choosing Cut, deletes the selected bars of the music file and places them on the Clipboard. From here they can be pasted into another music file or a different location in the current file.

Delete a File

This function from the File menu allows for choosing and deleting a file from the current music directory. Its design is identical to the Open… and Save As… windows.

To delete a file, click on the file name and then click OK. A warning dialog appears asking if you are sure you want to delete? Click Yes to delete, no to cancel.

Delete a Voice

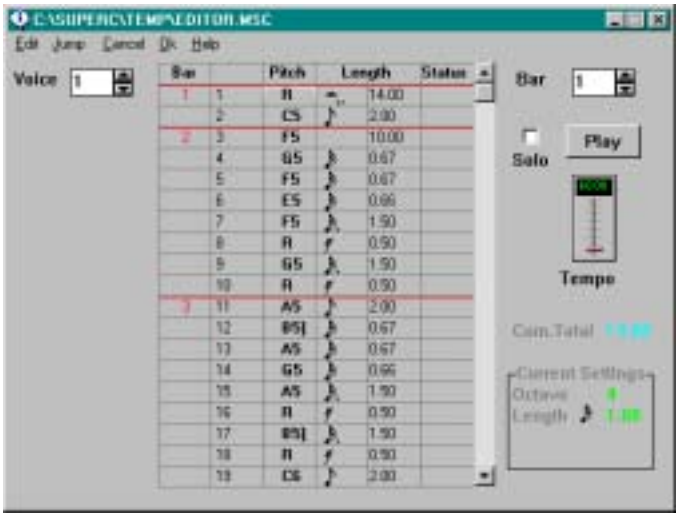
This function allows you to choose which voice to delete in total. This function cannot be undone.

Edit Menu

This menu contains many of the normal Edit functions found in Windows programs.

Editor

Choosing this item starts the Music Editor application. The first dialog that is presented allows you to select the range of bars you will be working on. The default value is the whole piece. Upon clicking OK, the following window is presented.



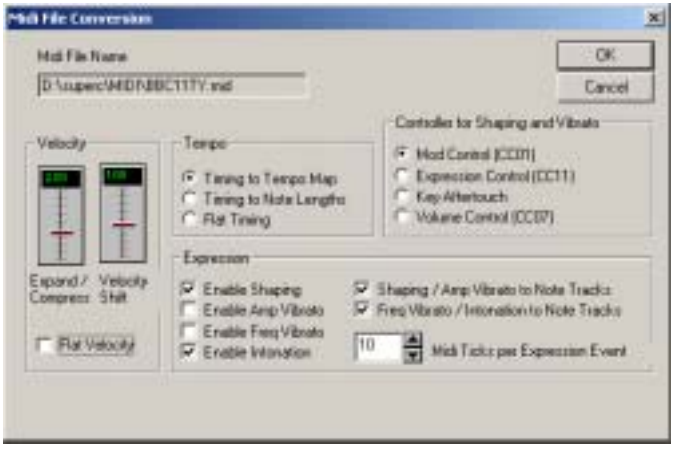
The Music Editor window presents a list editor interface that allows you to change the pitch, duration and articulation of each note in the music file. Trills can be entered, shaped, and edited using the trill editor. For an in-depth explanation of this application, see Appendix B “The Music Editor”.

Exansion/Compression

Found in the “Interpretation / Expansion Compression” menu, this slider lets you adjust the relative amount of dynamic range of a piece. Raising the slider expands the sound, giving it more dynamic range, and lowering the slider compresses the sound, giving it less dynamic range.

Export MIDI File

SuperConductor files may be exported into the MIDI file format using the "File / Export MIDI File" menu. Each voice in the SuperConductor file will be written out as a separate track in the MIDI file. Instruments will be set to their closest approximation in the MIDI file. See the section "Import MIDI File" for a complete description of track, channel and patch. There are several export options available, which are described below.



Velocity Section

Velocity usually represents the volume of the note being played. In some cases, velocity also changes the attack of a MIDI note, the timbre of the note, or even the instrument sample being used.

The **Expand/Compress** slider transforms variations in MIDI velocities to have less dynamic range (compressed) or more dynamic range (expanded). The default value of 2.0 offers the best average dynamics for most standard MIDI players and samplers. A larger value accentuates the changes in velocity. A smaller value diminishes the changes.

The **Velocity Shift** slider shifts all MIDI note velocities up or down and can be used to optimize the resulting output so that notes fall into the desired velocity ranges. It is often the case that MIDI players and samplers

map certain ranges of velocities to different instrument timbres and even different samples. Default 1.0

The **Flat Velocity** checkbox, if selected, will cause all exported notes to have equal MIDI velocity.

Tempo Section

MIDI files typically use a tempo map to control the tempo of a piece dynamically while it is being played. Another variation on controlling tempo is to play the notes with the correct timing and duration, ignoring the MIDI metronome. If this second option is used, bar lines are meaningless.

Flat Timing is the default. This option puts the main tempo for each bar in the tempo map, but ignores all other tempo changes created by ritards or pulse.

Timing to Tempo Map. This option translates all timing information from the SuperConductor pulse as well as ritards to the tempo map. By choosing this option, the MIDI file will grow considerably in size, and some MIDI devices may overload with too much information.

Timing to Note Lengths. This option varies note lengths to accommodate tempo changes. This is ideal in creating MIDI files which remain small, yet still contain all the tempo changes. The MIDI file will not be easily editable, as notes will not appear on bar lines or for that matter even in the same bar as they originated.

Expression Section

SuperConductor has a variety of functions that aren't directly supported by MIDI. Each of these functions can be emulated by sending a stream of controller information along with each track and note that controls the subtle variations in pitch and loudness that are necessary to create vibrato and dynamic note shaping.

The **Enable Shaping** checkbox, when selected, will emulate predictive amplitude shaping of notes by sending continuous volume control information with each channel of the MIDI data.

The **Enable Amplitude Vibrato** checkbox, when selected, will emulate amplitude vibrato (tremolo) by sending continuous volume control information with each channel of MIDI data.

The **Enable Frequency Vibrato** checkbox, when selected, will emulate frequency vibrato by sending continuous pitch control information with each channel of MIDI data.

The Enable Intonation checkbox, when selected, will emulate SuperConductor's patented Expressive Intonation functions by sending variations in pitch control information with each MIDI note.

Shaping/Amplitude Vibrato to Note Tracks and **Freq Vibrato/Intonation to Note Tracks** determine whether the controller information is written to separate MIDI tracks or to the same MIDI track as the notes.

Midi Ticks per Expression Event controls the number of controller events that are sent over each MIDI channel. The default value is 10. To reduce the number of controller events you must increase this value.

Controller for Shaping and Vibrato. There are a variety of MIDI controllers that are used by various sequencers and samplers to control continuous volume changes. There is no industry standard for these. In order to determine the correct controller channel for your sequencer please refer to the documentation of the sequencer. SuperConductor can send continuous volume change information for dynamic note shaping and vibrato over four possible controller channels, Mod (Breath) Control (CC01), Expression Control (CC11), Key After-touch, and Volume Control (CC07).

Important Notes:

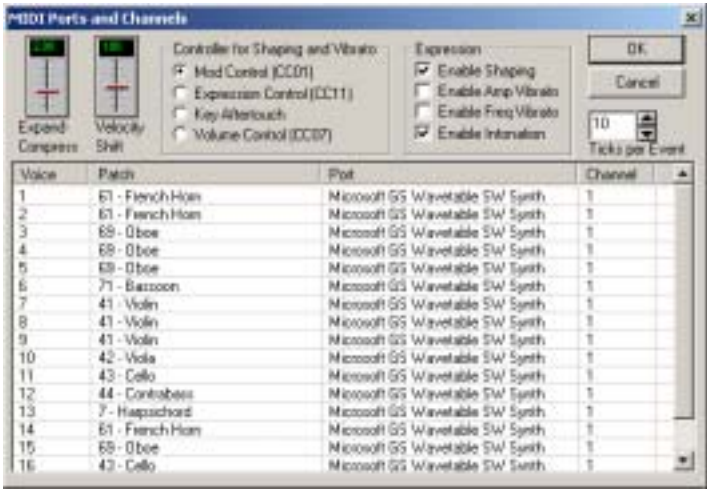
1. By enabling any of these features, a large number of controller messages are sent for each note and each track, and depending on the MIDI sequencer being used can cause an overflow and loss of information in the MIDI player. If you notice erratic performance or timing when you play the resulting MIDI file, try disabling some or all of these features or increase the number of MIDI ticks per event.

2. Since each midi channel has only a single volume controller, difficulties will arise when two notes are playing in the same channel at the same time and shaping or amplitude vibrato information is needed for each note independently. SuperConductor addresses this problem by attempting to separate voices into different channels, but in pieces with greater than 16 voices (the number of MIDI channels available) there is bound to be some overlap of notes.

Playing Directly to MIDI

Playing your SuperConductor music directly to a MIDI sequencer or sampler can be done by selecting the "**Output/Output to MIDI**" from the menu or the "**Output to MIDI**" option on the main play panel.

Settings for direct MIDI output are done either in the "**Output/Midi Settings**" menu or "**Midi Settings**" on the main play panel.



Instructions for the Expand, Velocity, Controller and Expression parameters of the MIDI Settings panel are described in detail in the "**Export MIDI File**" section above.

By clicking in the various columns of the Patch / Port / Channel list you can change the instrument, the port and the desired channel of each voice.

Flatten File

Choosing Flatten File will neutralize the parameters of the micro score except for default note shapes, balance, panning, delay and vibrato. The resulting performance will be what the score would sound like if it were performed exactly as written with default settings. When a file has been flattened, the menu item reads “Unflatten File”. Choosing this item will restore the microscore to the file.

Import MIDI File

MIDI files may be imported into the SuperConductor music file format using the "**File/Import MIDI File**" menu. The differences between the organization of MIDI files and SuperConductor music files must be understood in order to successfully import MIDI files.

MIDI File Organization

MIDI files are organized in (a) tracks, (b) channels (c) patches (d) ports and (e) events.

MIDI files can have any number of *tracks*, with each track used for grouping notes together. Tracks can be organized in many ways, but are usually created so that one track contains all the notes for one instrument in a piece.

Each MIDI device such as a keyboard, synthesizer, sampler, or drum machine is typically assigned one *port*. Each port has 16 *channels* available in MIDI. Every note in a MIDI piece must be played out on one of these ports and channels. More than one note may be played on a single channel at a time (polyphony) if the device supports it, but at any given time a single channel on any port can only generate sounds from a single instrument *patch*.

An instrument patch is a unique sound that is assigned to a single MIDI channel on a given device. Instruments can be changed while a MIDI file is playing, but only one instrument can be assigned at any given time to each channel. The General MIDI (GM) specification assigns a unique number from 1 thru 128 to every instrument patch.

Below is an illustration of the organization of a typical MIDI file. The tracks and channels in this example are arbitrarily chosen by the person who arranged the MIDI file. *The only exception is that channel 10 is often reserved for percussion, and follows special rules.*

TRACK	NAME	CHANNEL	PATCH
1	Flute	Channel 5	74 (Flute)
7	1st Violin	Channel 2	41 (Violin)
8	2nd Violin	Channel 2	41 (Violin)
9	Viola	Channel 3	42 (Viola)
10	Cello	Channel 4	43 (Cello)

Each track is organized in a time sequence, with each operation such as a note-on, note-off, patch change or volume control called an *event*. A MIDI *sequencer* reads each event from a MIDI file in the order it is to be performed and when the correct time comes, issues the command to whatever device is to play the sound. MIDI devices are varied, and range from electronic keyboards and drum machines to simple black boxes that produce sound.

The sound card in most standard PCs contains all the necessary equipment to play MIDI files directly to a speaker, or to send commands through a MIDI cable to external devices.

SuperConductor File Organization

SuperConductor files are organized as up to 128 voices, with each voice being monophonic (able to play a single note at a time). When a MIDI file is imported, SuperConductor begins by assuming that each track in the MIDI file represents a single instrument. Notes within that track are then separated into different voices if they are playing at the same time or are playing to different channels.

Some instruments such as the flute can only play one note at a time, and thus when imported will result in a single voice in SuperConductor, whereas other instruments such as the piano can play as many as 10 notes at a time (10 fingers) so may result in up to 10 voices.

Since MIDI files don't follow a standard organization, it is often necessary to edit the MIDI file before importing it. Here are some tips:

Most files will import without incident, but some will not. Listen to the MIDI file and try to understand it's organization before importing it. It is best to do this in a program which allows you to at least view and edit the event list. This will help to understand problems that may arise during the import process. Some signs that a MIDI file needs some work are too many resulting voices after importing to SuperConductor, wrong instruments, or badly aligned notes.

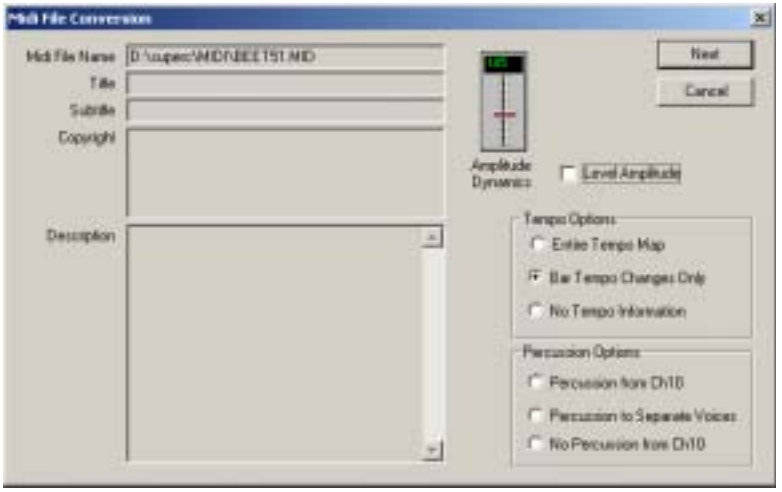
In order to conserve voices, make sure that notes for the same instrument are playing to the same MIDI channel. For example, in the case of a MIDI file which has 2 flutes, one playing out channel 6 and the other channel 7, set them both to channel 6.

Make sure correct instrument patches are in place. SuperConductor looks at the *first patch in each channel* to determine which instrument to use. Sometimes there is an incorrect patch immediately followed by a correct patch at the beginning of the MIDI file. This will cause the wrong instrument to be assigned. By removing the incorrect patch with a MIDI editor, this problem can be resolved.

Quantize the MIDI file correctly. Make sure notes start at bar lines, and that note lengths are accurate. Some MIDI files are 'played-in' in order to get a particular interpretive effect, but by doing so, are not synchronized to the MIDI metronome. This can cause awkwardness for some interpretive functions of SuperConductor, but will not affect global note shaping and organic vibrato.

Import MIDI Options

After choosing the **"File/Import MIDI File"** option from the menu, and selecting the MIDI file you wish to import, choose the options for importing as follows:



Amplitude Dynamics

This slider controls the relationship between the loudness of a MIDI note and the corresponding loudness of the SuperConductor note. A larger value accentuates the changes in loudness. A small value diminishes the changes. This slider's default value is 1.85.

Level Amplitude

MIDI files which are 'played-in' use note velocity and loudness for expression. SuperConductor adds these expressive qualities globally with its interpretive functions such as pulse. By choosing this option you will start with a 'flat' file, and can gain in a direct way from SuperConductor's interpretive functions. Alternately, if you want SuperConductor to play the MIDI file including how it is already interpreted, don't choose this option. You can then add SuperConductor's powerful functionalities to the interpretation limited by MIDI.

Percussion Options

MIDI files, by convention, use channel 10 for percussion. Instead of notes in this channel playing a particular pitch, *the pitch number selects an individual percussion instrument*. Because of the limited number of channels in MIDI, some pieces that don't use percussion override this option so as to free up channel 10 for another instrument.

Percussion from channel 10 is the default. All notes from channel 10 will be automatically mapped to the correct percussion instruments and placed in a minimum number of voices.

Percussion to separate voices will break out each percussive instrument into a separate voice which allows for greater control over individual sounds, but adds greater complexity to the music file. Since there are 128 different percussion instruments, it is possible, although unlikely, that percussion could use 128 voices or more in SuperConductor.

No percussion from channel 10 must be used if the MIDI file does not follow the standard percussion format, and instead uses other instruments in this channel.

Tempo Options

MIDI files use what is called a *tempo map* to control the tempo of a piece dynamically while it is being played. Simple files may have a single tempo setting at the beginning of a file. Complex MIDI files may have many tempo changes per measure in an attempt to create a more human feeling.

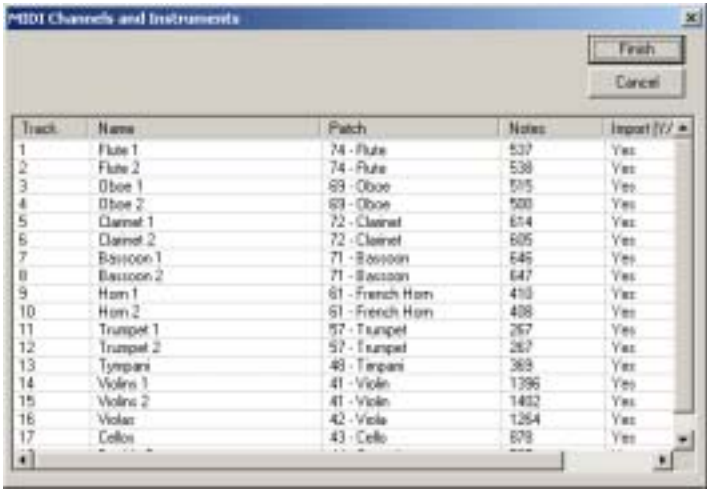
Bar Tempo Changes Only is the default. This option picks up the main tempo changes for the piece, but ignores more than one tempo change within a bar. This option is recommended if you wish to have full control over all of the interpretive functions of SuperConductor.

No Tempo Information. This option ignores all MIDI tempo information.

Entire Tempo Map. This option reads the entire tempo map, and uses it while playing the file with SuperConductor. This method precludes you from adjusting the tempo with the main Tempo slider or with the Meter / Tempo functions of SuperConductor. Tempo changes may be made using the Ritard functions.

MIDI Tracks and Instruments Report

After choosing the MIDI import options above, a summary of each track of the MIDI file is presented in a list. Check this list to see that each track has the correct patch assigned. You can choose at this time discard certain tracks by clicking in the Import (Y / N) column of the table. If things don't seem correct at this point, cancel the operation and edit the MIDI file with your favorite MIDI editor to fix the problems.



When satisfied with the list, click the Finish button to complete the MIDI import process.

The final step in importing a MIDI file is to review the way SuperConductor organized the instruments during the import process.

Click on the Balance Icon and check that each voice has been assigned the correct instrument and that the Level and Panning sliders are set to reasonable numbers.

Save the file with a new name and you're ready to begin interpretation of your new piece of music.

Conducting using a Joystick

When you plug a standard joystick (logitech attack3 recommended) into your PC's game port or USB port, SuperConductor detects its presence automatically and the joystick may then be used to control the tempo and volume of a piece while it is being played.

Fast small movements of the joystick bring the music to life, with accents, eloquent phrasing, subtle and rapid shades of loudness changes. After a short time, you become, as it were, one with the instrument, the joystick, and do your own 'dance' with it, differently for each piece of music.

Experience the full feeling, excitement and satisfaction of music that you conduct yourself, in the present moment.

The two dimensions of motion of the joystick instantly control tempo and loudness in any combination depending on angle of motion. Motion is largely quick and subtly penetrating. Various elliptical patterns, different for different pieces and composers can impart to music characteristic expression, in the smallest details. Instant connection to the heart of music. Increases the living and dynamic quality of music. Control the shape of tones even after they have begun (even piano).

One button on the joystick handle when pressed pauses the music.

Releasing the joystick will bring the tempo and volume back to the starting values.

To record your conducting session, click on the "Record" button. Once you start the music again, all your joystick movements will be played back.

Clicking on record a second time will allow you to "touch up" your previously recorded conducting.

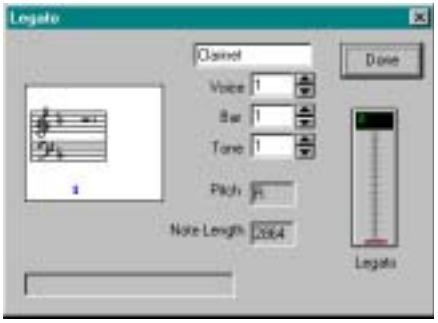
You can conduct any of the tens of thousands of MIDI files that may be downloaded from the Internet from sites like ClassicalArchives.com. See the section on Importing MIDI files for details.

NOTES:

For best results, put the joystick on a table, and position the joystick about 30 degrees counterclockwise.

You may need to go to the Windows Control Panel and select Game Controllers to enable and calibrate your joystick. Calibration is a simple wizard that will take you step by step through the process.

Legato



With some instruments, especially keyboards and harp, players overlap adjacent notes within a melody to create a smoothly flowing melody. The Legato function allows you to lengthen the sounding length of a note without changing its written duration. This has the effect of overlapping or smearing the end of one note with the beginning of the next. It is the logical opposite of the Staccato function. This can be done with all instruments in SuperConductor (even wind and string instruments). For piano, the legato function can also be used to provide a pedal effect by sustaining desired tones (even just in middle voices!)

Voice

This box displays the number of the voice to which the legato will be added.

Bar

This box displays the number of the bar to which the legato will be added.

Tone

This box displays the number of the tone in the chosen bar to which the legato is added.

Pitch

This box shows the name of the pitch of the current note. If the value is “R”, the note is a “rest” or measured silence.

Note Length

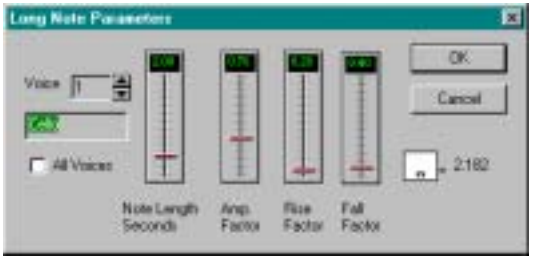
The Note Length is displayed in a decimal fraction of the nominal length of the note.

Legato

These sliders adds duration to the sounding length of the current note. The sounding length of the tone will increase by the value of the slider, without changing the timing of the notes following in this voice. Graduated in decimal fractions of the nominal note length, the range of the control is from 0 to 256.0. A typical value might be 0.1. Larger values are used for pedal effects. Coarse and fine sliders allow adjustment for short or long legato.

Note that legato is applied to the note specified, lengthening it to link with the following note. It is not applied to the next adjacent note.

Long Note Parameters



Notes that are longer than one or two seconds in music tend not to function as melodic elements but contribute to the musical texture and sustained harmony. Therefore, the note shaping parameters used in the normal melodic setting are not appropriate. With this function, you can direct SuperConductor to apply different parameters to notes that have durations longer than the threshold you specify.

Note Length Seconds

This slider controls the duration threshold for long notes. Tones whose durations are longer than the value specified will be treated as long notes. A typical setting is 1.5 seconds. The length of a whole note is shown for reference.

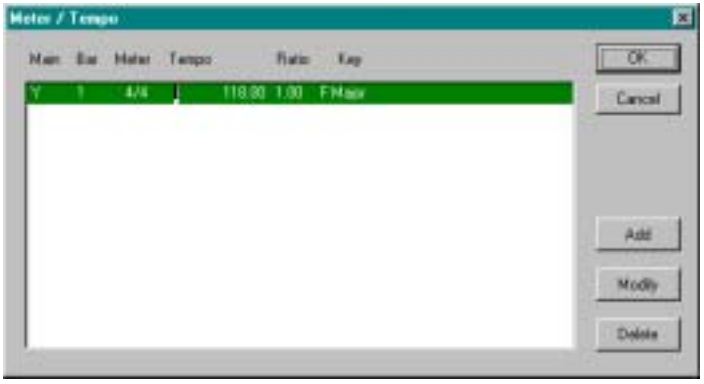
Amp. Factor

The amplitude of notes longer than the Note Length threshold will be multiplied by the Amp. Factor. The range of values is from 0.00 (-inf dB) to 4.0 (+12 dB). A typical setting is 0.70.

Envelope Rise Factor, Envelope Fall Factor

These values are used to scale the global Envelope Rise and Envelope Fall values for notes longer than the long note threshold. This enables long notes to rise faster and decay less quickly that they would otherwise do without needing to adjust each one manually. Typical values are from 0.2 to 0.5. Larger values cause Rise and Fall to be faster.

Meter/Tempo

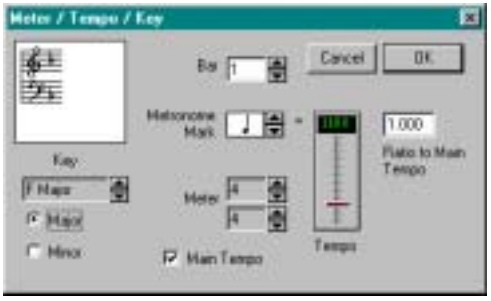


This function lets you specify a range of bars that have a meter, tempo or key different from that of the general piece. The change that you enter will stay in effect until the next Meter / Tempo reset.

To add a different tempo or meter for a voice, click the Add button. The Meter / Tempo / Key window appears. Use the controls described below to make modifications. Click OK to enter the changes in the Meter / Tempo list.

To modify an existing meter / tempo section, click on the section to be modified and then click on the Modify button. Enter the changes and click OK.

To delete a meter / tempo section from the list, select the section by clicking on it. Then click on the Delete button. The section disappears from the list.



Bar

This box displays the bar where the section will start.

Metronome Mark

This consists of the note value, equal to one beat, that applies to the tempo indication in beats per minute.

Meter

These two boxes display the current meter of the section. The top number is the number of meter units per bar. The bottom number is the type of note that is equal to the meter unit. For example, 3 / 4 means three quarter notes per bar, 3 / 8 means three eighth notes per bar. The range of the controls is 1 to 32. Usable values for the bottom number are 1, 2, 4, 8, 16, and 32.

Tempo

This slider controls the amount of tempo change that will occur in the section relative to the overall tempo set in the Play window. The range of values is from 20 to 440 beats per minute. This control should only be used when there is a change in meter in the music. Otherwise, Terrace Ritard / Accelerando is recommended for tempo changes within the same meter.

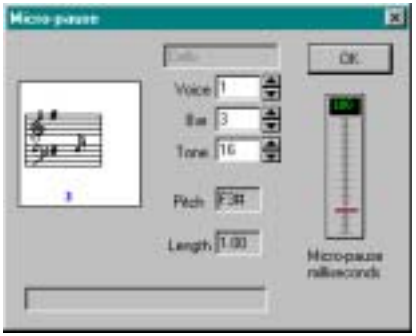
Key

Use the arrow keys to set the key signature of the section for the score displays in SuperConductor.

Main Tempo

If the Main Tempo check box is checked, this tempo setting is controlled by the main tempo slider on the play panel. If it is not checked, this tempo setting is always kept in the same proportion to the main tempo as specified in the 'Ratio to Main Tempo' box.

Micropause



In some music, master players will take short pauses in the flow of the music at certain points to clarify musical structure or, occasionally, to create a special articulation. The Micropause function allows you to add a short silence after a specific note or section. The pause is the equivalent of adding a short rest to the melodic line, so it is important to add the same length pause to all the voices in the music so that they stay synchronized. This occurs automatically in SuperConductor.

SuperConductor will usually make phrases “breathe”. If more separation at the end of phrases is desired, a micropause can be inserted. This should be necessary only rarely. This will interfere with the pulse and continuity if too large, but may be very appropriate at the end of major sections.

Voice

This box displays the number of the voice to which the micropause will be added.

Bar

This box displays the number of the bar to which the micropause will be added.

Tone

This box displays the number of the tone in the chosen bar.

Pitch

This box shows the name of the pitch of the current tone. If the value is “R”, the tone is a “rest” or measured silence.

Note Length

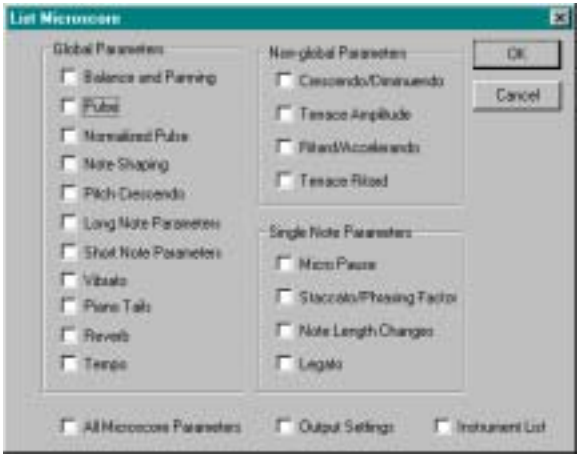
The Note Length is displayed as a decimal fraction of the note’s nominal length as shown in the score.

Micropause

This slider controls the duration of the micropause that will be added to the end of the current note. Inserting this small silence after the tone will make the next tone in this voice and all voices delayed by the length of the micropause. If some notes end later, they will be lengthened to fit.

Graduated in milliseconds, the range of the control is from 0 to 2000. The most common settings are from 100-300 milliseconds.

Microscore



Choosing this option calls the List Microscore window which allows you to indicate which elements of the microscore parameters you want listed.

New

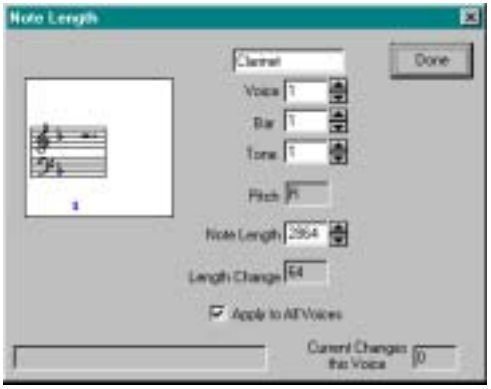
Clicking on the New item in the File menu causes the File window to appear. The directory display in the upper left corner shows the selected directory, the contents of which are displayed in the file list in the lower part of the window. Click on a file name to select it, or type in the name of a new file.

Click Cancel or hit <esc> to dismiss the window. Clicking OK opens the selected file and dismisses the window.

Note Length

With the Staccato and Legato functions, you can change the sounding length of a particular note. The Note Length function allows you to change the actual written length of a note. This can be dangerous because this has the effect of lengthening or shortening the music for a whole voice, thus putting the voice out of synch with the other voices. As a result, this function is mostly applied to all the voices simultaneously.

Note lengthening can be applied to one voice only, but requires that other notes of that voice be compensated in length to maintain alignment. Individual voice rubato can be achieved in this way.



Voice

This box displays the number of the voice in which the length change will be added.

Bar

This box displays the number of the bar to which the length change will be added.

Tone

This box displays the number of the tone which is to be lengthened or shortened in the chosen bar.

Apply to All Voices

Checking this box will add the effect of the lengthening to all the voices in the current music file.

Note Name

This box shows the name of the pitch of the current tone. If the value is "R", the tone is a "rest" or measured silence.

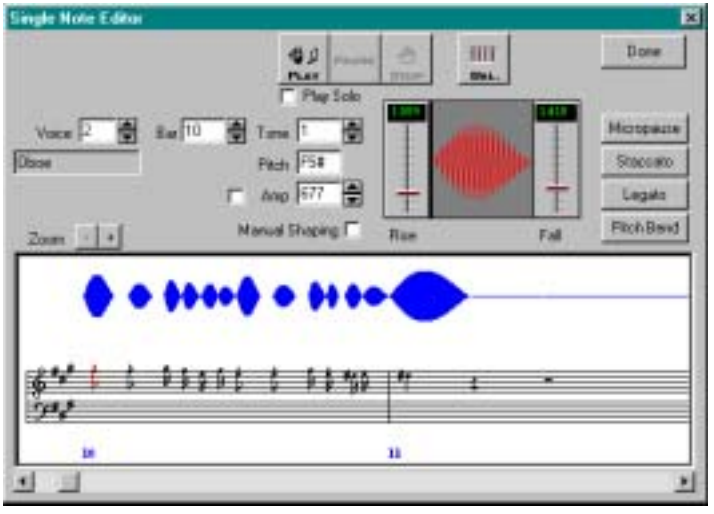
Note Length

The Note Length is displayed as its length in points. Increment or decrement the value by using the arrows. Individual voice note lengthening is displayed in points to ensure that absolute synchrony is maintained.

Current Changes This Voice

This box displays the number of points that have been added or subtracted through changing the number of points. In order to maintain absolute synchrony when making length changes to a single voice, this number must be adjusted back to zero before leaving this function.

Note Editor



Choosing this item from the Single Note menu calls the Single Note Editor window. This function allows you to change the pitch, loudness, amplitude envelope shape, staccato, legato and pitch bend for any one note in a piece. To pick a note to edit, click on the note in the score display.

Voice, Bar, Tone

These boxes display the voice, bar and tone for which the change will be made.

Pitch

This box shows the name of the pitch of the current tone. If the value is "R", the tone is a "rest" or measured silence.

Amplitude

This control adjusts the amplitude of the current note. The range of the control is 0 to 32767. The check box to the left of the Amp box indicates if the amplitude of this note has been changed manually.

Rise and Fall

These controls adjust the current note's rise and fall contour. Small values give a faster rise in the beginning of the note or a more sustained legato effect at the end of the note. Large rise values cause the note to sound late and to swell in longer note durations. Large fall values cause the note to diminish quickly, like a graded staccato.

Very large fall values produce percussive effects when combined with small rise values.

Note: Envelope Rise and Envelope Fall characteristics are scaled to the overall length of the note. The basic shape that is displayed is stretched over the length of the note, so that a very long note will have a long onset and release compared to a shorter note.

Manual Shaping

This box becomes checked when the rise or fall values are changed. Uncheck the box to allow the global predictive amplitude shaping parameters to apply to the current note.

Zoom

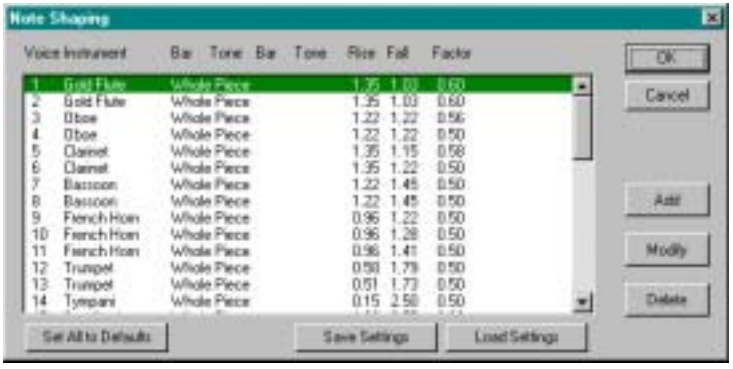
The Zoom boxes allow you to increase or decrease the amount of score shown in the score display.

Micropause, Staccato, Legato and Pitch Bend

See the respective reference sections of this manual for detailed descriptions of these functions.

Note Shaping

The Note Shaping window allows for adjusting the predictive note shaping parameters for each of the voices. This is usually adjusted first globally for each voice for the entire piece. Each note gets a different shape as a result of this function. Occasionally in a section of a piece the basic note shaping envelope may need to be modified to accommodate some special feature or section in the music [for example, pizzicato for strings]. The Note Shaping window allows you to program when this occurs and what settings are to be used.



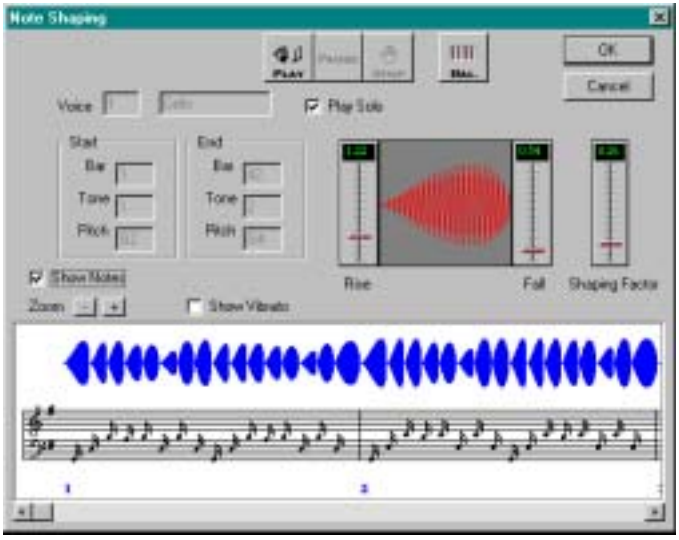
To add new shaping for a voice over a range of bars, click the Add button. The Note Shaping Editor window appears. It contains a graphic display of the amplitude envelope that will be used for shaping the notes. Use the controls described below to modify the note shaping parameters. Click OK to enter the changes in the Note Shaping list.

To modify an existing note shaping section, click on the section to be modified and then click on the Modify button. Enter the changes as above and click OK.

To delete a note shaping section from the list, select the section by clicking on it. Then click on the Delete button. The section disappears from the list.

Use the “Set All to Defaults” button to reset all the shaping values to their defaults.

“Save Settings” saves all the shaping parameters for this file in the shaping database, and “Load Settings” retrieves these settings. This can be used to copy settings from one file to another.



The Note Shape Display is a graphic representation of the basic envelope shape that will be used for varying the shape of notes in the specified bar range. Notes which are very long will be modified in shape by the Long Note Parameters in the Single Note menu.

Voice

The Voice number box shows the number of the voice being edited. Increment or decrement the value using the arrows.

Start and End

The Start and End boxes show the segment of the piece that will be affected by the current note shaping parameters. Default is for the whole piece. Adjust the range for the current section by using the arrows next to the text boxes, or type in the bar and note numbers.

Envelope Rise and Envelope Fall

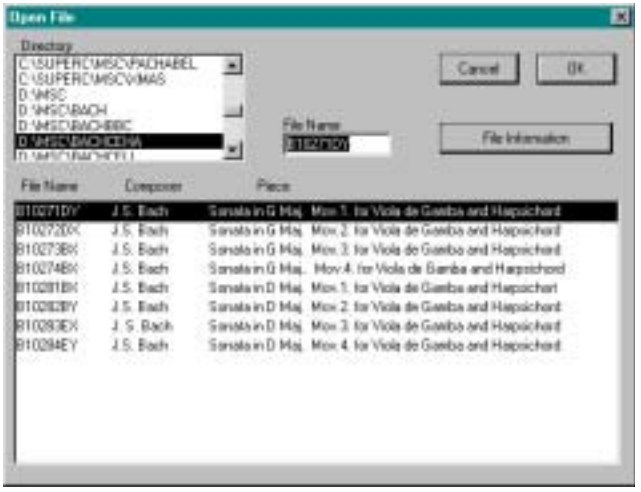
On either side of the envelope display is a slider. They are labeled Rise and Fall. The Rise slider mainly controls the shape of the note rise. Fall controls the shape of the note fall. These parameters are interactive and are, in effect mirror images of each other. Small values have little enveloping effect. Large values of Rise cause the note start to begin quietly and swell. Large values of Fall cause the note ending to taper to silence quickly.

Shaping Factor

SuperConductor's predictive amplitude shaping algorithm uses the time to the next note and the melodic interval to the next note to determine the change in the amplitude envelope it applies to the current note. If the next note is higher than the current note, the envelope is modified in form and effect to have a longer rise and a shorter fall. If the next note is lower than the current note, the envelope is modified to have a shorter rise and a longer fall. If the next note comes sooner, these effects become more pronounced. Predictive amplitude shaping is not applied to staccato notes and notes followed by a rest; they retain their basic shape unaltered by what follows.

The amount of shape change that is applied to the note shaping envelope is controlled by the time / interval slope to the upcoming note. The Predictive Shaping Factor slider controls the overall degree to which this happens. The slider's range of values is 0.00 to 1.0. Higher values cause larger differences in the note shaping envelopes. The normal setting is 0.5. If set to 0, the basic shape is used unchanged for all notes and spans the duration of each note.

Open...



Clicking on the New or Open... item in the File menu causes the File window to appear. The directory display in the upper left corner shows the selected directory, the contents of which are displayed in the file list in the lower part of the window. Click on a file name to select it, or type in the name of a new file.

Clicking on the File Information button brings up the Music File Information window where data about the composer, piece name, interpreter and comments can be entered and saved.

Click Cancel or hit <esc> to dismiss the window. Clicking OK opens the selected file and dismisses the window.

Output Menu

The Output Menu allows you to select how SuperConductor will generate audio output.

Paste

The Paste command places the contents of the Clipboard at the selected bar.

Paste From

Paste From allows you to paste another music file into the currently open file. Choosing this menu item calls the Open File dialog from which you choose the file you want to paste. The pasted data is inserted at the selected bar.

Points Per 16th Note

This item allows you to choose the number of time units used in the minimum pulse unit. Default setting is 200 points per unit.

Piano Tails

Hammered or plucked strings such as the piano, harpsichord or guitar cannot be shaped as compared to instruments like the violin or flute whose loudness can be continuously changed by the performer over the duration of the note. When a string is plucked or struck it continues to vibrate at a gradually decreasing amplitude and can only be stopped by dampering it. The piano tails function defines the length of time that the sound continues to play after dampering begins. Since high or soft notes decay faster than low or loud notes, the variables used in this function allow you to adjust the relationship of the tail length to the pitch, loudness and length

of the notes being played. The tail start function allows you to vary the time the tail damping begin.

Adjusting the tails function accomplishes two aims:

(1) allows you to adjust the piano (or harpsichord) sound to suit different composers and periods, eg Mozart, Beethoven, Brahms or Scarlatti.

(2) provides for global microphrasing varying the degree of legato and staccato using predictive technology like in the note shaping function.

NOTE: This function is computing power intesive, so it may be advisable to disable it if you experience sound buffer overflows on slower computer.

Tail Length Factor

This value is the length in seconds of a nominal tail. Increasing this value will increase the sounding length of notes being played. Decreasing this value will shorten them. (Default .125)

Length to Note Duration

Sets the relationship of tail length to the note's duration. (Default 0).

Length to Note Amplitude

Sets the relationship of tail length to the note's loudness. (Default 0).

Length to Note Frequency

Sets the relationship of tail length to the note's pitch. The higher the value, the more sustained the high frequency tones, and the more distinct and articulated the bass tones.

Begin Tail

Sets the phase of the notes when the tail starts to come into play. It is given in seconds before the nominal end of the note.

Begin Tail to Note Duration

Sets the time of the beginning of the tail to the note's duration. Lower values in relation to the begin tail setting increase the degree of phrasing. Higher values give a brighter sound.

Save Settings

This function is used to save the current tail settings into the tails database with a unique name. This function can be used to copy the settings from one music file to another, or to save your favorite settings for use in any file.

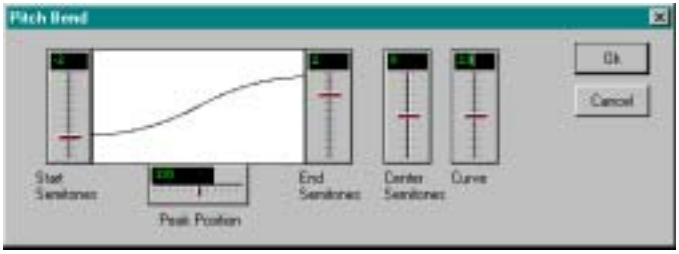
Load Settings

This function is used to load settings from the tails database into the current music file.

Piano Palette

This function imparts a smooth range of tone color to each Boesendorfer note depending on loudness, like the physical piano does. Lower settings (1 - 3) will result in a more mellow voiced instrument, higher settings (4 - 8) for greater brilliance and harshness. Note that for each single setting the notes will have a variety of tone colors depending on loudness. (This is not a filter function).

Pitch Bend



The pitch bend function allows you to change the pitch of a note gradually over the course of the note. This function is useful for creating portamentos in string solos and for making glissandi. It can also be used to provide expressive intonation, that is slightly changing the pitch of a note, to achieve expressiveness with an equal temperement tuning. Pitch bend may be placed on any individual note in a music file and is found in the Single Note Editor menu selection. Pitch bend is defined by 5 variables as follows:

Start Semitones

The pitch of the note's beginning, expressed in +- semitones from the nominal note pitch.

Middle Semitones

The pitch of the note at the "Peak Position" described below.

End Semitones

The pitch at the end of the note.

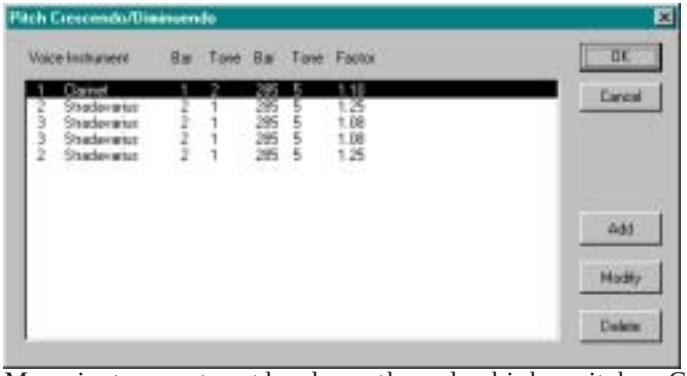
Peak Position

The position along the note where the "Middle Semitones" point occurs.

Curve

The curve factor that determines the shape of the pitch bend through the three points above.

Pitch Crescendo



Many instruments get louder as they play higher pitches. Good examples are the flute, trumpet, and the human voice. Other instruments like the oboe and bassoon get quieter as they go up in pitch. This function allows you set the amount of increase in loudness as a function of pitch for each voice individually. The correct amount of pitch crescendo allows for a natural rise in intensity and expression following the contour of the melody. This function is commonly called pitch / amplitude tracking in synthesizer parlance. It is set preferentially for different composers and often individual pieces.

To add a pitch crescendo setting for a voice, click the Add button. The Pitch Crescendo / Diminuendo Editor window appears. Use the controls described below to specify the pitch crescendo desired for the chosen voice. Click OK to enter the changes at the end of the Pitch Crescendo / Diminuendo list.

To modify an existing Pitch Crescendo / Diminuendo section, click on the section to be modified and then click on the Modify button. Enter the changes as above and click OK.

To delete a Pitch Crescendo / Diminuendo section from the list, select the section by clicking on it. Then click on the Delete button. The section disappears from the list.

Voice

The Voice number box indicates the number of the voice to which the current settings apply.

Start and End

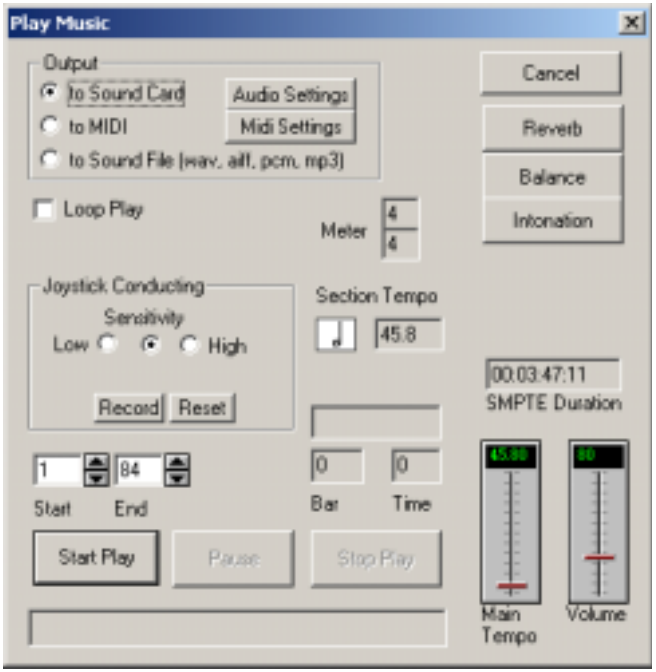
These boxes specify the starting bar and note and the ending bar and note over which the Pitch Crescendo / Diminuendo settings will take effect. The default range is the whole piece.

Per Octave Factor

This slider controls the amplification factor that will be used to increase or decrease the loudness of the present note as a result of its distance in octaves from the first note in that voice. Numbers greater than 1.0 cause the loudness to increase as the pitch increases. Numbers below 1.0 cause the loudness to decrease as the pitch increases. The range of values is from 0.5 (-6 dB) to 2.0 (+6 dB) per octave. The range including 0.8 to 1.3 is the practical range.

Play Music

The Play Music window is accessed from the Play icon or the Play menu item. The window controls various aspects of the play of music files. Only one file can be played at a time from the Play Music window. The various controls in the window are described below.



Output

The Output section of the Play Music window controls where the play signal will be directed. Click on the appropriate output for your application.

to Sound Card

The digital audio is directed to the audio outputs of your sound card.

to MIDI

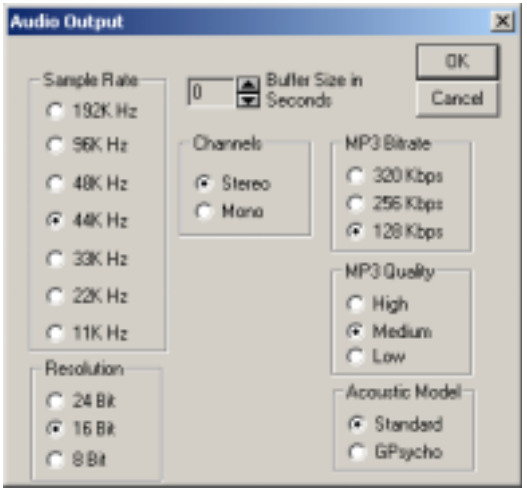
The output is directed to the MIDI section of the sound card. Set the desired MIDI output device with the MIDI Settings section described in the section "Playing Directly to MIDI" on page 99.

to Sound File

The output is written to a .wav, .aiff, pcm or mp3 file of your choice. The sample rate and number of channels will correspond to the output settings currently set in the music file. Set desired output parameters in the Audio Settings section described below.

Audio Settings

The Settings command button allows you to change sound output parameters such as sample rate, mono or stereo and output buffer size.



Loop Play

Checking the Loop Play box will cause the music file to play repetitively. Repeat play begins shortly upon completion of the previous play. Plays from specified Start Bar to End Bar.

Show Score

Checking the Show Score check box will cause the written score attached to the music file to appear when the Start Play button is clicked. If a score is note available for this piece, this check box will not appear.

Start and End

These two number boxes contain the bar numbers of the starting and ending points for play. Use the arrows to modify the range of bars to played.

Bar/Time

These boxes show the current play time in bars and in seconds. The empty box above them displays vertical strokes during play which represent the current pulse unit of the highest pulse level.

SMPTE Duration

Displays play length of the selected bar range in SMPTE time units.

Start Play

The Start Play command button initiates play.

Pause

The Pause button suspends play when clicked. During Pause mode, the button reads Resume. Click again to resume play.

Stop Play

The Stop Play button quits the play function and resets the play pointer to the Start point displayed in the Start number box.

Cancel

Clicking the Cancel button stops play and dismisses the Play Music window.

Reverb

Clicking on the Reverb button calls the Reverb Control window. See the "Reverb" section of this manual for details about using this window.

Balance

Clicking on the Balance window brings up the Instrumentation window. It has the same function as the Balance icon except that it can be accessed during real time play. See the "Voice Balancing" section of this manual for details.

Tempo

The Tempo slider controls the overall tempo for the play of the current music file. Graduated in beats per minute, its range is 40 to 220 beats per minute.

Volume

The Volume slider controls the overall loudness of play for the current music file. Graduated in arbitrary units, its range is from 0 to 255.

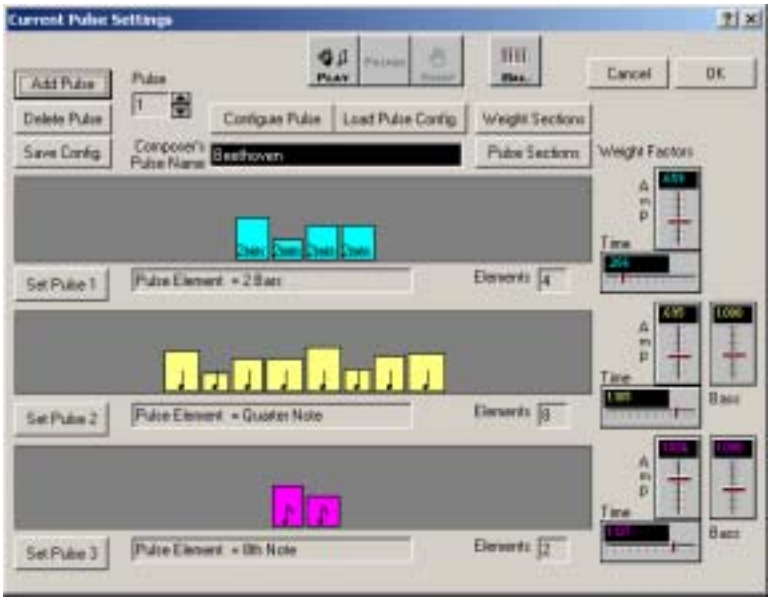
Joystick Conducting

When a Joystick is plugged into your PC, you can use the joystick to control Tempo and Volume of the piece while it is being played. By clicking on the "Record" button, joystick movements will be recorded so that you can play back your "conducting" session. Click the "Reset" button to zero out the recorded joystick conducting.

See the section "Joystick Conducting" for more information.

Pulse

Choosing this item from the Interpretation menu causes the Current Pulse Settings window to appear. The illustration below shows this window. Its functions are described below.



Add Pulse

Clicking on this button adds an additional pulse to the one already applied to the file. Any number of pulses can be created in a music file. The default settings for a new pulse are those that were set when the Add New Pulse button was clicked. The new pulse name is UNNAMED and its number, displayed in the Pulse Number display, is one greater than the number of the previous pulse.

Pulse Number

The Pulse Number display shows the numeric designation of the pulse displayed in the Current Pulse Settings window. As the value changes, so does the pulse settings which are associated with it. Most pieces will use only one pulse.

Configure Pulse

Clicking on the Configuration button calls the Pulse Configuration dialog. See Pulse Configuration.

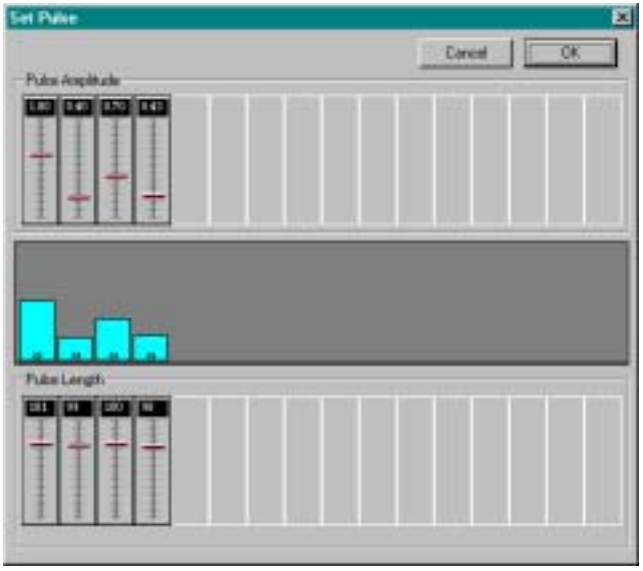
Pulse Name

This text box shows the name of the pulse displayed in the Current Pulse Settings window. This text can be edited.

Pulse Unit Display

This is a graphic display of the basic units that make up the pulse at the designated level. Symbolized as rectangles, pulse units have varying widths and heights corresponding to duration and amplitude respectively. Each pulse level has a different display color.

Set Pulse (n)



The Set Pulse (n) command button calls the Set Pulse Dialog. This dialog allows you to adjust the length in time (width) and amplitude (height) of each of the individual pulse elements. Pulse length and amplitude are controlled by sliders associated with each pulse element.

The Pulse Amplitude sliders are graduated in arbitrary units ranging from 0.1 to 1.5, minimum to maximum. The Pulse Length sliders are graduated in arbitrary units from 25 to 125. The slider value can be changed by dragging the thumb wheel with the mouse, clicking the mouse on the slider surface, or by selecting the text in the text box and typing in the new value.

Click Cancel or hit <esc> to dismiss the window. Clicking OK saves the current settings and dismisses the window.

Elements Text Display

This text box displays the number of pulse unit elements at the level of the pulse with which it is associated. Values range from 2 to 16.

Weight Factor Sliders

To the right of each pulse level display are a set of two sliders, one labeled Time, the other labeled Amp (for Amplitude). These sliders are called the Weight Factor sliders. They control the intensity with which the pulse settings at that level are applied to the music. There is one set of sliders for each level of the hierarchical pulse.

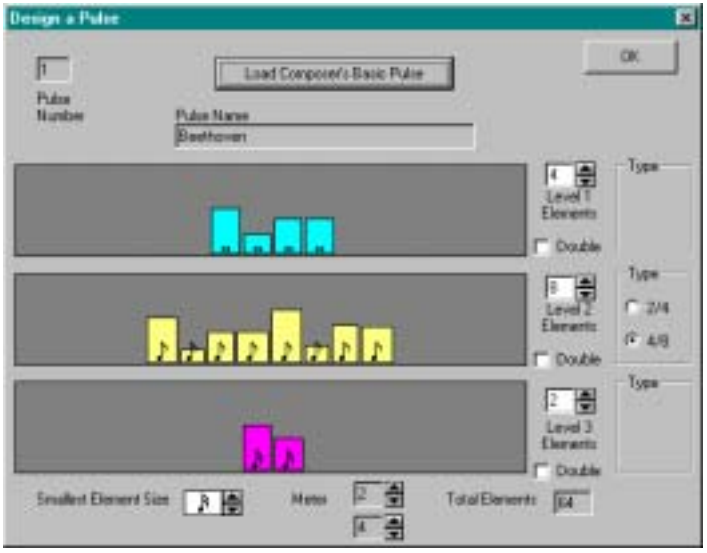
The vertical Amp slider controls the relative difference in loudness between the elements in the pulse level with which it is associated, hence "weighting" the differences. The display adjusts to show the difference in weighting. A value of 1.0 gives loudness ratios that are exactly equal to those set in the composer's pulse setting. The range of values is from 0.00 (no amplitude variations) to 1.50 (exaggerated amplitude variation).

The horizontal Time slider controls the relative differences in the durations of elements in the pulse level with which it is associated, thereby "weighting" the differences. A value of 1.0 gives length ratios that are exactly equal to those set in the composer's pulse setting. The range of values is from 0.00 (no length variations) to 1.50 (exaggerated length variation).

The slider value can be changed by dragging the thumb wheel with the mouse, clicking the mouse on the slider surface, or by selecting the text in the text box and typing in the new value.

The Bass sliders on pulse level 2 and 3 are used to enhance the amplitude differences of the pulse components for instruments in the lower register such as the cello and double bass thereby emphasizing the rhythmic effects of amplitude.

Pulse Configuration



The Pulse Configuration window is accessed through the "Config. Pulse" button in the Current Pulse Settings window. Its function is to set up the basic elements of each level of the Pulse and define the subdivisions of each pulse level. The pulse configuration is at the heart of the pulse function, and the choice will effect the performance considerably.

Pulse Number, Pulse Name

These designate the current pulse being edited.

Load Composer's Basic Pulse

Clicking on this button calls a dialog which contains a list of composer's pulses stored in the SuperConductor resource files. To select a composer's data, drag down the list with the mouse, releasing on the composer of choice, or click on the menu, then on the composer and then click OK. The composer's parameters will be entered into the Pulse Configuration window.

Level (n) Elements

The Level (n) Elements number boxes control the number of pulse divisions or elements in each level of the pulse hierarchy. Use the arrows to increment or decrement the value in the box. The range of values is from 1 to 16.

Normally, a level will have two, three, four, six or eight elements. Five or seven elements per level are rarely encountered.

Double

Checking the Double checkbox doubles the number of pulse elements in the respective level.

Type

When the number of pulse divisions in a level is an integer multiple of 3 or 4, the Type radio buttons become active. This control allows you to choose how to divide the group of divisions. For example in the case of six divisions per pulse level, you may choose between dividing into three groups of two, or two groups of three. The choice is dependent on the meter of the music being interpreted.

Total Elements

The Total Elements number box displays the total number of pulse elements in a complete pulse cycle. It is equal to the product of the number of divisions at all three levels of the hierarchy.

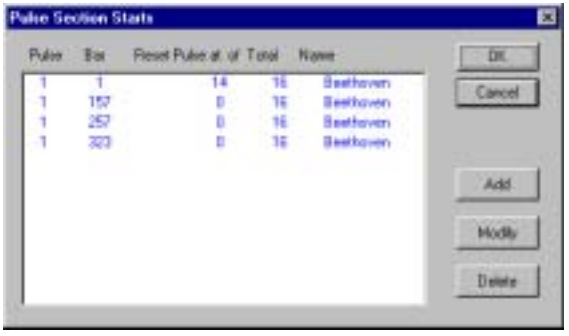
Meter

Use the arrows and type in the meter of the pulse being edited. This is for reference only.

Smallest Element Size

Usually the fastest notes of a piece are chosen as elements of the lowest pulse level. Trills and ornaments are excluded from being considered as fast notes.

Pulse Sections



From time to time in a piece the pulse needs to be reset to track some asymmetrical feature in the architecture of the music. The Pulse Section window allows you to program when and with which pulse a reset begins. Click on the Pulse Section button to access the Pulse Section window.

Clicking Add or Modify causes the Pulse Reset dialog to appear. Choose the pulse to be used in the Pulse Num. text box. The name of the pulse will appear in the text box above it. Select the bar of the piece where the pulse will reset by typing in the Start Bar text box. To start the reset pulse at the begining of the pulse array, which is one total cycle of the entire pulse, type 0 in the “Reset Pulse at Position” text box. If you wish to start the pulse at some other point in the array, type the number of the position you want in the text box.

Pulse Weight Sections

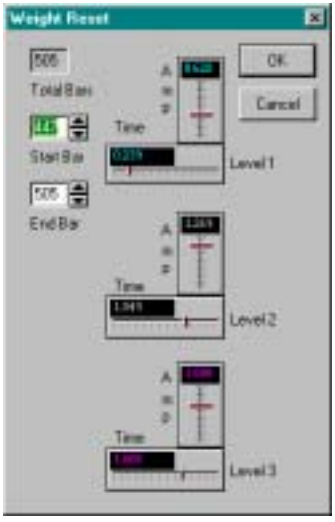
Because of changes in the character of the music, it may occasionally be advantageous to change the weight of the pulse. The Weight Sections window allows you to program the particular bar range over which the weight change will occur and how much change will be applied. A typical

use for the Weight sections is to reduce pulse effects during sustained trills.

To add a weight section, click the Add command button. In the window that appears, adjust the Amp and Time sliders, specify the starting bar, and ending bar. Click OK to add the weight section to the list in the Weight Section window.

To modify an existing weight section, click on the section to be modified and then click on the Modify button. Enter the changes as above and click OK.

To delete a weight section from the list, select the section by clicking on it. Then click on the Delete button. The section disappears from the list.



Reverb

The Reverb Parameters window controls the application of reverb to SuperConductor's output. NOTE: Audible feedback from changes in the reverb settings during real time play become available only after the amount of time allocated to the play buffer in the Buffer Time control in the Play Music window. Set this control to the lowest usable value (between 1 and 16 seconds).

Enable Reverb

Checking the Enable Reverb button directs the digital audio output of SuperConductor through the Reverb algorithm.

Reverberation Section

The controls in this section control the character and depth of the reverb. The controls are:

- **Time**

  The length of the reverb decay to -60 dB of initial input, graduated in seconds. The range of the control is from 0.1 to 4.0 seconds.

- **Mix**

  The ratio of direct signal to reverb algorithm output. The range of the control is from 0.0% reverb to 0.75 (75%) reverb.

- **Separation**

  Adding separation to the reverb creates a larger spacial separation between the left and right channel. The greater the separation, the greater the sense of space. Use especially for orchestral pieces.

- **Initial Delay**

  Also known as pre-delay, this is the amount of time between the onset of the signal and the onset of reverb. The slider is graduated in seconds. The range is from 0.01 secs. to 0.100 secs.

1st Reflections Section

The 1st Reflections Section contains controls that modify the density and complexity of the reverb sound.

- **Time Factor**

  Increasing the Time Factor increases the apparent size of the acoustical space the reverb is emulating. The Time Factor is a multiplier for the basic early reflection table used to generate the reverb.

- **Gain**

  The Gain control determines the strength of the first reflections. Number less than 1.0 cause the reverb to decay as the first reflections are being absorbed by the virtual room. A good starting value is 0.9.

- **Qty.**

  This slider controls the number of early reflections used in the reverb algorithm. The larger the number of reflections, the denser the resulting reverb. A large number of reflections is psychoacoustically associated with a room that has complex reflective surfaces. The range of the slider is from 0 to 10 reflections. Use small numbers for chamber music and solo instruments, and larger numbers for orchestral and other larger ensembles.

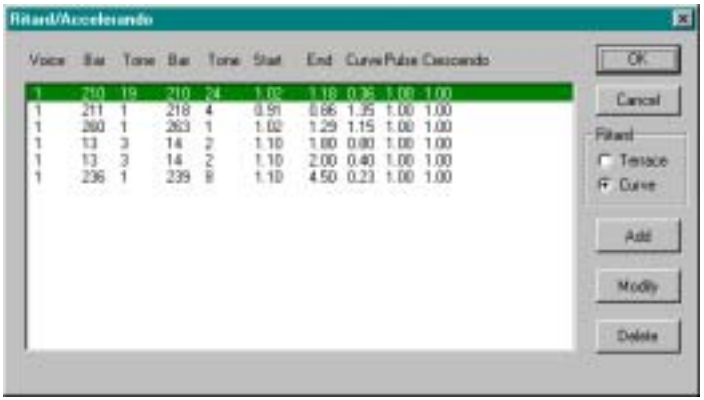
Channel Delay

It is sometimes desirable to introduce minute delays in the audio output of the reverb unit to simulate echoes in the acoustic environment. The Delay sliders are graduated in seconds and allow for introducing separate delays in each channel. The range of the sliders is from 0.00 seconds to 0.500 seconds.

Filtering Section

The Filtering Section contains a Freq. Resp. slider that controls the frequency response of the feedback filter in the reverb algorithm. The slider is graduated in arbitrary units. Larger values filter out more high frequency from the reverb. Small values allow more high frequencies into the reverberated sound. The range of the control is from 0.00 to 2.00. The default is 1.0.

Ritard/Accelerando

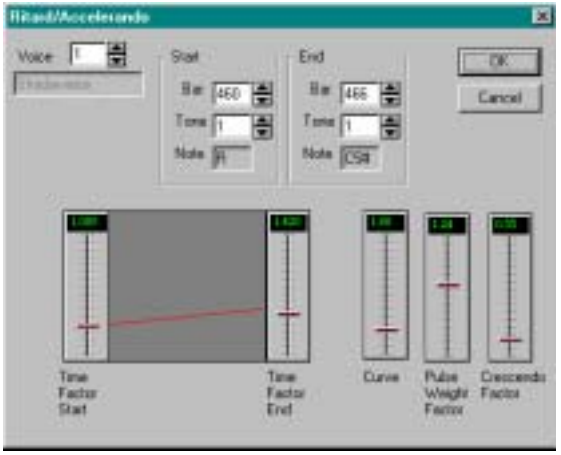


Choosing the Ritard / Accelerando item in the Interpretation menu or clicking on the Ritard icon causes the Ritard / Accelerando window to appear. This window allows you to enter bar ranges in the piece where a gradually changing increase or decrease in tempo is desired. The window's display shows a list of ranges where a ritardando or accelerando over a particular voice or range of voices has been specified.

To add a Ritard or Accelerando for a voice, click the Add command button. The Ritard / Accelerando Editor window appears. It contains a graphic display of the parameters that will be applied to the bar range you specify. Use the controls described below to modify the tempo. Click OK to enter the changes at the end of the Ritard / Accelerando list.

To modify an existing Ritard / Accelerando section, click on the section to be modified and then click on the Modify button. Enter the changes as above and click OK.

To delete a Ritard / Accelerando section from the list, select the section by clicking on it. Then click on the Delete button. The section disappears from the list.



Voice

The Voice number box indicates reference voice for the ritard.

Start and End

These boxes specify the starting bar and note and the ending bar and note over which the Ritard / Accelerando will take effect.

Time Factor Start and End

These sliders controls the multiplier which will be applied to the tempo of the voice at the beginning and end of the Ritard / Accelerando. The range is from 0.00 to 4.0.

Curve

This slider controls the power function that determines the contour of the Ritard / Accelerando. When the value is 1.0, the rate of tempo change over time is linear. The graphic display changes to show the effect of changing this value.

Pulse Weight Factor

During ritardandos and accelerando it may become desirable to increase or decrease the effect of the hierarchical pulse with the progress of the Ritard / Accelerando. This slider controls the amount of weighting that is applied to the pulse during a Ritard / Accelerando. It is equivalent to increasing / decreasing the *Time Weighting sliders only* of the two lowest levels of the pulse simultaneously. The range of values is 0.1 to 2.0, with 1.0 giving no change in the pulse weighting during the Ritard / Accelerando. Normal settings in ritards range from 1.1 to 1.35, 0.8 to 1.0 in accelerandos.

Crescendo Factor

During ritardandos and accelerando it may become desirable to increase or decrease the overall loudness with the progress of the Ritard / Accelerando. This slider controls the amount of crescendo that is applied to the music during a Ritard / Accelerando. The range of values is from 0.00 to 4.00 (+12 dB), with 1.0 giving no change in loudness during a Ritard / Accelerando. Note that the curve of this crescendo will be the same as set by the ritard curve slider, unless it is separately modified in the crescendo panel.

Save

Choosing the Save command from the File menu writes the current settings of the file to the hard disk at the directory where it is currently located. WARNING: *the new settings overwrite the old settings of this music file.*

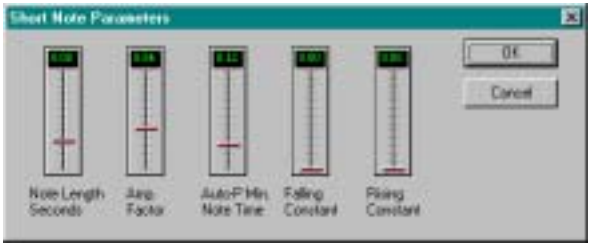
Save As…

The Save As… menu item in the File menu is configured like the Open… window. The directory display in the upper left corner shows the selected directory, the contents of which are displayed in the file list in the lower part of the window. Type in the new file name, or click on an existing file to overwrite it. After clicking OK, the File Information window will appear so you can make comments about the new interpretation.

Set Directories

Choosing this item from the File menu calls up the Directories window. The text box in this window shows the current directory where data will be written during the Save and Save As… functions. Change the directory by typing the new directory name and path in the text box and clicking OK.

Short Note Parameters



Very short notes, such as trills and ornaments, often sound too loud. At times, grace notes need to be louder than they would be otherwise. With this function, you can tell SuperConductor how to handle notes that are shorter in duration than the threshold you specify. Be careful not to increase the threshold too much as this would influence notes of normal length.

Note Length Seconds

Tones whose durations are shorter than the value specified in this slider's text box will be treated as short notes. The default is 0.08 seconds.

Amp. Factor

The amplitude of notes shorter than the Note Length threshold above will be multiplied by this value. The range of values is from 0.00 (-inf. dB) to 2.0 (+6 dB). The default value is 0.84.

Shaping Min Note Time

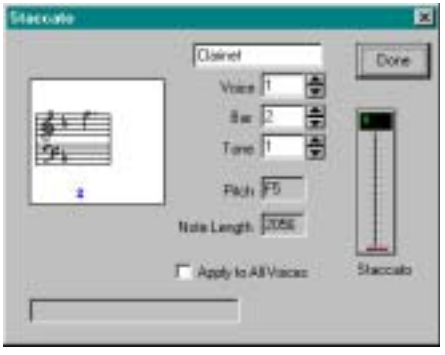
This setting is the threshold in seconds below which shorter notes will have note shaping modified by the Falling and Rising Constant sliders. (Note that this threshold is independent of the Note Length setting above). Use only when fast skipping notes are encountered.

Falling and Rising Constant

These factors modify the shape of the ends of short skipping notes whose durations are smaller than the threshold set in the above slider. These limiting factors gradually diminish the effect of note shaping only on notes that skip rapidly over intervals greater than 7 semitones, avoiding a sqeaky sound that such fast skips produce through an exaggerated predictive note shaping. Set the slider near the top of the range where this protection is required.

Staccato

This function shortens the *sounding length* of a particular note. That is, the written duration of the note remains the same, so that it remains in synch with the other voices, but the length of time the note *sounds* during that duration is shortened by the amount of units displayed in the Staccato slider text box. Staccatos are already entered in the "flat file", so this function is used only rarely to modify these. *All the staccatos that have been entered in the flat file can be globally modified in length in the Music Editor*. Staccatos can also be entered in the Edit Note option in the Single Note menu.



Voice

This box displays the number of the voice at which the staccato will be added or changed.

Bar

This box displays the number of the bar at which the staccato will be added or changed.

Tone

This box displays the number of the tone in the chosen bar at which the staccato is desired or changed..

Apply to All Voices

Checking this box will add the effect of the staccato to all the notes that *end simultaneously* with the selected note in the other voices of the current music file.

Pitch

This box shows the name of the pitch of the current tone. If the value is “R”, the tone is a “rest” or measured silence.

Note Length

The Note Length is displayed in a decimal fraction of the nominal length of the note.

Staccato

This slider controls the duration of the staccato that will shorten the sounding length of the current note. The written duration of the note will be preserved as will the timing of the subsequent notes in this voice. Graduated in a fraction of the nominal length of the note, the range of the control is from 0 to 0.95.

Statistics

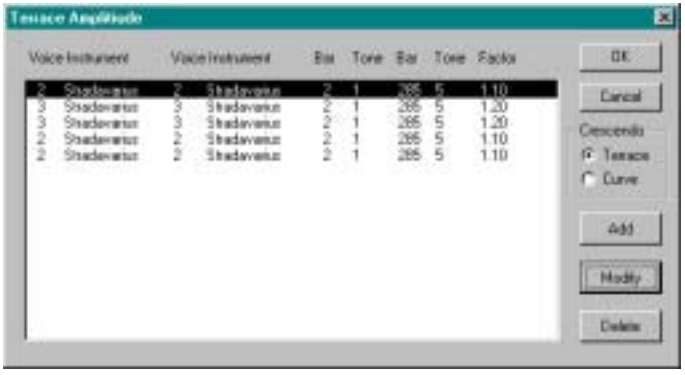
This function outputs a list to the screen which shows the maximum and minimum values for each voice in the area of amplitude, pitch, numbers of notes and rests, and duration.

Stereo, Mono

These choices let you choose whether SuperConductor will output in stereo or mono.

Terrace Amplitude

This window allows you to enter bar ranges in the piece where the overall loudness of the music is changed from the average level set in the Play window. Choosing this item using the radio buttons in the Crescendo window calls the Terrace Amplitude window which displays a list of ranges where the loudness of a particular voice or range of voices has been shifted up or down.

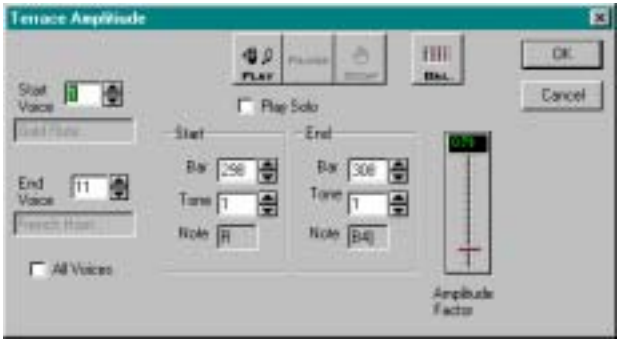


To add a dynamic change for a voice, click the Add button. The Terrace Amplitude Editor window appears. It contains a display of the parameters that will be applied to the bar range you specify. Use the controls described below to modify the dynamics. Click OK to enter the changes at the end of the Terrace Dynamics list.

To modify an existing dynamic change section, click on the section to be modified and then click on the Modify button. Enter the changes as above and click OK.

To delete a dynamic change section from the list, select the section by clicking on it. Then click on the Delete button. The section disappears from the list.

Clicking on Add or Modify in the list window will call the Terrace Amplitude Editor window. The following is a description of each parameter in that window.



Start Voice and End Voice

These boxes allow you to specify a voice range for dynamics change. Set these to the same number to specify a single voice instrument.

Start and End

These boxes specify the starting bar and note and the ending bar and note which this dynamic will effect.

Amplitude Factor

Ranging from 0.1 to 4.0, this slider controls the amount of change in the overall dynamic range of the voices specified. A setting of 0.1 will lower a voice's loudness by -20 dB. A setting 4.0 will increase the loudness by +12 dB.

All Voices

Checking All Voices will apply the dynamic change to all the voices playing in the bar range specified.

Terrace Ritard/Accelerando

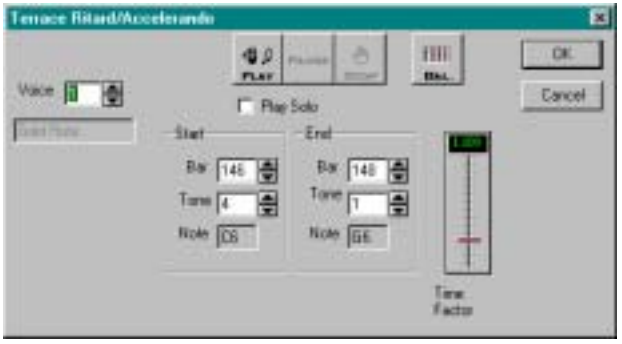
This function is similar to Terrace Amplitude except it controls tempo. With this function, you can specify a region of the piece where the tempo changes. This is particularly useful when introducing a slight tempo change in major sections of a piece, e.g. slowing 3-4% in the second theme area of a sonata form.

To introduced a terraced ritardando or accelerando, specify the starting and ending of the section and the voice where the change occurs. When the section is over, tempo goes back to its original level set in the Play window. Choosing this item from the Interpretation window calls the Terrace Ritard / Accelerando window which displays a list of ranges where the tempo has been shifted up or down.

To add a change of tempo for a voice or group of voices, click the Add command button. The Terrace Ritard / Accelerando Editor window appears. Use the controls described below to modify the tempo and or range. Click OK to enter the changes at the end of the Terrace Ritard / Accelerando list.

To modify an existing tempo or range for a section, click on the section to be modified and then click on the Modify button. Enter the changes as above and click OK.

To delete a tempo change from the list, select the section by clicking on it. Then click on the Delete button. The section disappears from the list.



Voice

The voice in which the tempo change should begin and end. The other voices will automatically participate in the tempo change.

Start and End

The starting and ending bar and tone for the tempo change.

Time Factor

The amount of change in the overall tempo in the range specified. A setting of 0.9 will increase the tempo ten percent. A setting 1.2 will decrease the tempo by twenty percent.

Transpose Voice, Transpose Piece

These items allow you to transpose one or all voices or up or down in pitch.

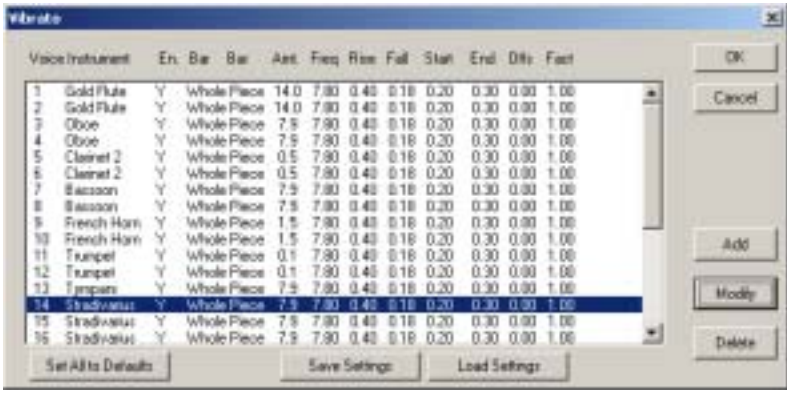
Voice

This number is the voice in which the transposition occurs.

Semitones

The number of half steps away from the original pitch that the voice will be transposed. The range of the control is ± 24 semitones or ± 2 octaves. Greater transposition can be done by reiteration.

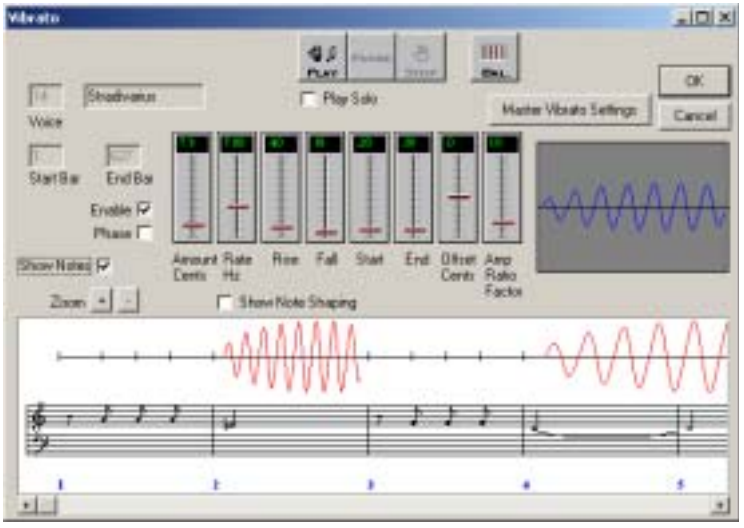
Vibrato



The Vibrato window controls the amount, speed, depth, and envelope shape of the vibrato that is applied to each voice. It is accessed by choosing the Vibrato item from the Interpretation menu or by clicking on the Vibrato icon. Each note automatically gets a different appropriate vibrato for all the vibrato variables.

Load and Save Settings functions load or save the vibrato settings for all voices to the vibrato database.

To add or modify or delete a vibrato section, click on the buttons. The following Vibrato Editor window appears.



Voice

Indicates which voice to which the following parameters are applied.

Enable

Check this box to enable vibrato in this voice.

Start Bar, End Bar

The starting and ending bars of this range of vibrato.

Amount - Cents

This slider controls the depth of modulation in the pitch component of the vibrato. Graduated in cents, the range is from 0.00 to 50. The most useful values lie between 3 and 15 cents. Settings are for the mean value. Each note will have a different customized value. Individual note values can be read in the “List Music” menu.

Rate Hz

This slider controls the mean frequency of the vibrato. The values range from 0.1 Hz to 20 Hz. The most common settings lie between 6 and 9 Hz. Both the amount and rate are compensated for pitch and duration of each note, and also in a predictive manner, looking ahead at the next note.

Rise and Fall

Master performers shape vibrato in addition to shaping the amplitude envelope of a note. The Rise and Fall sliders in this window allow the vibrato to be applied and removed gradually throughout the note duration. The range of mean values is from 0.00 (no envelope) to 3.0 (strong envelope effect).

Low values of Rise will have full vibrato applied from its beginning on the note. High values of Rise will cause the vibrato to be very shallow at the beginning and then to become more intense as the note continues.

High values of Fall will have the vibrato gradually disappear towards the vibrato end. Low values of Fall will give a deep vibrato towards the end of the vibrato period.

Start and End

This regulates the mean value where the vibrato begins and ends on a note. As for the amplitude shaping, the vibrato placement varies from note to note with the melodic structure in a predictive manner, looking ahead to the next note to determine the appropriate vibrato shape.

Offset Cents

This shifts the centerline of the pitch of the vibrato's up or down in cents (1 / 100 semitone).

Amplitude Ratio Factor

This allows adjustment of ratio between amplitude vibrato (tremolo) and the frequency portion of the vibrato for each voice.

Phase

Checking this box inverts the phase of the vibrato, that is, normal phase starts by going sharp, negative phase by going flat. Most string and wind players begin by going sharp.

Invert AV

Checking this box puts the amplitude and frequency vibrato 180 degrees out of phase with each other.

Show Notes

Checking this box causes the score display to appear. The whole voice is displayed in music notation and can be scrolled. The line above the musical staff displays the vibrato. Negative going waveforms are sharp, positive waveforms are flat to the original pitch.

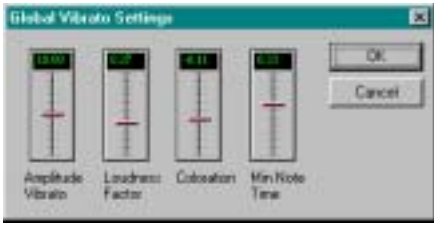
Zoom

Clicking on the Zoom controls allows you to see more or less of the score in one windowful.

Show Note Shaping

Checking this box overlays the note shaping envelope on the vibrato waveform.

Global Settings



Amplitude Vibrato

This control adjusts the ratio between amplitude vibrato and frequency vibrato. The vibrato of some instruments, like the oboe, is primarily in the amplitude domain. Other instruments, like the strings, have mostly a pitch vibrato. The range of the slider is from 0.0 to 20.0. The default is 10.0. Amplitude vibrato phase can be inverted with respect to the frequency vibrato phase by clicking on the “Invert AV” box.

Loudness Factor

This number determines how much more vibrato gets applied to notes of greater loudness. The range is from 0.35 to 0.40.

Coloration

This control modifies the tibral quality of the vibrato, making for a more natural sound. The default value is 0.11.

Min. Note Time

This slider controls the threshold for notes which will not get vibrato. In most musical examples, quick notes are not vibrated. The effect of this slider can be viewed in the score display.

View Original Score

This function allows you to view the score. The scores are scanned from existing old Urtext editions like the Bach Gesellschaft or Breitkopf und Härtel editions. Unlike MIDI scores, they show the composer's original indications.

To display the score of a loaded piece, click on the Score menu item. The score appears. The menu bar contains three commands; Cancel, PrevPage, and NextPage. Click on the appropriate command to view the desired page or to dismiss the score.

To display the score while the file is playing, check the Show Score box on the play panel, then click on the Play icon. While playing, the menu will contain the following commands:

Stop

Clicking on the Stop command causes play to discontinue and the score to disappear. The Play Music window is presented.

Pause

Clicking on Pause momentarily stops playback. The menu item changes to Resume. Clicking on Resume starts playback where it was paused.

Balance

Clicking on the Balance item calls the Instrumentation, Balance and Panning Window.

Volume

Clicking on the Volume menu item calls a volume adjustment window. Adjust the slider to the playback volume you desire.

PrevPage and NextPage

Clicking on these menu items moves the score forward or backward.

Voice Balancing

Choosing this item in the Interpretation menu causes the Instrumentation, Balance and Panning window to appear. This window is the control interface for several important functions in assigning instruments and their relative balance and placement.

In SuperConductor, the number of voices that an instrument must have is equal to the maximum number of notes that the instrument must sound simultaneously. For example, a flute or a trumpet only require one voice, since they can only sound a maximum of one note. The cello or violin can require up to 4 voices since they have four separate strings and can sound that number of notes simultaneously. Instruments like harpsichord, guitar or piano usually require from 3 to 10 voices. The maximum number of voices that SuperConductor can reproduce in real time is dependent on the speed of your computer. The SuperConductor program will support up to 128 voices.

The size of the Instrumentation, Balance and Panning window expands with the number of voices in a piece. The voices are represented by numbered Level sliders, Panning sliders, Instrument designators, and Solo / Mute buttons. The functions of each of these items are described below.

Level Sliders

The Level sliders control the loudness of each voice and are graduated in arbitrary units ranging from 0.00 to 25.00, minimum to maximum. The slider value can be changed by dragging the thumb wheel with the mouse, clicking the mouse on the slider surface, or by selecting the text in the text box and typing in the new value.

Panning Sliders

The Panning sliders control the apparent position of the voice in stereo space. The values range from -1.00 to 1.00. Negative values pan the voice to the left with -1.00 as the most extreme position. Positive values pan the voice to the right with 0.00 at dead center. The slider value can be changed by dragging the thumb wheel with the mouse, clicking the mouse on the slider surface, or by selecting the text in the text box and typing in the new value.

Master Panning

Pan the entire orchestra left or right.

Delay Slider

The Delay sliders control the delay in milliseconds that each voice has in relationship to each other. Use this to *advance* the cello and double bass instruments (about -30 msecs) that start with the same "inertia" to sound more synchronous with the other instruments. Also use it to *delay* the piano or harpsichord (about +25 msecs) when used in chamber music or concertos, so as to sound together with the violins and other instruments.

Instrument Designators

The Instrument designators are located below the delay sliders. They display the name of the instrument or other samples which are currently assigned to the voice. Click on the instrument to pop up a list of available samples.

Solo/Mute Check Boxes

Checking the Solo check box for a voice will mute all the other voices. Checking the Solo check Boxes for two voices will play only those voices. The Mute check boxes mute only the voice they are associated with.

Master Level

Master Level control sets the overall level at which SuperConductor reproduces the samples it uses to play music. This control is independent of the loudness slider in the Play Music window and is not affected by any

pulse or note shaping parameters. The possible range of adjustment is from 1 - 64. For most music, a setting of 6 - 12 is appropriate. It is chosen to avoid clipping at the loudest points of the music.

Undo

Choosing this menu item reverses the last action taken while modifying a file.

Utilities Menu

This menu contains utility functions which facilitate working with SuperConductor files as a whole.

16 bits, 8 bits

These items switch SuperConductor's output resolution. 16 bit resolution has better fidelity than 8 bit resolution. The only reason one would choose 8 bit playback would be to realize a score with many instruments on a very slow computer or to create sound for 8 bit multimedia use.

44 KHz, 33 KHz, 22KHz, 11KHz

These items allow you to choose the sample play rate of the stereo file that is generated by SuperConductor. In complex pieces of music containing many voices it may be necessary to choose a lower sample rate to maintain real time play. For the highest play quality, choose the highest setting that will allow play in real time.

CHAPTER 6

Hints, Rules and Suggestions for Interpreting

General Note: All the global settings such as balance, pulse, shaping, vibrato, piano tails and reverb, can be loaded from configurations saved for other *similar pieces* as a good head start from which you can modify the values to optimally suit the particular piece you are working with.

Instrumentation

Balance

To get a good overall sonority, the top voice of a piece should be approximately 30-50 % louder than the others as displayed by the slider controls. The bass should also be generally somewhat louder, about 20 to 30 %, with the inner parts set softer at about the same ratio. For example, if all the voices of a piece started at a loudness level of 5.0, the first voice might be increased to 7.2, the bass increased to 6.4 and the inner voices decreased to 3.5. The exact proportions will differ from piece to piece and will vary with the composer, i.e. Mozart requires a lighter bass than Beethoven and Brahms, as a general rule. Chords sound best when the inner parts are somewhat softer, about 30 to 40 % in piano and harpsichord chords as well as in string quartets. A generally good balance can be achieved by adjusting the loudness of all the voices for the whole piece. A deliberately harsh sound can be created by adjusting the inner voices to be equal to the outer voices..

With pairs of instruments, such as two oboes, two clarinets or two horns, the second of each of the two instruments should generally play about 30 to 40% softer than the first. Note: The Balance controls operate on a linear scale.

The terrace crescendo and crescendo functions are used to bring out various instruments during certain passages. For most pieces this extra enhancement will be unnecessary. Groups of instruments can be selected to be louder or softer for certain ranges within a piece. This is particularly helpful in concertos, where the group of instruments that accompany a solo sometimes needs to be softer than in tuttis (when the whole orchestra plays together).

Certain instruments may require a boost or cut in volume just to sound equally loud compared to the other instruments. These instruments may include timpani, bassoon, cello, etc.. The orchestration of the particular passage will have a large effect on the audibility of these instruments.

Panning

It is not desirable to "hard pan" to the extreme left or right of the panning controls. For string quartets and most other pieces panning values of .5 to .6, and -.5 to -.6 provide a large lateral placement of the voice. Other instruments might be placed in the .2 to -.2 range. In a quartet the usual spacing is first violin, about -.5, second violin -.5, viola - .2 and cello .3. Alternatively the viola and second violin may be switched. But of course you may try various other combinations. Generally, the melodic lines are best if they come from the left and rhythmic events from the right. This seems to work best because the brain processes melodies better with the left ear and rhythm better with the right. Traditionally, the first violins of an orchestra always are on the left of the audience.

Changes in panning can change the apparent loudness without any change in balance or amplitude controls. It also can change the clarity of certain voices. When voices are close together in space, they tend to merge with one another and mask each other. Sometimes this is desirable and other times not. The further apart they are placed in stereo space the more distinct from one another they will sound, and also the less unified. The optimum separation depends on the piece. Some pieces have contrapuntal textures that have many different voices that "con-

verse with one another" or homophonic textures, i.e. harmonies blend, and need to blend. Sometimes a group of instruments needs to be close together and yet separated form another group that are also closer together, for example wood winds and strings in an orchestra setting. Controlled three dimensional depth is not easy to achieve in stereo, but can be sometimes be achieved with judicious choices and combinations.

When a violin or viola part uses more than one string, i.e. double stops or certain tremolos, use different pannings for each string. As a general rule, a difference of 0.1 in the panning value may be a good choice. Two flutes, two trumpets, two horns or other instruments should never come from the same panning location.

Later versions of SuperConductor will enable panning to vary during a piece, that is, the instrument may be heard to move variously around in the orchestra, an interesting effect for some music seldom possible in conventional orchestras, and then only much slower than can be done with the computer.

Delay

The instrument delay settings serve two purposes. 1) To keep in synchrony instruments which have different attack shapes, and thus appear to sound at slightly different times, and 2) to create voices which lead the rest of the instruments in the piece.

The cello in relation to the violin often sounds late. The cello voice can be *advanced* (negative delay) as much as -30 milliseconds to synchronize the voices. The same effect would happen if you *delayed* the violin by 30 milliseconds.

The piano and harpsichord, with their sharp attacks, sound early in relationship to shaped instruments such as the flute or violin. Delay the piano voices up to 30 milliseconds to synchronize them with other voices.

It is often a good effect to have the first violin lead the other instruments by a slight amount. Advance the lead instrument by up to -20 milliseconds for this effect.

Choice of Instruments

Check the Solo checkbox to hear an instrument by itself and in combination with others - mute, if you want that instrument eliminated. Soloing an instrument teaches you many things: first it shows you how that instrument sounds by itself, whether it has the right shapes , and how musical it sounds by itself. This often is quite surprising, in that SuperConductor allows every voice to be musically shaped as an independent voice and without having touched that voice you may be amazed about its phrasing. This feature is very useful also in adjusting the shapes and vibrato for that instrument. Then try combining that voice with one or two of the others, bass or neighboring instrument, strings with woodwinds, etc. You will learn about balance and orchestration.

You will also learn that sometimes when combining voices, the shapes and vibratos that were ideal for them as solo voices need to be slightly adjusted: they now have to cut through the other instrumental sounds before they are heard. The attacks may need to be a little more pronounced (p1 slightly smaller), and the amount of vibrato may need to be a little larger. But this sort of adjustment depends on how big the ensemble is, and on the style of music. For a small group of instruments no adjustment at all should be necessary.

The mute button is useful when you want to rehearse and play that part yourself, and let SuperConductor play with you, as in a concerto. It is also useful in studying orchestration enabling you to hear how the omission of this or that instrument affects the music. You can also try doubling some of the voices, transpose them an octave higher or lower (look under the edit menu), and enrich or change the orchestration, using the solo and mute buttons to test the effect of the change.

Sometimes you may wish to use the Stradivarius even for the viola part. Unlike a real violin, the computer can play the Stradivarius for the full range of a viola, by transposing the sounds down. You merely select Stradivarius and it will play all the viola notes. This may be a preferable sonority to that of the viola itself, in a string quartet. In this case of course there will be three Strads, and one cello! This works out well at times. But do not replace the cello with a Strad! For orchestral pieces the Strad may also be used, or the group violin, in such combinations as you may like. But there is only one cello, one viola, one doublebass, so they are used in an orchestra, or in chamber groups and solos. You can make them as loud as you want, and vary the timbre with the timbre function.

We will try to provide massed string sounds in a later version, but this may not be really always necessary, as the loudness factor is certainly available already. Do twenty violins sound different from one violin playing as loud as the twenty together? Yes. But is that difference essential to the music? At times it is, at times not. For Bach it seems not to be of consequence, and may even not be desirable. For later composers, yes, it makes a significant difference especially as you proceed to the Romantics.

Pulse

One of the most important functions of SuperConductor is the pulse. Without it, nothing can flower. With it, as if touched by a magic wand, everything comes to life.

The pulse is hierarchical - to get the full meaning, the three levels of the pulse work together.

Although the top level of the pulse is also given by default as the composer's pulse, other pulse forms can be usefully experimented with at the top level, for some pieces. While mostly, the composer's pulse will give the best results, sometimes special pulses at the top level can be very interesting, and meaningful.

Some Notes About The Pulse

What are composer's pulses? A good question! How come a composer's personality can be expressed by the pulse, and how did composers discover this?

The idea of composer's pulses was first aired by Gustav Becking, a German musicologist, in 1928. Following his teacher, Eduard Sievers who earlier discovered that he could tell where authorship shifted in the bible, and which poet wrote particular lines of poetry, merely from the rhythm of the writing, by following it with the movement of a finger. Sievers noted that different but consistent shapes were produced by the finger movements that the scansion of the poetry or prose produced,

independent of the verbal significance. Somehow, these shapes reflected the identity of the author! Becking applied this to composers.

The shapes were first scientifically measured by Clynes in 1967, and graphs of "motor pulses" for the various composers obtained, from the experimental conducting by great artists on a pressure sensitive finger rest, the input device to the sentograph which he constructed for that purpose. These motor pulses when averaged looked very similar and distinctive for the same composer, no matter what piece was being conducted.

But it was not until 1983 that it was discovered how the composer's pulse was manifest in each note of the music, through its microstructure . The pulse values given in SuperConductor are the results of Clynes' research since 1983 on this.

While pulse component values are now available for most major composers, more remain to be found. SuperConductor users will be given upgrades periodically with additional composer's pulse as they are being found.

The pulse is an integral part of the music, and contributes to reveal the intimate personality, the point of view, of the composer. It does this regardless of the particular piece, and for both fast and slow pieces. It is necessary but not sufficient for interpretation! Without it, even if otherwise well shaped, the performance lacks the "presence" of the composer, his authentic feel. Who can say what is authentic? None, but you can feel the difference. And if you can find a better pulse that better expresses the music, then good! The pulse values given in SuperConductor are merely suggestions. We expect that they will be further refined and improved with coming generations of musicians.

Can you determine the pulse of a composer from the score? No, but there are hints in it in the accents, and note densities (distribution of note densities) that the composer favours. These hints tend to confirm the pulse in general terms, but are far too inexact and loose to be able to derive the precise values of the pulse components, which is so important.

The true test for a pulse is: does it add to the vitality, the meaning the uniqueness of the music? Does it reveal something that makes you really love that composer? Does it feel like it makes you a friend of the composer, an intimate friend even? Does it help to give reality to the music, to show you a truth that is somehow in the music, that it is a privilege to share?

As the answer to these questions becomes yes, you will have understood what the pulse can do to music, and how dead it is without it. And you will have sensed some of the wonders of being human that great music can attest to, wonders that make life an incredible gift.

As Pablo Casals said to us one day: “Bach, Beethoven, Mozart, Schubert - they have the answers to life’s problems. Be happy!”

Pulse Configuration

To get the pulse right, it needs to have the right pulse configuration. This means that it should correspond to the structure of the music, to its flow. How is that determined? The composer hardly gives any indication. He does give a meter, but that does not specify the pulse structure uniquely, nor even as a good starting point necessarily. Each level of the pulse takes a “chunk” of time, the lowest level the smallest, and the highest level the greatest.

The chunk of time of one whole bottom level is a single element of the second, next higher level. The chunk of time of the whole second level pulse is a single element of the highest level pulse.

The composer’s meter (1 bar) may cover a “chunk” of whole lower pulse level, or it may cover two chunks, or even at times half a chunk. That depends on the piece. However, whatever that proportion is, it carries through for the whole piece, except when the composer changes the meter. A pulse configuration for a 4/4 time may be 4 x 4 x 4, for the three levels, or it may be 2 x 4 x 4, or 2 x 8 x 4 , 2 x 4 x 2, or 8 x 4 x 4 or any similar combination. One of them will be the magic wand, to make the piece sound really right. Which one? We can’t always tell. So you might have to experiment.

We do provide suggested pulse configurations with the flat files, and of course with the interpreted files. It is one of the wonders of interpretation that changing the pulse configuration gives rise to different levels of musicality, and at times to more profound levels of meaning. Remember when changing pulse configurations, that the weight sliders will probably have to be readjusted.

Is the composer aware of his own pulse configuration? Probably. Good composers are very aware of bar structure.

Many compose in rather regular 4 bar sequences. But many of the great composers, while using 4 bar sequences predominantly, will intersperse them with 6 bar, 2 bar or 3 bar segments, at various times. SuperConductor makes you become aware of how they build their pieces. (Fugues generally do not have as regular bar patterns.)

Beethoven, Mozart and Haydn Pulses

The strength of the Beethoven pulse is the result of a combination of the light second tone with a pronounced and somewhat elongated fourth tone. Both the third and fourth tones are of relatively high amplitude. If it were not for the softened and shortened second tone, the pulse would consist of four rather emphasized tones which would make it sound quite heavy, as indeed it does in some performances. By having the light second tone, the pulse has a subtle strength that avoids heaviness. The fourth tone strongly contributes to this specific Beethovian quality (an even more marked and elongated fourth tone is found in the Brahms pulse).

The Mozart pulse exemplifies grace and symmetry and also a degree of abstraction. The duration deviations are less marked than for Beethoven and more symmetrical.

The Haydn pulse configuration has an elasticity similar to the Beethoven pulse, but replaces the characteristic strength and ethical constraint of the Beethoven configuration of tones three and four with a pattern that is more in accordance with a characteristic Haydnian sense of playfulness, wonder and of natural piety (in slower tempos). Noteworthy is that the Haydn 4-pulse shows no marked subdivision, unlike the Beethoven and Mozart 4-pulse.

Mozart And Beethoven Allegros and Slow Movements.

Much recent experience with Mozart and Beethoven Allegro movements has led to additional insights on how to best configure the pulse for these movements. It is actually a further extension of the pulse concept that particularly fits these composers:

The mid level pulse is doubled: two sets of pulse groups are placed side by side, resulting in eight pulse elements, consisting of two groups of four.

In the case of Mozart, the second group is somewhat reduced in amplitude, compared to the first. The opposite is the case for Beethoven, the second group is slightly larger. A reduction factor of .8 and an enlargement factor of about 1.2 is suitable.

The top level of four elements can suitably represent a 2 by 2 pulse. So effectively, there are 5 levels to the pulse! Or 4, if the top level is a four pulse. The time factors for the double mid-level pulse can be made identical for the two sets of four elements, or given minor alterations, as preferred.

This is in accord with the tendency in Mozart to require slightly less emphasis on a repetition of a phrase (or counterbalancing phrase), and of Beethoven the opposite, a slightly increased emphasis. This subtle difference can be felt also as a contrast in an implied philosophical attitude: for Mozart, viewing things from a perspective, considering, with a degree of detachment, of serenity - something like saying “as we have already heard’, Beethoven on the other hand, saying, “as I told you so before! and you’d better believe it!”, to put it in a semi-farcical way.

These pulse configurations (4 x 8 x 2) seem to apply to many Mozart Allegros, whether in the major or in the minor key, and regardless of the specific emotional character. It seems to represent the pulse aspect of the Mozartean musical logic.

It seems also that many Beethoven pieces from his early and midperiod, symphonies to his concertos may partake of that pulse cofiguration - take this as a hint, rather than as a firm rule. As a rule, Beethoven may not rule out a change in the rule! (However, recently we found that even the ninth symphony apparently partakes of this!).

We cannot say if similar constructs may benefit other composer’s works, as yet, that needs more exploration. (We invite you to share this exploration!) Such pulse organization reflects a “massive power of intellect”, almost a superhuman quality, in the music, we cannot say yet if and which later composers imbued the music with that kind of power.

Other Composers' Pulses

The Schubert pulse, notable for its lack of subdivision, is also remarkable for its relatively shortened first and fourth tone, particularly its lengthened second tone, and the pronounced amplitude of the fourth and third tone. The lengthened and moderately soft second tone largely contributes to the Schubertian flavor, the gentle but strong element of longing of a non-erotic quality.

With Schumann there is an inversion of the subdivided loudness pattern found in Mozart. This syncopation oriented pattern is conducive to the uniquely intimate quality, that special gentleness and ardor that characterizes so much of Schumann, as well as his particular kind of enthusiasm - in short, both Florestan and Eusebius.

The Mendelssohn pulse is characterized by a marked elongation of the first tone, a relative shortening of the second, and a pronounced although not strongly lengthened fourth tone. It has aspects of innocence and child-like openness.

Our recent studies of the Bach pulse have shown it to be of two seconds duration rather than the approximately one second typical of later composers. The Bach pulse is properly an 8-pulse rather than a 4-pulse. It provides a deep sense of peace which nevertheless allows for the full range of emotions as a superstructure, preserving the essence of Bach's music. In his fugues, the irregular bar structure often necessitates appropriate resetting of the hierarchical pulse. Also, for a two second long 8-pulse, a second level hierarchy would be four times as long as in a corresponding two level hierarchy comprised of 4-pulses.

In slow movements, the lowest level of the pulse configuration often is 4 thirty-second notes, and the two higher levels are otherwise similar to the configuration of Allegros, but of course on a different time scale.

Pulse Reset

When irregular bar structure occurs, the pulse needs to be reset. This is done using the reset function. Discover where to reset the pulse! This will help you understand the music and its structure more intimately.

Note that Resets involve the high levels of pulse, the low level does not need to be reset generally.

Resetting a 4 pulse when a 3 bar sequence occurs, there is a choice of resetting the three bar section as the first 3 bars of a four bar group (bars 1,2,3) or as the last three bars of such a group (bars 2,3,4). In the first case the reset is placed at the bar following the third bar. In the second case, the reset is at the first bar of the three bar group, calling it bar 2 of a 4 bar group. The choice to take will depend on the music, and often either way can work pretty well. The question is whether in the composer's mind, the first bar is as it were omitted, or the fourth bar, in what otherwise would have been a four bar sequence, to produce a foreshortened three bar sequence. Perhaps there should sometimes be a special different top level three bar pulse, but this is a subtlety we leave to the user, if he is so inclined. Similar considerations occur for 6 bar sequences, or the much rarer 5 bar sequences.

In some rare instances, like in the scherzo of the Beethoven's ninth symphony, the composer specifically indicates a certain section as being in three bar rhythm. In this case a three pulse at that level is of course required, which is readily accomplished by SuperConductor.

Some pieces will require no resets, and others quite a handful.

Incomplete Bars

If there is an upbeat at the beginning of the piece, the pulse group should start with 1 after the upbeat. (With an upbeat, there always are rests before the upbeat to make an entire bar, called bar 0. This is to satisfy the needs of the computer.) So either begin the piece with a last bar of the pulse group, so that the first bar of the group falls on the first bar of the piece, or, simply reset the pulse to start again at bar one, regardless of the upbeat before.

The first note of a piece, or upbeat, is usually taken at a slightly slower tempo than what follows. The tempo is so to speak eased into. (One of the teachings of the great master, Pablo Casals).

Pulse Weight Sliders

For a given pulse configuration, the most important interpretive actions are adjustments of the pulse weight sliders. These vary with the piece, and setting them is a sensitive guide to the spirit of the music.

Time weight sliders mostly are adjusted to lower values for the higher two pulse levels.

For faster movements, time deviations for the upper two levels of the pulse are often appropriately set at as little as half, and a quarter for the middle and upper level respectively, but sometimes higher settings are appropriate.

For slow movements, however, the time sliders often should not be reduced much below 1 even in the higher pulse levels. For the lowest level, the time sliders may often be increased somewhat beyond 1.

Amplitude Weight Sliders

These are not usually reduced for higher levels of the pulse, unlike the time weight sliders. In fact, it will be noticed that the effect of the amplitude pulse at the top pulse level is not as marked as on the lower levels. This is because slower acting amplitude changes are perceived differently by the brain. Consider those accents and loudness changes we are used to in speech say, in the articulation of different words and syllables. When different sentences are spoken with different loudness however, this provides a different kind of emphasis.

So, amplitude variations of the pulse often do not have to be reduced at the top pulse level, but time variations often do.

Phase shifted pulses

With the three level pulse, we may find occasionally that the composer does not always begin the piece with all three pulse levels set at 1 initially. There may be an "upbeat" for other levels than the lowest. This is often the case for Schubert, where the first main bar my well be bar 2, i.e. the top level pulse begins at bar 2, bar 1 being an "upbeat bar".

Sometimes a composer shifts the middle level pulse, in the middle of a piece, for a while. Mozart likes to do his every so often. This will revert to the previous relationship, having been shifted for perhaps 16 bars.

SuperConductor readily allows you to shift any of the levels of the pulse, using the reset feature.

New Pulses

Does a piece have more than one pulse? Yes, when the meter changes. A composer may write a slow introduction, or a final presto, within the same movement, or he may change the meter (time signature) a several times during the piece, alternating different meters, as in the last quartets of Beethoven, and more pervasively in modern composers such as Bartok, Stravinsky or Schoenberg.

Sometimes a composer indicates that in the new meter a particular note value equals a note value from the previous meter, for example a dotted quarter note of the new meter may equal a quarter note of the previous meter. Other times such relationships are implicit rather than explicit.

New pulses are entered at the reset panel, similarly to how the same pulse is reset. Important however are the tempo relationships between the old and the new pulse. With changes of meter, there generally will be notes which have an approximate whole number relation to notes of the previous meter. The relationship between the tempo of one meter and the other is given by the “tempo factor”.

Your Own Pulse

If you are a composer, you will want to find your own pulse. That may not be hard. You may find that once you optimize the pulse for one of your pieces, a few of your pieces, that soon the pulse will fit your next piece, with surprising and satisfying results, even if the music is very different.

Don’t try to fit a great composer’s music to your own. That is no way to compose good music, nor to get the qualities of that composer infused into your music. *Pulses are not transposable into other composers.* Unless the

notes fit, the pulse will not be integral. In a good piece of music, the pulse and the notes are made from the same cloth, they are organic. Importing a different composer's pulse into your own is not recommended, except as a prank.

Of all the composer's pulses we know, the Haydn pulse is probably the most flexible, and produces least atrocities when stolen, but even to introduce that into other music is an insult to the person of Haydn, like making believe that you *are* Haydn. You aren't, and cannot be. Just be yourself, and it will be great! The true is beautiful, and here you can prove it.

To find your own pulse, simply change the pulse elements, starting on the bottom pulse level, by changing the durations and amplitudes, and finding a suitable configuration, until it sounds as you want it to sound. For a 4 pulse, you need to find three amplitudes and three timings. For the first amplitude you can simply take 'one' as the value. And one of the timing elements can be 100. So you need only to find three values for each. It is easiest to do this with music that has sometimes four notes of equal duration nominally at that level, e.g. four sixteenth or four eighth notes. Take sixteen bars, say. Don't try to find your pulse at the top level initially.

Once you know your pulse, you can prescribe it now, notate it for others who want to perform your music! Like the metronome mark, only several orders of greater subtlety. And any performer and any computer can endeavor to follow your wishes and meaning.

Weight sections

Sometimes there are sections of a piece, that change radically in nature from what has gone on before. There may be a much slower section or a much faster one. Then you might wish that the weight sliders for the pulse were adjusted differently for that section. You can do this in fact, by using the weight section feature of the pulse. This allows you to change any of the slider positions of the three pulse levels, for that section only. Slower sections might require increases in the time slider settings of the higher levels, faster ones a reduction. Highly expressive sections will often benefit from an temporary increase in slider settings.

Pulse in Long Trills

Another use of the weight section feature is for longer trills. Mostly, it is desirable for such trills to reduce the lowest level *amplitude slider* setting to about 0.2, and possibly reduce the middle level amplitude settings a little also. Otherwise those trills have too much pulse effect in them. Doing this will temporarily change the corresponding settings for the other voices also, but this usually can be tolerated for the few bars that the trill occupies, and not be burdensome. It is usually not necessary or desirable to change any other slider settings. Note that it is not good to completely eliminate even the lowest level pulse effect in the trill: a slight pulse effect is good to avoid that the trill sounds like an electric bell.

Note Shaping

Tone Contour Shaping contributes greatly to phrasing and musicality. It does this in two ways:

1. By suitable choice of the basic shape for each voice, or region of the voice. *Even slight differences in shape, that can hardly be seen on the screen do in fact change the character of the music.* In the region of .7 to 1.4 say for p1, differences of 0.05 already have a sizable effect.

2. By their predictive function which changes the shape note by note, always looking ahead at the next note. This effect can be increased by increasing the predictive factor from its normal value .5 to .6 or more for solo instruments.

This effect should be decreased (say to 0.2) for the very fast notes of trills and notes which are tremolos and textural repeated patterns, like the so-called Alberti bass and similar non-melodic patterns. Use the bar range of these patterns for this reduction.

The basic shape should remain throughout, except when there is a marked change in character for sections of the piece, or for pizzicato. Small values of p2 will result in a greater legato, say 0.4-0.6. Larger values of p2 such as 1.8-3 will result in very detached, staccato like effects. Slower pieces can require different settings than fast ones within such ranges.

Selecting p1 and p2 are truly wonderful exercises in musicality: they sharpen one's discrimination and sensitivity to nuance, feeling and musical meaning.

Note that *if there is a rest after a note (or the note is staccato)*, that note will not participate in the predictive function. The p1 and p2 values for that note will have the values set for the basic shape. In most cases this is quite appropriate. This is also true of the last note of the piece, which however may need to be set for p1 and p2 with the single note function selected from the menu.

Ritards

Few things are as valuable for an interpretation as really good ritards. The shape of the ritard, where the ritard starts (and ends, at times) all contribute to the musical quality. But SuperConductor offers a unique feature that makes ritards incomparable: the ability to increase the weight of the pulse during the ritard. That means that the deviations from evenness in time of the pulse components can be enlarged during the ritard (there is no enlargement for the amplitude deviations, and none seems to be required). The relatively longer notes become longer and the relatively shorter notes become shorter, when the weight slider is set above the value 1. This is over and above the general slowing down of the ritard. As a result of this there is a difference between a Beethoven ritard, a Mozart ritard, a Schubert ritard, a Chopin, a Bach ritard and so on. A good useful value for the weight slider in the ritard is 1.20 to 1.35. (For accelerandos, you might want to try values slightly less than 1, say 0.9-0.8 for the weight slider). This is especially valuable at ends of pieces, where you as it were, say 'good bye' to the composer. A great ritard suddenly gives you a frame for the whole piece, a moment when you perceive it in retrospect, and when you might concentrate on the composer's identity, like bidding farewell to someone who visited you at your house. Only a few great artists have been able to do a really good ritard, Toscanini, Casals, Schnabel, Landowska are examples. Too often others merely slow down. With the pulse enlargement feature, you can try to make a really fine ritard.

The crescendo slider is also useful, though you might wish to create a curve for it different from that of the ritard curve which it automatically assumes as default.

Initial Tempo Setting

The tempo at the beginning of a ritard is often chosen already slower than the main tempo, by a few percent. The end of the ritard may be as much as 50% slower, i.e. 1.5 or more at times without seeming unduly slowed. This is sometimes because the last note of the ritard can be a relatively longer note. The resumption of the main tempo is often best done slightly gradually, the first note of the resumed tempo, or even the first few notes can be a little slower than the main tempo, and it will seem a natural resumption of the tempo.

Boundaries of the Ritard

The boundaries of the ritard and accelerando are important to get right. Sometimes the tempo will pick up at the upbeat before the actual marking in the score. On what exact note to begin the ritard is another instance where the artistic judgment of the interpreter is called upon. Sometimes a change in that makes a big difference in the naturalness of the ritard. The beginning of a ritard sometimes is left a little ambiguous by the composer, to the extent of one or two notes, or he simply does not exactly notate it. Often, ritards are not notated at all, especially at the ends of pieces.

Values for the Ritard Curve Parameter

Values for the ritard curve usually range between 0.40 to 0.70, depending of the length of the ritard, and the tempos, but values less than this also occur for ritards that slow down most right near the end of the ritard. Accelerandos may require curves with values greater than 1, say 1.1 to 1.2, but this depends on the piece - accelerandos often are more extended in bars than ritards.

A ritard can always be pieced together as a series of terrace ritards, and this is an alternative that sometimes give excellent results. Often a quite small but extended terrace ritard may precede the final ritard.

A micropause is often useful somewhat before the ritard starts (perhaps as much as a few bars before), to give a signal: “we are coming towards the end” or, just before the final note of the piece.

With a ritard that ends with a long note, consider that the ritard range may include that last note: if so then much of the ritard duration may be occupied by that last long note, and so the ending portion of the ritard curve may be used up by that long note: only a portion of the curve is then used for leading up to it. But if alternatively you exclude the last note from the ritard, then that long note may be too short. It can then be lengthened using the length single note function, however.

Terrace Ritards (or Accelerando)

Terrace ritards are exceedingly useful. Usually they are employed over larger sections of a piece and cause the tempo to change a few percent, anywhere form 1 to 12 percent say. Several of these may be good to use in a longer piece, where for example the second subjects (second sections) of a piece may well be taken say 3 % slower with good effect. Even a 2% slowing is quite effective - the amount needs to be judiciously chosen. A trio of a minuet can be taken at a very slightly different tempo than the minuet itself, as another example. Such terrace ritards always point to and correspond with the larger structural aspects of a piece, and are generally not used for local effects. They are used in sizes that are equivalent to a fraction of one metronome mark (5 %), or a little more.

Always use the terrace ritards for sustained tempo changes within a piece. Use the "tempo" function only when the meter changes within a piece.

The metronome mark of the piece at the "play" panel will be unchanged during a terrace ritard, or a ritard, or accelerando, and will only change when there is a meter change.

That means that the metronome mark will be wrong for that section, and stays unchanged as the basic tempo for the piece. The advantage of this is that you can make small changes in the basic tempo, and all the other tempo changes will correspondingly follow, without any adjustments, as they are entered as percent changes from the basic tempo, whatever that might be.

Tempo of Subsections

Every piece is considered to have a *main tempo.* Subsections of the piece that have a different meter and pulse, are related by tempo to one another by the "tempo factor" that applies to the subsections. It is often the case that pieces are organic by their choice of whole number relationships between the tempi of the various subsections. In that way relationships of tempo between the various sections can be set - while they often are close to whole number relationships (or simple fractions), yet they generally will somewhat deviate from this.

When the main tempo is modified by adjusting the tempo slider on the tempo screen, all the subsections, having different pulses will also be adjusted in the same proportion automatically. To change the relative tempo between them, you can change the *tempo factor* of that subsection.

This is very useful in that it keeps the proportions of all the tempi constant when the main tempo is changed, when experimenting with the interpretation. Usually this is very desirable. In that way the tempo of the subsections behaves just like terrace ritards do.

The tempo factors of course can be individually changed, having the new main tempo is established, so that changes in proportions if required can be achieved.

Crescendo/Diminuendo Functions

In operation in Superconductor these are formally very similar to the ritard, functions. Curve slide values for crescendos are typically in the 0.6 to 0.9 range. Longer crescendos tend to have lower slide values, i.e. more concave shapes. Diminuendos on the other hand are the opposite, the curve should also be concave upward, but to do this, now the slider values are greater than 1, - 1.3-1.4 say. The end loudness level of a diminuendo may need to be lower than what follows. This is because the curve usually follows to the end of the last note in a diminuendo, even though any further decrease , or increase of the curve after the last note is struck has no effect. You will want to shape each crescendo and diminuendo individually to get it right, as you want it to be. Often a crescendo should best start at a loudness level that is lower than what has preceded immediately before it. In that way, by dropping in loud-

ness before you increase the effect can become enhanced. A pianissimo may be in the range of .12 to .2 say, a piano around .6, 1 may be mezzoforte, 1.3 forte, 2 -2.5 fortissimo. But this is merely a rough guide, in practice every piece will demand a different dynamic palette. Quite often composers distribute the voices so that the dynamics they wish are at least in part produced by the number of instruments playing, i.e. by the massiveness of the orchestration, or ensemble. As more and more instruments come in, it gets louder and louder. At other times, though, this needs to be supplemented.

Terrace Dynamics

This is highly useful and may be used frequently in many pieces. It may apply to one voice, to a group of voices, or, most often to all voices together. In Bach, Mozart and Haydn this function is essential. In that time dynamics were of a terrace kind, predominantly, allowing contrast, which related to the musical structure. But for later composers this function is also used, besides the gradual crescendos and diminuendos. The latter become frequent in Beethoven, and Schubert, where they constitute the fabric of the music itself. It is hard to imagine Beethoven adding the dynamics afterwards to the music, as earlier composers often did - rather he seems to have thought of the dynamics integrally with the shaping of the music. With Schubert we may additionally see that a crescendo followed by a diminuendo, as often occurs, finds the diminuendo ending considerably lower in loudness than the level from which the crescendo started. It is not a mere returning to the initial level, but going well below that. In general, the ear finds a proper balance by a sharper diminuendo than one would expect from just symmetrical mathematical proportions. This is because the ear adapts, and after a loud passage, the diminuendo must be especially marked, or it will be masked by the adaptation. After such a diminuendo, the basic loudness is resumed in what follows, without any special notation of that by the composer.

And also after a very loud tutti passage, the immediately following soft notes need to be louder than otherwise, or they will not be properly heard, for the same reason as explained above.

So, a good crescendo is easier to make than a good diminuendo. In SuperConductor you can do both, however, rather easily. As in ritard, the choice of where to begin and end these needs care. Composers usually are very careful about this in their indications.

The hierarchic pulse will often provide dynamics that already incorporate some of the desired results. How much of this it provides, depends of the piece and the composer. But it can be very surprising in many cases. Often the proper pulse configuration, and attenuation will provide very subtle dynamics, so that little else is necessary to supplement these by using the dynamics functions of this section.

There is no change in the pulse parameters with crescendos or diminuendos. It naturally participates in the dynamics without any need to modify it. A change in tempo may occasionally occur, either a slight deceleration or acceleration, in more romantic music. Quite often it may better to decelerate slightly, to hold back, as greatest loudness is reached, rather than the opposite, and conversely. This can be done by appropriate combinations of the terrace ritard and ritard functions with the crescendo-diminuendo functions.

For short pieces (say 16-32 bars) the dynamics and tempo changes may be designed as a single pulse, so that one hierarchical pulse comprises the entire piece.

Each bar then may be a pulse element of an extended highest pulse level, e.g. 16 elements.

The loudness and durations of the highest pulse level elements are adjusted to contour the entire piece, as one large pulse.

Vibrato

Different instruments, different pieces and different composers have need for different kinds of vibrato. How do these vibratos differ from each other?

A uniform vibrato, as often found in synthesizers, or in inferior performances, applied like a lacquer to a musical piece can ruin the meaning of a fine interpretation. Vibrato needs to be organic to the piece, organic to the composer, and even organic to the particular instrument. Then it

adds to the eloquence and conviction of the music. What does this mean? And how do we do it?

Consider first the instrument: a flute requires a greater amount of vibrato than an oboe or a violin for an equivalent expressive quality, a piano should have none or at most very little. A harpsichord can sometimes benefit from a very small amount of vibrato, however, even though it normally is played without it (but note the clavichord often benefits from vibrato, Bebung it was called, and was achieved by a vertical vibrating of the hand on the key). There is frequency vibrato and amplitude vibrato. Mostly these are combined, and sound more natural in combination than each does alone. (In Superconductor, frequency and amplitude vibrato are combined in a suitable proportion that is not normally altered.)

The amount of vibrato and its main frequency are the two variables which will differ to an extent for different instruments. Lower pitch instruments will require slightly lower frequency vibratos. Normal ranges of basic vibrato frequency is 6.5 to 8.0 per second, with lower pitched instruments favoring the lower part of this rather narrow range. No two voices should have exactly the same vibrato frequency, it is best to separate the frequencies slightly, unless one wants to have the voices fuse more. Identical vibrato will tend to make voices sound more as one, and as coming from the same space. Even slight differences in vibrato frequencies avoids this.

Generally solo instruments will want to have somewhat more vibrato amplitude than others. In a string quartet, the first violin may have slightly more vibrato as a rule. Cello needs rather less vibrato in SuperConductor, because the samples used already contain a certain amount of vibrato. Note that this is not so for the Double Bass.

In SuperConductor, uniform vibrato is completely avoided, because what is entered refers only to the basic vibrato, which is then altered by SuperConductor for every note according to its pitch, its duration, the step the melody takes. Both the frequency and the amplitude of the vibrato is changed from note to note.

But most importantly, the placement of the vibrato on the note is changed for each note, in accordance with the melodic structure.

A mean placement is entered for beginning and ending the vibrato as a proportion of the note duration, and that placement is moved forwards or backwards on each note according to its melodic function, using

similar criteria to that used in the predictive amplitude shaping of the notes.

It turns out that the mean placement of the vibrato on the notes is an important variable to set both for individual pieces and also for composers. There is “early vibrato” and “ late vibrato” and “stretched vibrato”. The expressive character of the music is subtly altered by the choice of the mean placement of the vibrato.

The emotional character of the music is affected by this. You can make a piece sound more loving, or more sad by appropriate choice of vibrato placement - more longing, or more serene. It can even differentiate among different kinds of longing, if you adjust it right. Combining the basic amplitude shaping setting and the basic vibrato placement setting give you a great scope to change the meaning of the music in subtle and not so subtle ways. When the pulse is well designed the combined effect of all three can be magical.

The mean abruptness in which the vibrato begins and in which it ends can be separately adjusted also. For vigorous pieces, vibrato will usually be applied more abruptly, but the choice is not always obvious, but has a relatively minor effect. But even the abruptness is graded from note to note by SuperConductor according to the melodic structure.

Different composers will tend to favor different kinds of vibrato. This is specially marked with regard to the mean position of the vibrato on the notes. You can roughly classify composers as to tending to favoring early vibrato or late vibrato. Mendelssohn favors early vibrato, Schumann late vibrato. Bach early vibrato, Beethoven medium, Mozart medium. Brahms broad vibrato. You will discover that finding the right mean vibrato placement for the piece you are interpreting is a paramount interpretive action.

Piano Tails

In SuperConductor, the piano damper action can be regulated according to what kind of piano sonority is suitable. Is it the lovely Mozartean clarity, the Beethoven solidity, or the Brahmsian opulence. The Chopin singing tone, its virility, or the scintillating Scarlatti colors? These are

selectable through the piano tails adjustment, as well as many shades in between.

But most specially, for all these selections, the piano tails function is not static. The damper action is made to vary organically with the melodic structure. Like the "custom" shaping of notes for violins, voice, woodwinds and brass that predictive amplitude shaping uniquely provides in SuperConductor, the tails of the piano (or harpsichord) dampers are made to vary organically with melodic structure, so that there is a subtle difference between ascending and descending intervals, depending on timing, translating into delicate nuances of slight variations in the effective gradations of legato and staccato from note to note, whether in Mozart or in Chopin, or in Brahms, appropriately adding special richness and subtlety to expressiveness in a way even a great pianist will not always succeed.

(In this capacity musical qualities are guiding principles rather than just historical verisimilitude.)

Pitch Crescendo

The use of pitch crescendo is very different for different composers. It largely supplies what Casals used to call the "rainbow", the crescendo-diminuendo as the melody rises and falls. However different composers have different affinities to rainbows, if one can stretch the analogy a bit.

Beethoven restrains pitch crescendo. You need it very sparingly or not at all, perhaps a little more for his later works. It is part of his "ethical restraint". Mozart and Bach use more (say 1.15 -1.25). Schubert quite a lot (1.3 - 1.35). The more melodic and songlike, and the more romantic the music is, the more pitch crescendo will generally be appropriate.

Sometimes bass parts benefit from a negative pitch crescendo, an increase in loudness as the bass goes lower. Use values less than 1 (about .9 - .85)

Long Notes

Notes longer than about 1.5-2 seconds should often be considered not melodic but textural: they provide a sustained harmonic background or texture. SuperConductor learns to distinguish these from melodic tones through the Long Note Function. Long notes would start and decay too slowly otherwise. The cutoff point needs to be checked for each piece, as some faster pieces may have some “long notes” as short as one second that should be treated as non-melodic tones. Generally there is little problem to draw the line. Adjust the sliders to give the right attack and decay for the textural tones. If some long tones don’t have the required shape after adjusting the long note function to satisfy most of the others, then use the single note shaping function from the single note menu. In working with symphonies, this occasionally may be required, mainly for very long tones, held for many bars.

Short Notes

Trills and ornaments are often too loud, or less often too soft. The values for the cutoff of this function sometimes need careful adjusting, so that other fast notes, not quite as fast as the ornaments and trills, don’t get included in the reduction (or increase) of loudness. For Scarlatti, ornaments often are suitably played with an increase in loudness. In Symphonies, too, as they otherwise may be masked by other instruments. But mostly, in solo instruments, and in chamber music, trills and ornaments need generally to be softened, so that they sound as ornaments, rather than protrusions. Trills and ornaments also need to have shape. Partly this is achieved as result of the global parameters. For longer, sustained trills however, the effect of the pulse needs to be largely (but not completely) suppressed. See helpful hints under “trills and ornaments”.

Trills can be shaped very subtly in the editor. Without touching single trill notes, the overall shape of the trill can be designed readily to be, as required, subtly accelerated or slowed or both. You may also want to use the crescendo / diminuendo function appropriately as well for shaping the loudness of the trill at times.

Pizzicato

Shaping is also used to create pizzicato. Use values in the neighborhood of 0.16-0.40 for Rise and 1.5-1.8 for Fall, and bar regions. The exact values to use will depend on the tempo and nominal duration of the note, and on the character of pizzicato desired. Lower pizzicato voices such as those of a cello or bass require slightly larger values for Rise, and somewhat smaller values for Fall. Vibrato can be applied to pizzicato with good results, as appropriate. Precise optimal values chosen will also depend on the tempo of the piece. The third slider, the predictive shaping factor appropriately has no effect in pizzicato if the notes are entered as staccato, or are separated by rests.

Micropause

In traditional music teaching, there has been a concept to separate sections, and sometimes phrases with a short breathing pause, often called "Luftpause". These are of the order of 150-250 milliseconds. The need for these comparatively larger pauses is very obvious, and can be accomplished with the use of the micropause function. However, micropauses are especially useful in places where no luftpause would have been contemplated. A small micropause, of perhaps 50-100 milliseconds or so, can be very helpful occasionally to prepare an event, such as the last chord of a piece, or a sudden modulation, a subito piano such as Beethoven often uses, or the separation of sections where normally no luftpause is contemplated. With good pulse application, and well designed ritards, micropauses are only rarely required, perhaps two or three in a piece.

It is not recommended to attempt to achieve expressiveness by an abundant use of micropauses.

Sometimes a micropause is very good to use a few bars before the final ritard in a piece, if placed judiciously (particularly in Bach). This signals that something is about to happen, that we are coming to the end of the work. Then when the final ritard begins, it does not come as a shock, but as a fulfillment.

Staccato

The staccatos indicated by the composer are already entered in the flat file, in a generic way, before any interpretation is done. On the whole staccatos in Mozart for example, are somewhat shorter than in Beethoven. But all staccatos together can be altered at the choice of the interpreter in the editor. However, individual staccatos can also be designed as desired. This is not often necessary, however, since the pulse (and the predictive amplitude function where it is employed) vary the effective staccato length depending on context, so that the actual staccatos are in effect varied, as they may well advantageously need to be, without superimposing any individual alterations.

Thus the use of the manual staccato function of this panel is actually rare. Indeed, it is there as an “emergency” and is not recommended as a required practice.

The effect of a staccato is not only brought about by its duration: the loudness of that tone also contributes to its character. The combined effect of duration and loudness is what the listener experiences.

The duration of staccatos is related to the general character of the music and the composer. Shortest staccatos are encountered in fairy dance like pieces, as in Mendelssohn scherzi, and give especial airiness and lightness. (But if you make them too short they sound like insects, not fairies dancing). However that duration of the note itself is an indication also: composers often write rests after notes to give them shorter duration, rather than just stacccato dots (for example, in the last quartets of Beethoven, he often used this more precise method). So that one cannot give a general rule. Beethoven scherzi that demand greater “solidity” will need somewhat longer staccatos than Mozart’s Magic Flute Overture, for example, where the sense of magic and adventure makes the shortness of the notes, the air between them, itself be pregnant with fun and mystery.

Staccato is a single word, but the reality is a varied world, of gradations that words cannot describe, but even slight differences will provide different character and meaning to the music: in a chain of staccatos, each has its own organic function, like a group of people, no two the same.

In SuperConductor, the global Pulse and Predictive Amplitude shaping functions, creatively adjusted, provide much of the organic variety, the articulation they need - the organic combination of shades of duration and shades of loudness.

Legato

Legato means a slight overlap between notes, bringing about a fusion between notes, giving a sense of continuity within a phrase, or melody. While an increased legato effect can be obtained by choosing a small p2 in the amplitude shaping function, this cannot provide overlap. In the piano, the tail function does provide an adjustable overlap. When certain notes are desired to be closely tied together, or fused, then the legato function may be used to connect the present note to the next one. The amount of legato should not be too much, otherwise the next note will not be heard clearly. Unlike most of the physical instruments, the instruments of SuperConductor are all able to provide legato. Thus a violin tone can be legato to the next one (overlap it a little) even when played on the same string, a feat that no violinist can do, no matter how desirable. The same can be done with any woodwind instrument, even horns, trumpets, and the human voice on Superconductor. This enlarges the expressive arsenal of music ito satisfy natural musical requirement, not for weird effects, but to give music greater eloquence, beauty and persuasion.

Remember that legato is used from one note to the next within phrases. That means the last note of a phrase should not have a legato on it connecting it to the next note, otherwise it will destroy the separation of phrases. Not all phrases benefit from legato, also. And most phrases have in them a varied articulation that combines various degrees of "non legato' or "staccato' with " legato" for different notes in the melody or phrase. These terms allow almost infinite shades of variation. In traditional music notation and teaching they cannot be given all their individuality and subtlety that they need, by a verbal or notational description. It is the "feel" of the phrase that governs it. Here you can see how the principles of hierarchic pulse and of Predictive Amplitude shaping provide much of the phrasing subtlety, when properly adjusted. At times however, this can be supplemented and heightened with the judicious , selective use of touches of the legato function. A typical

amount of legato is 0.1 to 0.2 seconds. It too is rather infrequently needed, but can be quite magical when used appropriately, especially in the new sense, which physical instruments can not do. In the old days, a special legato singing quality was highly prized in singers especially, the bel canto style, in Bellini's operas for example, in Chopin's melodies also. But all music, Bach and before Bach can use the legato effect meaningfully . But it too, like vibrato is not a uniform lacquer to be applied en masse, and indiscriminately. To do that results in dullness. Life in music results through interplay between the shades of legato, and staccato, as it does in speech between vowels, consonants, phonemes, syllables and silence.

Note Length

The note length function really has two main different functions, depending on whether you use it for all voices together or for a single voice. Using it for all voices together is appropriate for fermatas, where the notes of a chord have to be lengthened suitably, or at the end of a piece, for the last note or chord. Alternatively in such cases you can use the terrace ritard, just for that one note. It is also useful at the beginning of a piece, where the first note (or upbeat) might be lengthened somewhat, to ease into the piece, often a good practice. (This can also be achieved by a slight ritard at the beginning, accelerating into the tempo of the piece, but this should not generally be extended over more than a few notes.)

The other function of changing the Length is within a voice. Here you can lengthen, or shorten a note without affecting the length of the notes in other voices. When you do this, you have to compensate for the change by changing other notes or rests of the same voice, so that the total change is zero. This allows you also to achieve a real "rubato", such as written about by Carl Philipp Emanuel Bach and by Chopin generally for slower tempi, where the rubato is to let one voice proceed freely, while the "left hand" keeps the same tempo going, causing the two voices to be temporarily apart in time, but then catching up (or gradually waiting), resuming togetherness. Such rubato, while recommended by those authorities as being their practice in their day, has been largely lost in the ability of today's artists, who mostly tend to slow down and accelerate with all voices. With the length change, you can now experi-

ment to resurrect this effect, powerful when done right. At this time, any rubato of this nature is constructed by controlling individual notes. In later versions of SuperConductor, it may be possible to have "rubato" functions, which would make it easier to design a local rubato optimally.

A third function is to allow a slight delay between voices over a particular (short) range. Using milliseconds, such a delay will improve voice leading clarity, and give a more singing tone to the melody, if used appropriately. If the melody tone occurs a little after or before the accompaniment (10-15 milliseconds say) then it will ring out more, being less masked by the accompaniment tones. This is especially true of piano and harpsichord music. Sometimes the melody will want to be ahead of the accompaniment, sometimes a bit behind, mostly at the beginning of phrase it may like to take the lead, and near the end be at little lagging, but it depends on the piece. These are delays of a shorter magnitude than in "rubato", and are done primarily for beauty of tone.

It is not recommended that this local Length Control be used extensively to create expressiveness with SuperConductor, since the global controls of hierarchic pulse and predictive amplitude shaping already cause local length changes, which when supplemented by ritards, and terrace ritards where appropriate, already efficiently provide the necessary possibilities of expressive length changes.

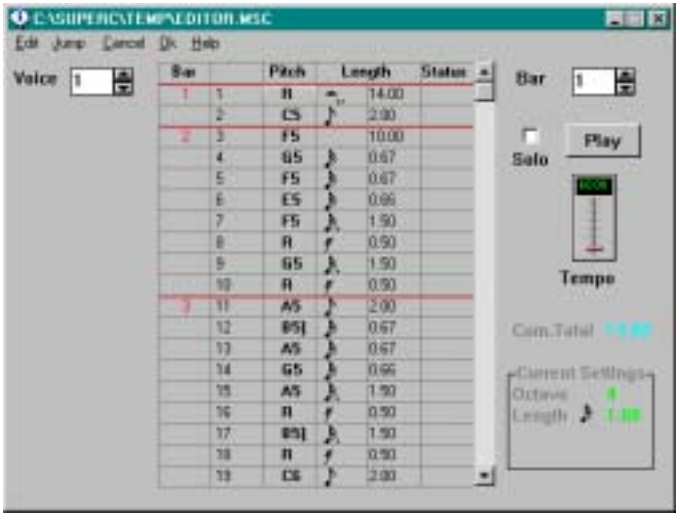
APPENDIX A

The Music Editor

Introduction

The Music Editor for SuperConductor is a simple way to enter and edit notes in a format compatible with SuperConductor.

The music Editor uses the “Step Method” of music entry, which is the only way to create a fully quantized file necessary for SuperConductor to accurately interpret a piece of music. In the step method, you first specify the correct note length and other attributes such as staccato or triplet, and then enter the note value either from the computer keyboard or the MIDI keyboard. Rests of the correct duration are also entered. Although this method is slower than playing in the notes, it is far more accurate and the user need not be concerned with keeping an exact tempo.



File Organization

You may have up to 128 voices in a SuperConductor file, but there are some restrictions. Each voice represents only a single tone from a single instrument at any given time, therefore you must enter a separate voice for each additional note an instrument is playing at one time. For example, if a violin is playing a double-stop, you must enter the top note in one voice and the bottom note in another.

It is best therefore to plan your voice organization in advance of entering notes. First determine the maximum number of notes that any given instrument will play in your piece, then make a list of voices for your own reference. For consistency, we recommend that you use the same basic organization set out below.

Microsound uses the following voice arrangements for consistency and ease of interpretation. Voice 1 through N represents the first voice of each instrument in the orchestra, then voices N+1 and on represent the additional notes for each of the main voices in the same order. A list for a string quartet would be as follows:

Voice 1	Violin 1
Voice 2	Violin 2
Voice 3	Viola
Voice 4	Cello
Voice 5	Violin 1 second note
Voice 6	Violin 1 third note
Voice 7	Violin 2 second note
Voice 8	Violin 2 third note
Voice 9	Viola second note

The only exception to the rule above is for piano, harpsichord or other instruments played with many notes at one time. In these cases it is best to separate the voices based on the different melody lines in the music. This approach allows the user to set different parts of the music to different loudness, panning and other interpretive effects.

Creating a New File

Files may be edited by running the Editor as a stand-alone program, or by calling the Editor from within SuperConductor. The following examples will create and edit files from SuperConductor.

To begin a new file:

- **Select New from SuperConductor's File Menu.**

  Enter the file name and other information including number of voices, meter, and name of piece in the File Information window.

- **Click on OK**
- **Choose Editor from the Edit menu.**

  The Music editor will be started. The cursor will be placed on Voice 1, Tone 1 of the new file.

See the Keyboard section of this appendix for information on how to enter notes.

- **Enter notes for Voice 1**

  Using the Voice Number box in the upper left corner of the screen, move to the next voice you wish to enter.

To enter a meter change in your piece:

- **Click once on the bar number in the bar column of the sheet**

  A meter dialog will pop up. Enter the new meter for this section and press OK.

It is suggested that you save your work periodically. Click on OK to return control to SuperConductor, then use the Save and Save As functions to save your work. To return to the editor, choose Editor from the Edit Menu again.

Editing an Existing File

To edit an existing file, open the file in SuperConductor, then select Editor from the Edit Menu. You will be asked to specify the range of bars that you wish to edit. The default is the whole piece.

Editing Notes

You may place the cursor at any position in the music and enter a new note using the computer keyboard or MIDI keyboard. Existing notes at the cursor location will be replaced.

If you double-click on a note pitch or length, an edit box will appear allowing you to type in the new length or note name using the keyboard. Pressing Enter will move to the next note for ease of changing a series of notes. When ready to enter more notes using your MIDI keyboard or computer keyboard, press Escape to exit the edit mode.

Importing a Track from a MIDI File

You can import notes from one or more tracks of a MIDI file using the **Import MIDI Track** menu item. Select the file and tracks you wish to import the data from, and the voice you wish the data to be applied to.

Note that a single MIDI track may require more than one voice in SuperConductor. The import routine will automatically use as many voices as are necessary to accomodate all the notes in the track. Use caution because existing notes will be overwritten in any voice needed for importing.

Keyboard Editing Commands

The Insert key will insert a Rest of the currently selected note size at the cursor location.

The Delete key will delete a note or selection of notes.

To move around in your music file, use the arrow keys. Page Up or Down, Home and End keys to navigate. To change voices, enter a new voice number or use the spin control in the Voice box in the upper left corner of the screen.

Menu Commands

Cut, Copy and Paste

• Cut, Copy and Paste operations function similarly to a word processor. You can select a region of notes using the mouse, and Copy them to the Clipboard. You can then reposition the cursor at another location and Paste, which will insert all the notes which are in the Clipboard at the current cursor location. The Cut operation will copy all the selected notes to the Clipboard and delete the selected notes.

Undo

• Undo will reverse the previous function that you performed. The undo list extends to the beginning of the current editing session of a particular file. Use the Undo function carefully as you may undo something that you really meant to keep.

Clear Voice

• Clear Voice will remove all the notes in the currently selected voice. Be careful with this one.

Copy Voice

• Copy Voice will copy all notes in the currently selected voice to a specified voice. All the notes in the destination voice will be erased.

Transpose

• Transpose will transpose a single note or range of notes in the current voice by a specified number of semitones.

Select All

• Select All will highlight all notes in the currently selected voice. This is useful for large cut, copy or transpose functions.

Set Start Bar

• Set Start Bar labels the first bar of the current piece to a specified number. This is useful if you enter your music in small sections and paste them together at a later time.

Jump to Start

• Jump to Start, End, Bar, Line will move your cursor to the specified position in the file.

The Keyboard

To enter notes with the computer keyboard, first select the note length using the function keys or number pad as illustrated above, then select any special attributes such as dotted, staccato, portamento or phrasing.

The note which you have selected will appear in the status window in the lower right corner of the screen.

Select the octave of this note using the keys on the QWERTY row.

Finally play the note using the ASDF and ZXCV rows, which are arranged like a piano keyboard with C of the octave selected starting on the X key. Use the space bar to insert a rest.

In addition to using function keys for note lengths, you may use the number pad for all of the same functions.

The note length keys all stay in effect until you select another note size, so if you wish to enter a series of 16th notes, press the 16th note key once, then play in all the notes, including rests.

The Dotted, Staccato, Portamento and Phrasing keys are one-time toggles. Press the key once to enable the function. Press it again to turn off the function. The status window in the lower right corner of the screen reflects the currently selected item, if any. As soon as a note is played, the function turns off automatically. For example, in order to play successive staccato notes, you must press the staccato key each time you enter a note.

The Triplet key requires that you enter 3 notes before the triplet function returns to a normal note. When using the triplet key, the computer automatically divides the note lengths to fit into a full note size.

Keyboard Shortcuts

<Home>	Move to beginning of file
<End>	Move to end of file
<PageUp>	Move up a page
<PageDn>	Move down a page
<Up arrow>	Move to preceding note
<Down arrow>	Move to next note
<Enter>	Begin edit mode or move to next note
<Esc>	End edit mode or cancel
<Insert>	Insert a rest at the cursor position
<Delete>	Delete note at cursor position
<Ctrl-X>	Cut
<Ctrl-C>	Copy
<Ctrl-V>	Paste
<Ctrl-Z>	Undo

<Ctrl-Down>	Select Down
<Ctrl-Up>	Select Up
<Ctrl-Home>	Select to beginning of file
<Ctrl-End>	Select to end of file
<Ctrl-T>	Transpose selected notes

Function Keys

F1 Whole Note

F2 Half Note

F3 Quarter Note

F4 Eighth Note

F5 Sixteenth Note

F6 Thirty-second Note

F7 Sixty-fourth Note

F8 Dotted Note

F9 Triplet

F10 Staccato

F11 Portamento

F12 Phrasing

Number Pad

7 Whole Note

8 Half Note

4 Quarter Note

5 Eighth Note

6 Sixteenth Note

1 Thirty-second Note

2 Sixty-fourth Note

9	Triplet
. (Decimal Point)	Dotted
* (Multiply)	Portamento
- (Minus)	Staccato
+ (Plus)	Phrasing

Transposing Notes

To transpose a section of notes in a single voice, select the notes with the mouse and use the Transpose menu option. You will be queried on how many semitones you wish to raise or lower the selected notes.

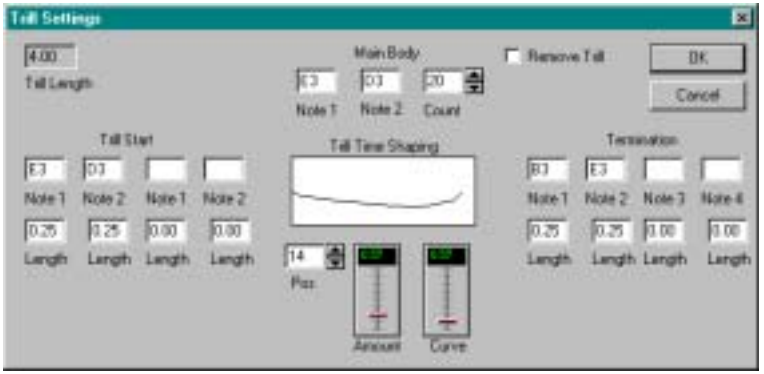
Interaction with SuperConductor

The Music Editor may be run as a stand-alone program, or can be launched from SuperConductor when the Editor menu item is selected. When run as a stand-alone program, all interpretive effects of SuperConductor are discarded, so this mode is most useful for entering new pieces before interpretation with SuperConductor.

When the Music Editor is run from SuperConductor, all data are preserved, but appear “flattened” or quantized for editing.

Trills

Trills are entered by first entering a single note which has the full value of the trill. Select the note, then choose Adjust Trill from the Edit menu. Trills may have 1 to 4 lead in notes, a main body consisting of any number of notes, and 1 to 4 termination notes of any length and pitch. You may also assign a curve to the main body of the trill, which will vary the timing of the notes, slowing down or speeding up during the course of the trill.



Here is an example of the trill setting dialog. This trill has two lead in notes, twenty notes in the main body, and 3 termination notes. A curve has been applied using the Trill Time Shaping parameters. To add more lead in or termination notes, just type in the correct note values. To remove lead in or termination notes, set the note length to 0 in the appropriate box.

MIDI Input

MIDI input for this program works with any standard Sound Blaster compatible sound card which has a MIDI interface. You will probably need a special cable to connect your MIDI keyboard to the sound card. A Windows MIDI driver will have to be installed and enabled for this to work. The usual name for the MIDI driver is MPU401 found in the Microsoft section of sound drivers.

When the MIDI driver is successfully installed, each time you play a note on the MIDI keyboard, that note will appear at the current cursor location in the Music Editor screen. See the section on Keyboard for a description of how to select note lengths and attributes. Note size must be selected before playing the note on your MIDI keyboard.

This is the most common way to enter data into SuperConductor. It is possible to become extremely proficient using the computer keyboard and the musical keyboard together.

APPENDIX B

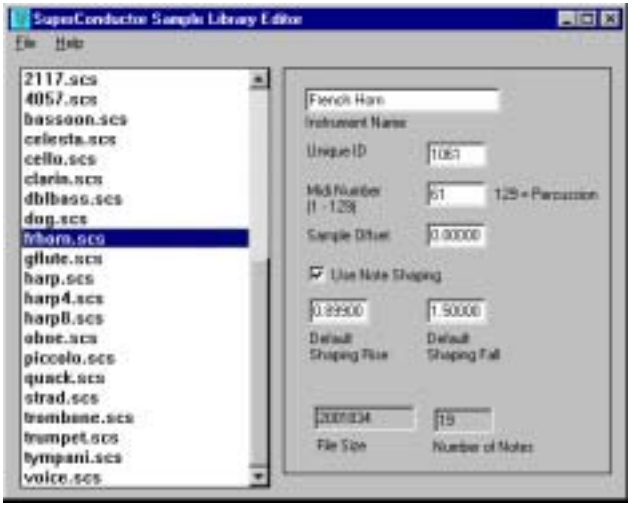
Creating and Editing Instruments

The Instrument Sample Library Editor

(Professional Version Only)

You can add your own sampled instrument sounds for use in SuperConductor with the **Instrument Sample Library Editor** included with the Professional version of the SuperConductor.

The Instrument Editor allows you to take a set of notes recorded into WAV or AIFF files from any instrument including the human voice and convert them into the instrument format used by SuperConductor. It can be run as a stand-alone program or by selecting the **Utilities/ Instrument Editor** menu in SuperConductor.



Changing Instrument Settings

Run the Instrument Editor either by selecting the **Utilities/Instrument Editor** menu from SuperConductor, or starting it as a stand-alone program.

Select the instrument you wish to change from the list on the left of the Sample Library Editor main window. The settings for the instrument will appear in the right half of the main window. Make any necessary changes, and use the File/Save menu to save your new settings. See below for a full description of each parameter.

Instrument Name - This is the name that will appear in the instrument list in SuperConductor.

Unique ID - This number must be different for each instrument in your collection of instruments.

Midi Number - This is the General Midi number of the instrument. This number is used to categorize instruments in the SuperConductor list. MIDI supports up to 128 different instruments. Number 129 is a special case used by SuperConductor to designate a percussion bank.

Sample Offset - This is the time that SuperConductor will skip at the beginning of each sample. This is useful to remove clicks, breath noise or silence from the beginning of sounds. The default setting is 0.

Use Note Shaping - There are two main categories of instruments in SuperConductor – those that use shaping, and those that don't. Instruments like the violin and flute who's sound can be shaped by the performer, either with the breath or a bow, should use the shaping feature. Plucked, hammered or percussive instruments, such as the piano, guitar or drum, which once started, decay at their own rate and can't be shaped, should not use this option. See the section on Predictive Amplitude Shaping in the SuperConductor manual for more details about how this functions works.

Default Shaping Rise and Fall - These are the default start and end shaping parameters that will be used with this instrument when you create a new piece of music in SuperConductor. They do not have any effect on existing pieces of music.

Creating a New Instrument

The Sample Library Editor will assemble a collection of audio samples from an instrument into a single instrument file used by SuperConductor.

Audio samples may be mono or stereo, 8 or 16 bit, and sampled at 11025, 22050 or 44100 hertz. Samples may be looped, but only sustain loops in the forward direction are supported.

Step 1 - Copy all your audio sample files for the new instrument into a **new directory or folder**. Each sample must be in either .WAV or .AIF audio file format, and must be named with the pitch and octave of that sample. C4 is middle C, so a wave file into which you recorded a middle C of an instrument would be named C4.WAV. Sharps are designated with a '#' and flats with a ']' (right bracket) so C#4.WAV and C]4.WAV would be C sharp and C flat respectively.

Step 2 - Run the Sample Library Utility either by selecting the **Utilities/ Sample Library Editor** menu from SuperConductor, or starting it as a stand-alone application.

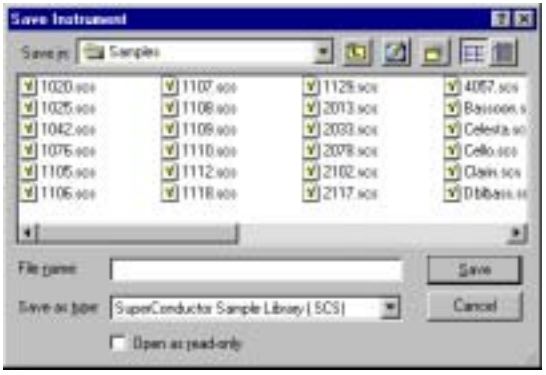
Step 3- Select File / New from the menu of the Sample Library Editor program and select the drive and directory where the audio samples are located, then click Next.

Step 4 - A list of samples found in the selected directory will be shown. At this point, you can delete one or more samples from the list so they won't be included in the new instrument. This will not delete the actual sample file from disk.

Step 5 - Enter the instrument name, ID, MIDI number and whether or not to use note shaping with this instrument. In most cases, the Sample Offset and the Default Shaping Rise and Fall should be left at 0.

You will be given a warning and an opportunity to correct it if the Unique ID you have chosen already exists in SuperConductor's samples.

Step 6 - Save the new instrument. It is recommended that you use the Unique ID as the filename for the instrument, as it will make it easier in the future to find and edit the sample settings.



Step 7 - Exit the Instrument Editor by selecting the **File/Exit** menu. Restart SuperConductor if you were running the Intrument Editor as a stand-alone program.

Recording and Editing Samples

You can record samples using any simple sound recording program on your computer but in order to achieve the best results a high quality digital recording and editing program is recommended. There are a number of these types of programs available including **Cool Edit or Sound Forge** for Windows and **SoundEffects or Alchemy** for the Macintosh. Each of these programs let you record the sound, then perform various filtering, looping and other conversions to the sampled sound.

The SuperConductor Pro CDROM includes the shareware versions of **Cool Edit** for Windows and **SoundEffects** for the Macintosh. Each of these programs must be installed manually by running the installation program found in the appropriate folder on your CDROM.

Samples should be **looped** if they are to continue playing beyond the actual time of the recorded sound. Both Sound Forge and Alchemy offer simple looping tools, and a program called **Infinity** for the Macintosh is devoted to developing the best loops possible using a number of algorithmic approaches. Note however that storing the samples on hard disk, which SuperConductor provides, allows very long samples to be used without looping.

Straightening your Samples

In order for **Predictive Amplitude Shaping** functions of SuperConductor to work optimally, the sampled sounds should be straightened, especially the first quarter second of the sample. This allows the predictive amplitude function of SuperConductor to provide a full range of attacks and decays which are possible on that instrument, through the choice of the shaping parameters. Most high quality digital sound editing programs offer what are known as **Amplitude Fitting** or **Envelope Shaping** functions. If your recorded samples vary in amplitude over the duration of the note, you will need to **straighten** the sound by using one of these functions to apply a straight line amplitude fit to the sample. Both **Cool Edit** and **SoundEffects**, which are included with your SuperConductor Pro CDROM offer straightening functions specially designed for use with SuperConductor.

NOTE: Straightening samples only applies to instruments like the violin or flute whose amplitude can be varied by the performer, and not to instruments such as the piano, guitar or drum, which have their own natural decay of the sound.

APPENDIX C

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