ANTARES

Auto-Tune 3

Owner's Manual
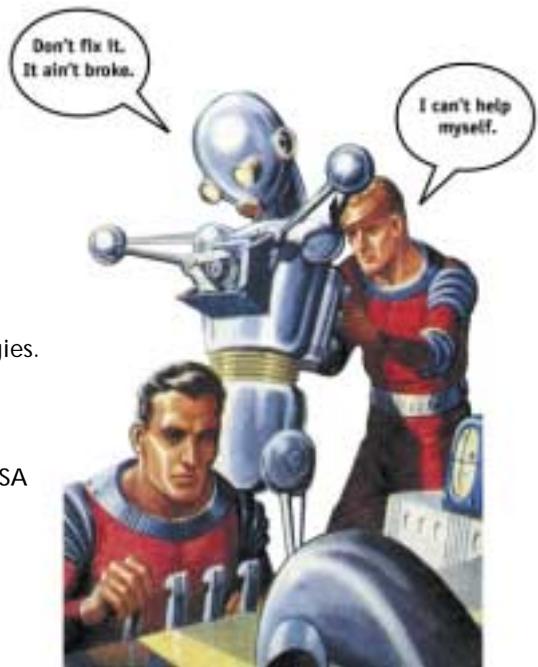
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Whew! Now that that's over, let's get on to the good stuff.

Contents

Welcome!

On behalf of everyone at Antares Audio Technologies, we'd like to offer both our thanks and congratulations on your decision to purchase Auto-Tune 3, the most powerful intonation correction tool in the world. Before you proceed any farther, we'd like to strongly encourage you to register and authorize your copy of Auto-Tune 3. (You can skip ahead to the Authorization and Installation instructions on page 4. We'll wait.) Also, if you're planning on discarding that lovely Auto-Tune 3 box, it's probably a good idea to write down the serial number that appears on the bottom of the box for future reference. (The inside cover of this manual would be a good place.)

As an Auto-Tune 3 owner, you are entitled to receive notification of any software upgrades, technical support, and advance announcements of upcoming products. But we can't send you stuff unless we know who and where you are. So please, register.

At Antares, we are committed to excellence in quality, customer service, and technological innovation. With your purchase of Auto-Tune 3, you have created a relationship with Antares which we hope will be long and gratifying. Let us know what you think. You can count on us to listen.

Again, thanks.

The Whole Antares Crew

Chapter 1: Getting Started

What's New in Auto-Tune 3

If you are upgrading from a previous version of Auto-Tune, you will find that most all of what you're already doing will continue to work in Auto-Tune 3, only better.

The following are the key new features that have been added in Auto-Tune 3:

• A revised core pitch detection algorithm that greatly improves pitch detection reliability in both Automatic and Graphical Modes.

• "Source Specific" pitch detection and correction algorithms. Choices include Soprano Voice, Alto/Tenor Voice, Low Male Voice, Instrument, and Bass Instrument. Matching the appropriate algorithm to the input results in even faster and more accurate pitch detection and correction.

• Phase-coherent pitch correction of stereo tracks.

• A Bass Mode that lowers the lowest detectable frequency by about one octave to 25Hz. Since the lowest E string on a bass guitar is approximately 41Hz, Bass Mode allows the user to apply pitch correction to fretless bass lines as well as other low bass range instruments.

• The ability to set target pitches in real-time via MIDI from a keyboard or sequencer track.

• A new Make Scale From MIDI function for occasions when it is not clear exactly what key a melody line is in, or where the line has too many accidentals to fit comfortably into a conventional scale. For those occasions, the Make Scale From MIDI function allows you to simply play the line from a MIDI keyboard or sequencer and let Auto-Tune 3 construct a custom scale containing only those notes that appear in the line.

• High sample rate (88.2kHz, 96kHz) compatibility (depends upon host application and audio hardware support).

• Enhanced MIX chip usage efficiency for more instantiations per MIX chip (TDM only)

• An AudioSuite version (TDM only).

• A spiffy new user interface.

How To Use This Manual

Auto-Tune 3 has a very friendly user-interface and is extraordinarily easy to use. However, because Auto-Tune 3 does things that have never been done before, a few aspects of the user-interface may not be immediately obvious. You should read either Chapter 3, Auto-Tune 3 Controls, or Chapter 4, Auto-Tune 3 Tutorial, to learn the essential information you will need to operate Auto-Tune 3.

The Contents Of This Manual

Chapter 1: Getting Started
The chapter you are reading.

Chapter 2: Introducing Auto-Tune 3
This chapter explains basic facts about pitch and how Auto-Tune 3 functions to correct pitch errors. The basic functionality of Auto-Tune 3 is discussed, and information you need in order to use it effectively is provided.

Chapter 3: Auto-Tune 3 Controls
This chapter is reference information for all of the controls used in the Auto-Tune 3 interface. Much of the information in this chapter is also presented in Chapter 4, however some of the less important controls are only explained in Chapter 3.

Chapter 4: Auto-Tune 3 Tutorial
This chapter introduces you to details of how Auto-Tune 3 works by guiding you through several tutorials. The tutorials will give you insight into how and when to use each of Auto-Tune 3's key functions.

Chapter 5: Creative Applications for Auto-Tune 3
Some cool, but not-so-obvious stuff you can do with Auto-Tune 3.

Installing Auto-Tune 3

Instructions for installing Auto-Tune 3 for your specific plug-in format are located in the Auto-Tune 3 Read Me file that accompanies the plug-in. This file may also contain any last-minute Auto-Tune 3 information that didn't make it into this manual.

Auto-Tune 3 is designed to work with a wide variety of digital audio applications. Please refer to your host application's user manual for more information on installing and using plug-ins.

Authorizing Auto-Tune 3

Authorization (the process by which this software is allowed to run on your computer) is accomplished by a technique called "Challenge/Response." Basically, the first time you launch this software you will be presented with a string of words (the Challenge) and will be asked to enter another string of words (the Response).

Note: When initially installed, this software will run for ten days without authorization.

So even if you can't authorize it right away you can still use your software in the meantime. (During this period, click the "Try It" button whenever you are presented with the Trial Period screen at launch.) But don't procrastinate too long. After those ten days are up, you will no longer be able to launch this software until the correct Response is entered.

Challenge/Response Authorization:

If you have internet access, you can authorize your software using our automated web form by doing the following:

• Access Challenge/Response authorization by pressing "Next" at the Trial Period screen. This will take you to the iLok screen. Be sure to uncheck the box that says "Use my iLok key" and then press "Next" to access the Challenge screen.

The Challenge screen displays the Challenge string. To receive the appropriate Response you will need to provide us with both the Challenge string and the Registration Code that was included on the yellow card in your software package (if you bought a retail package) or supplied with your download.

• To obtain your Response, have your Registration Code and Challenge string at hand. (If you will be accessing the web from the same computer that will be running your software, you can press "Copy Challenge" at the Challenge screen and then simply paste the Challenge into the appropriate field on the web page below.)

• Point your web browser to:

   http://www.antarestech.com/register/

and simply follow the directions there. (Be extremely careful to enter the Registration Code and Challenge string accurately.) You will receive your Response, which you should carefully copy into the appropriate field on Auto-Tune 3's Challenge/Response screen. You should also copy the Response in a safe place - like the inside front cover of this manual — so that you can refer to it if it is ever necessary to reinstall your software.

If, for some reason, you do not have access to the web but do have email, copy and paste your Challenge string and Registration Code into an email along with your name and the product name (e.g., Auto-Tune 3 for MAS), and send it to:

register@antarestech.com.

You will receive your Response by return email, typically within one working day (unless you have registered on a weekend, in which case you should receive it the following Tuesday).

If you do not have access to the web or email, fax your Challenge string along with your Registration Code to us at 831.461.7801. Be sure to include your fax number. We will fax the Response string back to you at that number.

Technical Support

In the unlikely event that you experience a problem using Auto-Tune 3, try the following:

1. Make another quick scan through this manual. Who knows? You may have stumbled onto some feature that you didn't notice the first time through.

2. Check our web page for tips, techniques, or any late-breaking information:

   http://www.antarestech.com

3. Call your local Antares dealer.

4. Email our tech support department by pointing your web browser to:

   http://www.antarestech.com/support/etech.shtml

and filling in the form there.

5. Call us at (831) 461-7814 Monday through Friday between 9am and 5pm USA Pacific Standard Time.

For options 3, 4, or 5, please be prepared to provide the Registration Code of your copy of Auto-Tune 3.

Chapter 2: Introducing Auto-Tune 3

Some background

In 1997, Antares Audio Technologies first introduced the ground-breaking Auto-Tune Pitch Correcting Plug-In. Auto-Tune was a tool that actually corrected the pitch of vocals and other solo instruments, in real time, without distortion or artifacts, while preserving all of the expressive nuance of the original performance. *Recording Magazine* called Auto-Tune a "holy grail of recording." And went on to say, "Bottom line, Auto-Tune is amazing... Everyone with a Mac should have this program." (In fact, we know of quite a few people back then who bought kilo-buck ProTools™ systems just to be able to run Auto-Tune.)

In the intervening years, Auto-Tune has become available for most every major plug-in format and has established itself as the worldwide standard in professional pitch correction. Today, it's used daily by thousands of audio professionals to save studio and editing time, ease the frustration of endless retakes, save that otherwise once-in-a-lifetime performance, or even to create unique special effects.

Now, never content to leave a good thing alone, Antares has created Auto-Tune 3. Preserving the great sound quality, transparent processing, and ease of use of Auto-Tune, Auto-Tune 3 adds significant new features as well as a spiffy new user interface.

So what exactly is Auto-Tune 3?

Auto-Tune 3 is a precision tool for correcting intonation errors or creatively modifying the intonation of a performance. Auto-Tune 3 employs state-of-the-art digital signal processing algorithms (many, interestingly enough, drawn from the geophysical industry) to continuously detect the pitch of a periodic input signal (typically a solo voice or instrument) and instantly and seamlessly change it to a desired pitch (defined by any of a number of user-programmable scales or through the use of graphical editing tools.).

To take maximum advantage of the power of Auto-Tune 3, you should have a basic understanding of pitch and how Auto-Tune 3 functions to correct pitch errors. This chapter presents basic terminology and introduces Auto-Tune 3's operating paradigm, giving you information you need to use it effectively.

A little bit about pitch

Pitch is typically associated with our perception of the "highness" or "lowness" of a particular sound. Our perception of pitch ranges from the very general (the high pitch of hissing steam, the low pitch of the rumble of an earthquake) to the very specific (the exact pitch of a solo singer or violinist). There is, of course, a wide range of variation in the middle. A symphony orchestra playing a scale in unison, for example, results in an extremely complex waveform, yet you are still able to easily sense the pitch.

The vocalists and the solo instruments that Auto-Tune 3 is designed to process have a very clearly defined quality of pitch. The sound-generating mechanism of these sources is a vibrating element (vocal chords, a string, an air column, etc.). The sound that is thus generated can be graphically represented as a waveform (a graph of the sound's pressure over time) that is periodic. This means that each cycle of waveform repeats itself fairly exactly, as in the periodic waveform shown in the diagram below:

Because of its periodic nature, this sound's pitch can be easily identified and processed by Auto-Tune 3.

Other sounds are more complex. This waveform:

is of a violin section playing a single note in unison. Our ears still sense a specific pitch, but the waveform does not repeat itself. This waveform is a summation of a number of individually periodic violins. The summation is non-periodic because the individual violins are slightly out of tune with respect to one another. Because of this lack of periodicity, Auto-Tune 3 would not be able to process this sound.

Some pitch terminology

The pitch of a periodic waveform is defined as the number of times the periodic element repeats in one second. This is measured in Hertz (abbreviated Hz.). For example, the pitch of A3 (the A above middle C on a piano) is traditionally 440Hz (although that standard varies by a few Hz. in various parts of the world).

Pitches are often described relative to one another as intervals, or ratios of frequency. For example, two pitches are said to be one octave apart if their frequencies differ by a factor of two. Pitch ratios are measured in units called cents. There are 1200 cents per octave. For example, two tones that are 2400 cents apart are two octaves apart. The traditional twelve-tone Equal Tempered Scale that is used (or rather approximated) in 99.9% of all Western tonal music consists of tones that are, by definition, 100 cents apart. This interval of 100 cents is called a semitone.

The twelve equally-spaced tones of the Equal Tempered Scale happen to contain a number of intervals that approximate integer ratios in pitch. The following table shows these approximations:

INTERVAL	CENTS	NEARBY RATIO	RATIO IN CENTS
minor second	100	16/15	111.75
major second	200	9/8	203.91
minor third	300	6/5	315.64
major third	400	5/4	386.31
perfect fourth	500	4/3	498.04
tritone	600		
perfect fifth	700	3/2	701.65
minor sixth	800	8/5	813.69
major sixth	900	5/3	884.36
minor seventh	1000	16/9	996.09
major seventh	1100	15/8	1088.27
octave	1200	2	1200.00

As you can see, the intervals in the Equal Tempered Scale are NOT equal to the harmonious integer ratios. Rather, the Equal Tempered Scale is a compromise. It became widely used because once a harpsichord or piano is tuned to that scale, any composition in any key could be played and no one chord would sound better or worse than that same chord in another key.

How Auto-Tune 3 detects pitch

In order for Auto-Tune 3 to automatically correct pitch, it must first detect the pitch of the input sound. Calculating the pitch of a periodic waveform is a straighforward process. Simply measure the time between repetitions of the waveform. Divide this time into one, and you have the frequency in Hertz. Auto-Tune 3 does exactly this: It looks for a periodically repeating waveform and calculates the time interval between repetitions.

The pitch detection algorithm in Auto-Tune 3 is virtually instantaneous. It can recognize the repetition in a periodic sound within a few cycles. This usually occurs before the sound has sufficient amplitude to be heard. Used in combination with a slight processing delay (typically about 1 to 10 milliseconds), the output pitch can be detected and corrected without artifacts in a seamless and continuous fashion. (Although it must be kept in mind that some plug-in protocols introduce a certain amount of inher-ent and unpredictable delay that depends largely on what else your CPU is doing at the time.)

Auto-Tune 3 was designed to detect and correct pitches up to the pitch C6. (If the input pitch is higher than C6, Auto-Tune 3 will occasionally inter-pret the pitch an octave lower. This is because it interprets a two cycle repetition as a one cycle repetition.) On the low end, Auto-Tune 3 will detect pitches as low as 25Hz (when the Bass Instrument Input Type is selected). This range of pitches allows intonation correction to be per-formed on virtually all vocals and instruments.

Of course, Auto-Tune 3 will not detect pitch when the input waveform is not periodic. As demonstrated above, Auto-Tune 3 will fail to tune up even a unison violin section. But this can also occasionally be a problem with solo voice and solo instruments as well. Consider, for example, an exceptionally breathy voice, or a voice recorded in an unavoidably noisy environment. The added signal is non-periodic, and Auto-Tune 3 will have difficulty determining the pitch of the composite (voice + noise) sound. Luckily, there is a control (the Tracking control, discussed in Chapter 3) that will let Auto-Tune 3 be a bit more casual about what it considers "periodic." Experimenting with this setting will often allow Auto-Tune 3 to track even noisy signals.

How Auto-Tune 3 corrects pitch

Auto-Tune 3 provides two separate and distinct ways to approach pitch correction: Automatic Mode and Graphical Mode. The basic functionality of each is described below.

Automatic Mode

Auto-Tune 3's Automatic Mode works by continuously tracking the pitch of an input sound and comparing it to a user-defined scale. The scale tone closest to the input is continuously identified. If the input pitch exactly matches the scale tone, no correction is applied. If the input pitch varies from the desired scale tone, an output pitch is generated which is closer to the scale tone than the input pitch. (The exact amount of correction is controlled by the Retune Speed parameter, described below and in Chapter 3.)

Scales

The heart of Automatic Mode pitch correction is the Scale. Auto-Tune 3 lets you choose from major, minor, chromatic or 26 historical, ethnic and microtonal scales. Individual scale notes can be bypassed, resulting in no pitch correction when the input is near those notes. Individual scale notes can also be removed, allowing a wider range of pitch correction for neighboring pitches. The scale can be de-tuned, allowing pitch correction to any pitch center.

For added flexibility, you can also select the target pitches in real time via MIDI from a MIDI keyboard or a pre-recorded sequencer track.

Retune Speed

Auto-Tune 3 also gives you control over how rapidly, in time, the pitch adjustment is made toward the scale tone. This is set with the Retune Speed control (see Chapter 3 for more details).

• Fast Speed settings are appropriate for short duration notes and for mechanical instruments, like an oboe or clarinet, whose pitch typically changes almost instantly. A fast enough setting will also minimize or completely remove a vibrato, as well as produce the infamous "Cher effect."

• Slow Speed settings, on the other hand, are appropriate for longer notes where you want expressive pitch gestures (like vibrato) to come through at the output and for vocal and instrumental styles that are typified by gradual slides (portamento) between pitches. An appropriately selected slow setting can leave expressive gestures intact while moving the average pitch to the correct tonal center.

Vibrato

Auto-Tune 3 can also apply a vibrato to the input sound. You can program the vibrato depth, vibrato rate and the onset delay of the vibrato. You can also choose the shape of the pitch variation in the vibrato (sine, square or sawtooth). By combining a fast Retune Speed setting with Auto-Tune 3's Vibrato settings, you can even remove a performer's own vibrato and replace it with Auto-Tune 3's programmed vibrato, all in real time. Also, unusual combinations of Vibrato Waveform, Rate and Depth settings can be used for some interesting special effects.

An Example of Automatic Mode Correction

As an example, consider this before-and-after graphic representation of the pitch of a vocal phrase that contains both vibrato and expressive gestures.
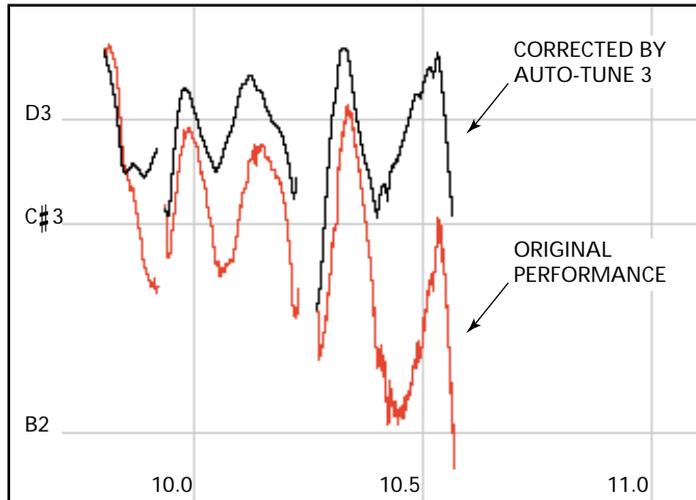
In the original performance, we can see that although the final note should be centered around D, the vocalist allowed the tail of the note to fall nearly three semitones flat. The "after" plot is the result of passing this phrase through Auto-Tune 3's Automatic Mode programmed to a D Major Scale (with C # and B set to "Remove") and a Retune Speed setting of 25. That Retune Speed causes the pitch center to be moved to D, while still retaining the vibrato and expressive gestures. (Setting C # and B to "Remove" is necessary to keep Auto-Tune 3 from trying to correct the seriously flat tail of the last note to those pitches. See Chapter 3 for more details.)

Graphical Mode

The Graphical Mode is similar to the Automatic Mode in that it also continuously tracks the pitch of the incoming sound and modifies the output pitch to be closer to a desired pitch. But in the Graphical Mode, the desired pitch is not a predefined scale tone, but rather is a graphical representation of your desired pitch.

As in Automatic Mode, the rate of change towards the desired pitch is controlled by the Retune control.

The key feature of Graphical Mode is the Pitch Graph display. On this display, the vertical axis represents pitch (with higher notes towards the top) while the horizontal axis represents time.

The red curve represents the original pitch contour of the input track, while the desired target pitch or pitch contour is indicated in yellow.

The horizontal grid lines represent scale pitches. The key annotation, scale name, scale pitches and Scale Detune value are those defined in the Automatic Mode. They do not affect the computations of the Graphical Mode in any way. They are merely a reference to guide you in setting the target pitches. If you wish to change them, you can select the Automatic Mode and change the Key pop-up, Scale pop-up, or the Scale Detune setting, respectively. (Changing the Scale Detune setting will also result in the scale pitch graph lines moving up or down relative to the tracked pitch.) Then, return to Graphical Mode.

The Graphical Mode also includes the Envelope Graph, which displays the amplitude (loudness) envelope of the sound whose pitch is shown in the Pitch Graph. The horizontal scale of this graph will either 1) show the envelope of the entire extent of the pitch-detected sound or 2) align with the horizontal scale and position of the Pitch Graph above it.

In Graphical Mode, you can draw the desired target pitches using line and curve drawing tools. Complete image scaling and scrolling controls are provided. A graphical editor allows easy editing, including cut, copy and paste functions.

The basic steps you will perform in Graphical Mode are:

- In your host application, select some sound for processing.

- Bring up Auto-Tune 3. Set the buffer length for at least the number of seconds from the beginning of the track to the end of the audio you are going to tune. Press the Track Pitch button, then play back the sound. The pitch will be detected and then displayed in the Pitch Graph as a red curve.

- Create a target pitch function using the graphical tools and adjust the Retune Speed for the desired effect.

- Press Correct Pitch and play back the sound. The pitch will be corrected as specified.

Chapter 3: Auto-Tune 3 Controls

This chapter is a reference for all of the controls used in the Auto-Tune 3 interface. This chapter describes the function of each control. How these controls are used together for intonation correction is demonstrated in Chapter 4, Auto-Tune 3 Tutorial. Much of the information in this chapter is also presented in Chapter 4. However, a few of the less commonly used controls are only explained here.

Common Controls

The following controls and displays are visible regardless of which operating mode is selected. Their settings affect both Automatic and Graphical Modes.

Sample Rate Display

This display indicates the sample rate of the current audio file as reported to Auto-Tune 3 by the host application.

Note: Auto-Tune 3 is high sample rate compatible. If your host application and audio hardware are capable of dealing with 88.2 kHz and 96 kHz files, Auto-Tune 3 will process them correctly. However, it's important to remember that high sample rate files require twice the DSP power of 44.1 kHz and 48 kHz files, so the number of possible simultaneous Auto-Tune 3 instantiations will be halved.

Another Note: If you are using external A/D converters with independently selectable sample rates, it can be possible to establish a mismatch between the actual conversion sample rate and what the host application thinks is the sample rate. If this happens, Auto-Tune 3 will appear to be correcting pitch to the "wrong" key. If this seems to be happening, check to be sure that your converter sample rate and your host application sample rate (as displayed by Auto-Tune 3) match.

Input Type
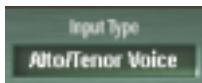
As a result of Antares research into the unique charac-
teristics of various types of audio signals, Auto-Tune 3
offers a selection of optimized processing algorithms for
the most commonly pitch-corrected inputs. Choices
include Soprano Voice, Alto/Tenor Voice, Low Male Voice, Instrument, and
Bass Instrument. Matching the appropriate algorithm to the input results
in even faster and more accurate pitch detection and correction.

To select the desired Input Type, click on the Input Type pop-up and then
select the desired type from the pop-up list.

*Note: Choosing the wrong Input Type (or just forgetting to set
it at all) can result in compromised performance. Pay attention.*

*Another Note: When any Input Type other than Bass Instrument
is selected, Auto-Tune 3 is reliably able to detect pitches down
to A0 (55Hz). Selecting Bass Instrument lowers the lowest
detectable frequency by about one octave to 25Hz. Since the
lowest E string on a bass guitar is approximately 41Hz, Bass
Instrument (as its name so ably implies) allows you to apply
pitch correction to those pesky fretless bass lines as well as
other low bass range instruments. However, when Bass Instru-
ment is selected, pitches above A4 may be incorrectly tuned by
a perfect fifth, so be sure to select Bass Instrument only when
correcting bass range tracks.*

Correction Mode
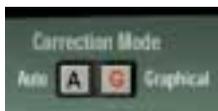
Click the appropriate button to select either Automatic
or Graphical Mode.

Select Pitch Reference

Auto-Tune 3 provides the ability to pitch correct stereo
tracks while maintaining the tracks' phase coherence.
(Refer to your host application's manual for instructions
on assigning a plug-in to a stereo track.) Click the appro-
priate button to select which of the two stereo tracks (left
or right) Auto-Tune 3 will use as a pitch reference.

*Note: If there is a marked difference in the two tracks, pick the
cleanest, most isolated track. For example, if one track is a close
mic'd vocal while the other is mic'd from farther away for
ambience, or is heavily processed, select the close mic'd track.*

Another Note: Auto-Tune 3 will only pitch correct true stereo tracks. If the second track (i.e., the track not selected as a pitch reference) is simply an independent unrelated track, unpredictable (and potentially unpleasant) sounds may result. On the other hand, something interesting might happen. You never know.

Bypass

Auto-Tune 3 does not include a dedicated Bypass control as that function is typically provided by the host application's plug-in interface. However, it is worth noting that Auto-Tune 3 is designed such that switching the bypass state will not cause any audio artifacts. It can safely be used in performance or in the middle of a recorded track.

Automatic Mode Controls

Knobs

All of Auto-Tune 3's continuous parameters are represented as knobs. To "turn" a knob, position the cursor over the desired knob, press and hold the left mouse button (or the only mouse button, if you're using a one-button mouse) and move the cursor up to turn the knob clockwise or down to turn the knob counter-clockwise. The current value of each parameter appears in its associated numeric display.

Double-clicking on a knob will return it to its default value. In some host applications, Command/Control clicking on a knob will also reset it to default (see the Auto-Tune 3 Read Me and/or your host application manual for details).

Key Selection
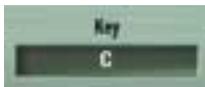
To select the desired key, click on the Key pop-up and then select the desired note from the pop-up list. This determines the pitch of the first note of the scale according to the standard A3 = 440 Hertz.

Scale Selection
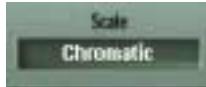
To select a scale, click on the Scale pop-up and then select the desired scale from the pop-up list.

Note*: To avoid having to deal with scales containing those annoying double flats, double sharps and notes like Cb, E#, Fb and B#, Auto-Tune 3 will automatically choose the simpler of two enharmonically equivalent scales. For example, if you select Db Major, the Edit Scale Display will duly display the Db Major scale. However, if you then go to the Scale selection pop-up and select Minor, the Key will automatically be changed to C# and the Edit Scale Display will, in fact, display the much friendlier C# Minor scale. This will also be reflected on the Pitch Graph Display in the Graphical Mode.*

The Scales

Auto-Tune 3 comes with 29 preprogrammed scales. The first three scales are equal tempered. These are the ubiquitous scales typically found in Western tonal music. The other scales are historical, ethnic, and microtonal scales. An in-depth discussion of these scales and their history is beyond the scope of this manual. The interested reader will find more information in *Tuning In — Microtonality In Electronic Music* by Scott R. Wilkinson, published by Hal Leonard Books.

The following is a brief synopsis of the scales:

Modern equal temperament:

- **major**: a seven-tone equal tempered major scale.

- **minor**: a seven-tone equal tempered minor scale.

- **Equal Tempered chrom**.: a twelve-tone equal tempered chromatic scale.

Historical tunings:

- **Ling Lun**: a twelve-tone scale dating from 2700 B.C. China.

- **Scholar's Lute**: a seven-tone scale dating from 300 B.C. China.

- **Greek diatonic genus**: a seven-tone scale from ancient Greece.

- **Greek chromatic genus**: a seven-tone scale from ancient Greece.

- **Greek enharmonic genus**: a seven-tone scale from ancient Greece.

- **Pythagorean**: a twelve-tone scale dating from 600 B.C. Greece. This scale is derived by tuning twelve pure perfect fifths upward and adjusting the octaves downward. This leads to some pure intervals and some very impure intervals.

- **Just** (major chromatic): a twelve-tone scale. Just intonation tunes the most frequently used intervals to be pure (integer ratios in frequency). These tunings depend on the mode (major or minor) and the key. This scale is tuned for major mode.

- **Just** (minor chromatic): (See Just (major chromatic), above)

- **Meantone chrom**.: a twelve-tone scale. This tuning is a combination of Pythagorean and just tunings so that music in a wider variety of keys could be usable.

- **Werckmeister III chrom**.: a twelve-tone scale. This scale was a first attempt (about Bach's time) to allow an instrument to be played in any scale. It was in response to this scale that Bach wrote Well-Tempered Clavier.

- **Vallotti & Young chrom**.: a twelve-tone scale. Another derivative of the Pythagorean scale designed to allow arbitrary keys.

- **Barnes-Bach** (chromatic): a twelve-tone scale. A variation of the Vallotti & Young scale designed to optimize the performance of Bach's Well-Tempered Clavier.

Ethnic Tunings:

- **Indian**: This 22 tone scale is used in India to perform ragas.

- **Slendro**: This five-tone Indonesian scale is played by ensembles called gamelans.

- **Pelog**: This seven-tone Indonesian scale is more interesting than Slendro and is now the primary scale in Balinese music.

- **Arabic 1**: This 17 tone scale is the original Arabic scale adopted from the Pythagorean scale.

- **Arabic 2** (chromatic): This twelve-tone scale is the modern version of the Arabic scale popular in Arabic music today.

Contemporary Tunings:

Equal tempered scales with a large number of tones are typically used to play common tonal harmony with greater purity of intervals and chords. The typical approach is to analyze a passage (or less) of music and select tones from a scale that will best approximate the desired pure intervals.

- **19 Tone**: This scale has greater purity of minor thirds and major thirds (and conversely, minor and major sixths) than twelve-tone equal temperament. A disadvantage is that perfect fifths are narrower than those found in twelve-tone equal temperament.

- **24 Tone**: Also know as the quarter tone scale, this scale is used for variety but has no advantage in terms of ratios that better approximate pure intervals.

- **31 Tone**: In addition to intervals that better approximate pure intervals, this scale also contains good approximations to Indonesian pelog and slendro scales.

- **53 Tone**: Related mathematically to the cycle of fifths, the 53-tone scale has very pure major and minor thirds, and fifths and fourths.

- **Partch**: Harry Partch is considered the father of modern microtonality. This scale was devised by him and used in instrument building and performances.

- **Carlos Alpha**: Wendy Carlos performed extensive computer analysis to devise a number of equal tempered scales with good approximations for the primary harmonic intervals and their inversions. This scale is good at approximating the primary intervals including 7/4. This scale divides the octave into 15.385 steps forming intervals of 78.0 cents.

- **Carlos Beta**: This scale divides the octave into 18.809 steps forming intervals of 63.8 cents.

- **Carlos Gamma**: This scale achieves perfect purity of the primary intervals 3/2, 4/3 and 5/4. This scale divides the octave into 34.188 steps forming intervals of 35.1 cents.

- **Harmonic** (chromatic): This twelve-tone scale is created in the partials in the fifth octave of the harmonic series. The scale degrees that correspond to the classic just intervals are the major second, major third, perfect fifth and major seventh.

The Edit Scale Display

The Edit Scale Display is used to create custom scales or to modify any of the preset scales. Edits made using this display are associated with each scale. That is, each scale retains its own edits independent of the other scales. For example, if you select C Major and Remove or Bypass certain notes and then change to C Minor and make other edits, when you return to C Major your previous

edits associated with C Major will be restored.

The Edit Scale window displays each note of the currently selected scale in the currently selected key. If the selected scale includes more than twelve notes, Up and Down arrows will appear to allow scrolling through all of the available notes.

Beside each note name are two buttons: a Bypass button and a Remove button. Click on a button to toggle its state. The button will light to indicate that its mode is active.

If neither of these buttons are lit, Auto-Tune 3 treats this note as a normal scale note, i.e., when the input pitch is close to this note, Auto-Tune 3 will correct the pitch to this note at the rate set by the Retune Speed control.

Bypass

If the Bypass button is lit, when the input pitch is close to this note the input will be passed through with no correction.

Why set Scale notes to "Bypass?"

There are two main reasons to set one or more scale notes to "Bypass."

1. If a performance includes pitch gestures around one or more specific notes that you want to preserve with no modification whatsoever, you can set just those notes to Bypass. This lets Auto-Tune 3 correct any pitch problems elsewhere in the scale but passes everything near the bypassed notes completely unprocessed.

2. If a performance contains only a single error, you can set all notes to Bypass except the one "sour" note. Auto-Tune 3 will then pass the entire performance through unprocessed except for the sour note, which will be corrected.

Remove
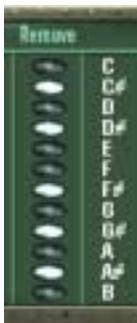
If the Remove button is lit, then the note is simply removed from the current scale. For example, selecting the Chromatic scale and then setting setting C#, D#, F#, G#, A# to Remove would cause a C Major scale to remain. In that case Auto-Tune 3 would always retune the input to the closest note of the C Major scale.

Why set Scale notes to "Remove?"

To understand why it is sometimes necessary to set even correct scale notes to "Remove," let's look again at the example from Chapter 1.
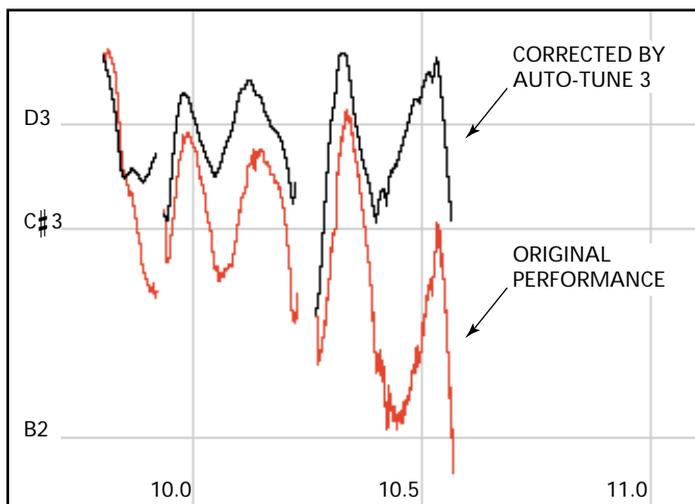
This phrase is in D Major and, if all the pitch errors were no greater than about 49 cents, would work fine with a standard D Major scale (D, E, F#, G, A, B, C#). However, the pitch error of three semitones at the end of the last note is so large that with B and C # present in the Scale, as the pitch fell, Auto-Tune 3 would see first C# and then B as the target pitch and therefore allow the error to remain. With C# and B removed from the Scale, Auto-Tune 3 continues to see D as the target pitch for the entire duration of the note and therefore pulls the phrase up to the correct pitch.

Cents
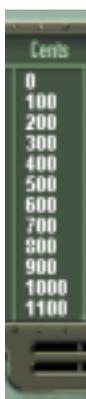
The number in the Cents column is the associated note's interval, in cents, from the root note of the scale. It's provided for reference purposes and to help you choose which notes of a microtonal scale to include or remove.

Set Major Scale/Set Minor Scale

When any scale that includes more than seven notes (i.e., any non-diatonic scale) is selected, the Set Major Scale and Set Minor Scale buttons will appear. Clicking on either of these buttons will "Remove" all notes from the scale except for those notes closest to the notes of a traditional diatonic major or minor scale (depending, of course, on which button you clicked).

Auto-Tune 3 MIDI Functions

Auto-Tune 3 contains two new functions that require it to receive MIDI data from the host application. Depending on your intent, this data could come in real time from a MIDI controller (typically a keyboard) or from a pre-recorded MIDI sequencer track. Refer to your host application's manual for details on how to route MIDI to Auto-Tune 3.

Please note that some host applications may not support the routing of MIDI information to plug-ins. In that case the following two functions will not be selectable.

Target Notes Via MIDI

To use the Target Notes Via MIDI function, ensure that the desired MIDI source is routed to Auto-Tune 3, then click the Target Notes Via MIDI button. Its associated "LED" will light and the Edit Scale display will automatically be set to a chromatic scale with all of the notes set to Remove. While in this mode, Auto-Tune 3 continuously monitors its MIDI input for Note On messages. At any instant, the scale used for correction is defined by all MIDI notes that are on. For example, if MIDI notes A, C and E are held, Auto-Tune 3's input will be retuned to an A, C or E, whichever is closest to the input pitch.

The source of the MIDI input would typically be a MIDI keyboard or sequencer track, and could consist of chords, scales, or, most powerfully, the exact melody that the input should be corrected to.

Important Note: If you will not be defining Auto-Tune 3's target pitches via MIDI, be sure that the Target Notes Via MIDI button is off. If it is left on and no MIDI note data is present, Auto-Tune 3 will pass through all audio unprocessed — giving the impression that Auto-Tune 3 is not functioning.

Learn Scale From MIDI

In most cases, you will probably tell Auto-Tune 3 which notes to correct to using the Edit Scale Display described above. However, there may be occasions when it is not clear exactly what key a melody line is in, or where the line has too many accidentals to fit comfortably into a conventional scale. For those occasions, the Make Scale From MIDI function allows you to simply play the line into Auto-Tune 3 from a MIDI keyboard or sequencer track and let Auto-Tune 3 construct a custom scale containing only those notes that appear in the line.

To use the Make Scale From MIDI function, ensure that the desired MIDI source is routed to Auto-Tune 3 and then click the Make Scale From MIDI button. Its associated "LED" will light and the Edit Scale display will automatically be set to a chromatic scale with all of the notes set to Remove.

Now simply play the melody to be corrected from your keyboard or sequencer. Tempo and rhythm don't matter, so take your time and make sure you don't play any wrong notes. As each note is played, the corresponding Remove button in the Edit Scale Display is turned off. Assume, for example, that your melody starts with D, B, and then A. After playing those notes the display would look like this:

When you have played the entire melody, press the Make Scale From MIDI button again to end the process. The Edit Scale Display will now contain a scale containing only those notes that appeared in your melody.

If you happen to make an error during note entry, or want to try again for any other reason, simply click the Make Scale From MIDI button and start the process again.

Note: When you start the process by pressing the Make Scale From MIDI button, all notes are first Removed from the chromatic scale in preparation for adding just the notes you play. If you then press the Make Scale From MIDI button again without playing any notes, you will be left with a chromatic scale with all notes removed. In this state, Auto-Tune 3 will pass all notes with no correction applied. So don't do that.

Another Note: We realize that there is some possibility of confusion between the Make Scale From MIDI function and Target Notes Via MIDI function described above. To clarify: Target Notes Via MIDI is used to specify target pitches in real time while pitch correction is occurring, while Make Scale From MIDI is used in advance of correction to create a custom scale.

Scale Detune

The Detune parameter allows you to change the pitch standard of Auto-Tune 3 from the default A = 440Hz. The values are cents (100 cents = 1 semitone). The range of adjustment is from -100 to +100 cents. The Detune function can be used to tune a vocal performance to some irreparably out-of-tune instrument (a piano or organ, for example), or to allow correction to other than the conventional 440Hz standard.

Refer to the following table to convert cents to Hertz relative to 440Hz.

DETUNE SETTING	A=HERTZ
-20	435
-16	436
-12	437
-8	438
-4	439
0	440
+4	441
+8	442
+12	443
+16	444
+20	445

This table can be extended in either direction by adding or subtracting 4 cents per Hertz, as appropriate.

If you have a tone that you want to use as the pitch standard, select that tone and play it in a loop. Adjust Scale Detune until the Change meter reads zero. (You may be required to use the Edit Scale dialog to remove adjacent notes so that Auto-Tune 3 doesn't tune to the wrong note.)

The default Scale Detune setting is 0 cents. Double-clicking the Scale Detune knob will reset it to that value.

Retune Speed

Retune Speed controls how rapidly the pitch correction is applied to the incoming sound. The units are milliseconds. A value of zero will cause instantaneous changes from one tone to another and will completely suppress a vibrato (note that any related volume changes will remain). Values from 10 to 50 are typical for vocals (unless you're going for the now-infamous "Cher effect," in which case use 0). Larger values let through more vibrato and other interpretative pitch gestures but also slow down how rapidly pitch corrections are made.

Although the above suggestions can be used as starting points, finding the correct Speed setting for a particular performance is largely a matter of trial-and-error and depends on such attributes as song tempo, note duration and vocal style, among others. As always, let you ears be your guide.

The default Retune Speed is 20. Double-clicking the Retune Speed knob will reset it to that value.

Tracking

In order to accurately identify the pitch of the input, Auto-Tune 3 requires a periodically repeating waveform, characteristic of a voice or solo instrument. The Tracking control determines how much variation is allowed in the incoming waveform for Auto-Tune 3 to still consider it periodic.

If you are working with a well-isolated solo signal (e.g., tracking in a studio or off of a multi-track tape) you can typically set the Tracking control to 25 and forget it.

If, on the other hand, your signal is noisy or not well-isolated (as might be more common in a live performance situation) or you are dealing with a particularly breathy or guttural voice, it may be necessary to allow more signal variation (higher Tracking numbers). However, under these circumstances tracking is not guaranteed and a too "relaxed" setting may introduce distortion and popping.

The default Tracking setting is 25. Double-clicking the Tracking knob will reset it to that value.

> *Note: The improved pitch detection algorithm in Auto-Tune 3 (in combination with the new Input Type selection described above) results in noticeably more reliable pitch detection compared to previous versions of Auto-Tune. If you have used older versions of Auto-Tune, you may find that situations that previously required constant modifications of the Tracking control now track perfectly at the default setting.*

The Vibrato Section

The Vibrato Section contains one pop-up and three knobs. The Vibrato pop-up allows you to select the shape of the vibrato's pitch variation. The choices are: (no vibrato), sine wave, square and sawtooth. Depth, which controls the amount of pitch variation in the vibrato, varies from 0 to 100 cents. The Rate varies from .1 to 10.0 Hz and controls the speed of the vibrato. Delay varies from 0 to 3000 milliseconds, controlling the speed of onset of the vibrato. For example, if it is set to 1000, the first 500 milliseconds of a new tone will contain no vibrato and the next 500 milliseconds will make a transition from no vibrato to the full vibrato.

The vibrato is re-started every time the Auto-Tune 3 matches the incoming pitch to a different scale tone. Also, the vibrato is applied after the effects of the Retune Speed control. Hence, even with a slow retune value of 50, a square wave vibrato will make instantaneous changes in pitch.

> *Note: Although we perceive vibrato primarily as a variation in pitch, in most cases there is also a matching variation in amplitude. Setting Auto-Tune 3's Retune Speed to 0 will remove an existing vibrato's pitch variation, but the amplitude variation will remain. If you then apply a new vibrato using Auto-Tune 3's Vibrato section, the results may be less than convincing. Auto-Tune 3's Vibrato section is more often useful for adding a vibrato to an input that originally had none, or for various special effects.*

The Pitch Change Indicator
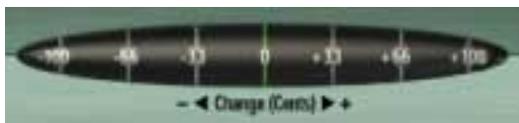
The Pitch Change Indicator shows you how much the pitch is being changed, measured in cents (100 cents = one semitone). For example, if the indicator bar has moved to the left to -66, it indicates that the input pitch is 66 cents too sharp and Auto-Tune 3 is lowering the pitch by 66 cents to bring the input back to the desired pitch.

Graphical Mode Controls

The Playback Controls

Track Pitch
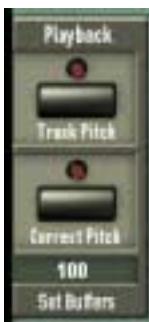
The Track Pitch function is used to detect the pitch of the audio to be processed so that it can be displayed on the Pitch Graph Display.

Locate the desired audio and press the Track Pitch button. Its "LED" will flash to indicate that Auto-Tune is waiting for audio. Next, start playback of the audio. (The Track Pitch LED will light steadily.) When all of the audio you want to correct has played, stop playback. Track Pitch is automatically deactivated and the detected pitch is displayed on

Note*: If the length of the audio to be processed exceeds the currently set size of the buffer (see below), playback will stop when the buffer is full. If this happens, increase the buffer size as necessary.*

Correct Pitch

After you have used the graphical tools (as described below) to create a target pitch contour, this button is used to apply the pitch correction to the audio.

In all cases, pressing the Correct Pitch button and then starting playback will cause the pitch correction to be applied to the audio. In some host applications, starting playback when the Pitch Graph contains any yellow pitch correction contour will automatically engage the Correct Pitch function. Check your Auto-Tune 3 Read Me file for details.

Set Buffers

Set Buffers controls the number of seconds of memory buffer space that are permanently reserved for pitch tracking and pitch correction data. (There is a separate buffer for each plug-in occurrence.) To change the buffer allocation, click on the Set Buffers data field and enter the required amount into the resulting dialog box.

Note: As buffer memory is typically allocated from within your host application, for large buffers, it may be necessary to increase the memory allocation of your host.

Another Note: Some host applications allow Auto-Tune 3 to display all tracked pitch information at their correct times within the track (see the Auto-Tune 3 Read Me file for details). If your application supports this capability, setting the buffer to the length of the entire song and tracking the pitch in one pass will allow you to quickly and easily move to each section of audio to be corrected as necessary.

The Pitch Graph Display

The Pitch Graph displays the pitch contour of the audio to be processed as well as the target pitch contour objects that you create. On this display, the vertical axis represents pitch (with higher notes towards the top) while the horizontal axis represents time.

The red curve represents the original pitch contour of the input track, while the desired target pitch or pitch contour is indicated in yellow.

The horizontal grid lines represent scale pitches. The key annotation, scale name, scale pitches and Scale Detune value are those defined in the Automatic Mode. They do not affect the computations of the Graphical Mode in any way. They are merely a reference to guide you in drawing the target pitches. If you wish to change them, select the Automatic Mode and change the Key pop-up, Scale pop-up, or the Scale Detune setting, respectively. (Changing the Scale Detune setting will also result in the scale pitch graph lines moving up or down relative to the tracked pitch.) Then, return to Graphical Mode.

Pitch Graph Scale

The Pitch Graph Scale Buttons control the horizontal (time) and vertical (pitch) scaling of the graph. Clicking the appropriate "+" button causes the view to zoom in, while clicking a "-" button causes it to zoom out.

The Envelope Graph Display

The Envelope Graph displays the amplitude (loudness) envelope of the sound whose pitch is shown in the Pitch Graph.

Envelope Graph Scale

The "+" and "-" buttons next to the Envelope Graph control the vertical scale as expected, while the horizontal (time) scale is controlled by the "All" and "Tie" buttons.

Clicking the All button causes the envelope graph to display the entire time scale represented by the current buffer setting. This is useful for locating and selecting various portions of audio spread over the duration of a song.

Clicking the Tie button slaves the position of the Envelope Graph to that of the Pitch Graph. When this setting is selected, the horizontal scale of the Envelope Graph is controlled by the Pitch Graph horizontal scale buttons.

The Graphical Tools

The graphical tools are used in conjunction with the edit buttons to create the desired target pitch contour.

The Line Tool

The Line Tool is used to draw multi-segment straight lines on the Pitch Graph.

Start the process by selecting the Line Tool and clicking anywhere on the Pitch Graph to set an anchor point. As you move the cursor, a line will extend from the anchor point to the cursor position. Click again to set a second anchor point and define the first segment of your pitch contour. Continue clicking and defining lines until your contour is complete. End the process by double-clicking on the final anchor point or pressing <esc> on your keyboard.

If you move the cursor outside the Pitch Graph during point entry, the graph will automatically scroll.

To delete the last anchor point entered, press <delete> on your keyboard (you can do this repeatedly back to the very first anchor point).

Pressing Option/Alt on your keyboard during line entry will force the current segment to be perfectly horizontal.

Only one pitch contour object (line or curve) can exist at any time point on the Pitch Graph. When you complete the entry of a line object, any object(s) that previously existed at the same time will be deleted.

The Curve Tool

The Curve Tool is used to draw arbitrary curves on the Pitch Graph.

Start the process by selecting the Curve Tool and clicking anywhere on the Pitch Graph to set an anchor point. Hold down your mouse button and move the cursor to draw the desired pitch contour curve. End the process by releasing your mouse button.

Unlike the Line Tool, the Pitch Graph will not scroll if you attempt to move the Curve Tool cursor outside the current display area.

Only one pitch contour object (line or curve) can exist at any time point on the Pitch Graph. When you complete the entry of a curve object, any object(s) that previously existed at the same time will be deleted.

The Pointer Tool

The Pointer Tool is used to select and drag existing target pitch contour objects (yellow lines and curves).

The Pointer Tool behaves as follows:

• Clicking on the background of the Pitch Graph and dragging horizontally selects objects' anchor points. Shift-clicking extends the selection.

• Dragging beyond the Pitch Graph boundaries automatically scrolls the graph.

• Moving the Pointer Tool over a pitch contour object causes the cursor to change to the object cursor (a horizontal bar). Clicking on an unselected curve or line segment with the object cursor causes the curve or segment and its anchor points to become selected and allows that object to be dragged. Clicking on an already selected curve or line segment with the object cursor allows that object, along with all other selected objects, to be dragged.

- Moving the Pointer Tool over a pitch contour object anchor point (whether that point is currently selected or not) causes the cursor to change into the anchor point cursor (four diagonal arrows). Clicking on an anchor point with the anchor point cursor deselects all other objects and anchor points and selects that anchor point so that it can be dragged. Dragging an anchor point stretches or compresses the pitch contour object relative to the nearest unselected anchor point(s).

- The extent to which you can drag selected objects is constrained by the position of neighboring unselected objects.

- In some host applications, holding down the Option/Alt key and then clicking to drag will restrict the cursor to vertical movements only (the cursor will change to indicate this state). The effect of this is to allow you to modify the pitch contour while preserving the object's location in time. This is particularly handy after using the "Make Curve" button, discussed below.

- Clicking on the background of the Pitch Graph de-selects all selected objects.

While the above may seem a bit mind-boggling on first reading, in practice it's quite intuitive. Spend a minute or two playing with the Pointer Tool and all will become clear.

The Zoom/Select Tool

The Zoom/Select Tool serves two purposes, depending on whether it is used in the Pitch Graph or the Envelope Graph.

In the Pitch Graph, use the Zoom/Select Tool to click and drag a box around an area of interest. Dragging off the Pitch Graph automatically scrolls the graph. When you release the mouse button, the scale and position of the Pitch Graph will be changed to display the area enclosed by the box.

In the Envelope Graph, click and drag with the Zoom/Select Tool to select a range of time containing audio. This causes the Make Curve button to become active (see below). Clicking Make Curve will create a pitch contour curve with anchor points at the selection boundaries.

Note: The Zoom/Select Tool can also be used to add new anchor points in the middle of an existing curve previously created by the Make Curve function. Simply select a range of time such that one or both boundaries of your selection fall at the point(s) where you would like a new anchor point and then click Make Curve. Voilá.

The Undo Button

The Undo button becomes active whenever you move or modify a target pitch contour object. Clicking the Undo button allows you to alternately undo and redo the last change.

The Cut and Copy Buttons
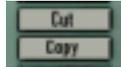
The Cut and Copy buttons become active whenever a pitch contour object is selected. Cut removes selected objects. Both Cut and Copy copy selected objects to the Auto-Tune 3 clipboard. You can then paste the objects elsewhere in the Pitch Graph display.

The Paste Button

The Paste button becomes active whenever an object has been Cut or Copied to the clipboard. Clicking Paste places the contents of the clipboard in the center of the current Pitch Graph view.

Note: Since only one pitch contour object (line or curve) can exist at any time point on the Pitch Graph, any object(s) that previously existed at the time where an object is Pasted will be deleted. Hence, before you press Paste, be sure that the Pitch Graph view does not contain any pitch contour object(s) that you want to keep.

The Select All Button
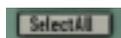
The Select All button causes all pitch contour objects, whether currently visible on the Pitch Graph view or not, to become selected.

Keyboard Equivalents

Some host applications support the following keyboard command equivalents for the above Edit Buttons. Consult the Auto-Tune 3 Read Me file or your host application's manual for details (or just try them and see if they work).

Command/Control-Z	undo/redo
Command/Control-X	cut
Command/Control-C	copy
Command/Control-V	paste
Command/Control-A	select all

The Make Curve Button

[Make Curve] The Make Curve button is enabled whenever there is any red input pitch contour data present in the Pitch Graph (whether it is displayed in the current Pitch Graph view or not). Pressing the Make Curve button causes yellow target pitch contour objects (curves for short) to be created from the input pitch contour data. These curve objects can then be dragged and stretched for very meticulous pitch correction. This is the central technique of Auto-Tune 3's Graphical Mode and is described in more detail in Chapter 4.

Note: If a range of time has been selected by using the Zoom/ Select Tool in the Envelope Graph, the Make Curve button works only in the selected time range.

The Make Auto Button

[Make Auto] The Make Auto button is enabled whenever there is any red input pitch contour data present in the Pitch Graph (whether it is displayed in the current Pitch Graph view or not).

Pressing the Make Auto button causes yellow target pitch contour objects (curves for short) to be created from the red input pitch contour data. The yellow curve(s) created by the Make Auto function is a precise representation of the pitch correction that would result from processing the tracked input pitch through the current settings of Auto-Tune 3's Automatic Mode. These include the Automatic Mode's Key and Scale selections, the Edit Scale settings, and the Scale Detune, Retune Speed and Vibrato settings.

Note: If a range of time has been selected by using the Zoom/ Select Tool in the Envelope Graph, the Make Auto function works only in the selected time range.

Another Note: The Automatic Mode Tracking control is not involved the Make Auto function. In Graphical Mode, the input pitch has already been determined, (i.e., the red input pitch contour), hence the Automatic Mode Tracking setting is not needed for the Make Auto computation.

Once you have used the Make Auto function to create a yellow target pitch curve, setting the Graphical Mode Retune Speed to 0 and clicking Correct Pitch will result in exactly the same output as you would have gotten by processing the audio through Automatic Mode. Alternatively, you can adjust the Retune Speed or further edit the yellow curve using any of the Graphical Mode tools to get precisely the effect you want.

If you aren't satisfied with the results of the Make Auto function, simply switch to Automatic Mode, modify any of the settings as desired, and then return to Graphical Mode and click Make Auto again.

> *Note: In addition to its use as a Graphical Mode correction tool, the Make Auto function can also be used to provide an informative visual representation of the results of Automatic Mode settings. If there are times when you'd prefer to use Automatic Mode, but can't quite zero in on the ideal settings, examining the results of various settings with the Make Auto function can give you a visual picture of exactly what's going on. This will often make it readily apparent which Automatic Mode settings need to be changed to give your desired results.*

> *Another Note: One potentially confusing aspect of the Make Auto function is the relationship between the Automatic Mode Retune Speed setting and the Graphical Mode Retune Speed setting. To summarize:*

> • *The Automatic Mode Retune Speed controls how the input audio would be processed in Automatic Mode. Changing this setting will change the shape of the yellow curve that will be created by the Make Auto function.*

> • *The Graphical Mode Retune Speed controls how quickly the pitch of the input audio will be changed to that of the yellow target pitch curve by the Correct Pitch function. As mentioned above, to precisely duplicate the results of Automatic Mode, set the Graphical Mode Retune Speed to 0.*

Tracking
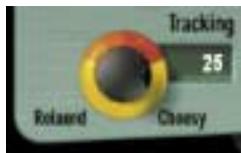
The Graphical Mode Tracking control is similar in function but separate from the Tracking control in Automatic Mode.

In order to accurately identify the pitch of the input, Auto-Tune 3 requires a periodically repeating waveform, characteristic of a voice or solo instrument. The Tracking control determines how much variation is allowed in the incoming waveform for Auto-Tune 3 to still consider it periodic.

If you are working with a well-isolated solo signal (e.g., tracking in a studio or off of a multi-track tape) you can typically set the Tracking control to 25 and forget it.

If, on the other hand, your signal is noisy or not well-isolated (as might be more common in a live performance situation) or you are dealing with a particularly breathy or guttural voice, it may be necessary to allow more signal variation (higher Tracking numbers). However, under these circumstances tracking is not guaranteed and a too "relaxed" setting may introduce distortion and popping.

The default Tracking value is 25. Double-clicking the Tracking knob will reset it to that value.

Note: Be cautious about changing the Tracking value after performing the Track Pitch function. Auto-Tune 3 uses the Tracking setting during both the Track Pitch and the Correct Pitch functions. Changing the Tracking setting after Tracking Pitch, but before Pitch Correction, may result in unpredictable pitch modifications or strange (though possibly interesting) artifacts.

Retune Speed

The Retune setting is used only during the Correct Pitch process. It's similar in function but separate from the Retune control in Automatic Mode.

In Graphical Mode, the target pitch is not the scale tone nearest to the input, but rather the yellow target pitch curve. The Retune Speed control allows you to specify how quickly Auto-Tune 3 will change the pitch of the input to that of the target pitch curve. A value of zero will cause the output pitch to precisely track the target pitch curve. Depending on the target pitch curve, this may or may not provide the desired results. Slower values will have the effect of "smoothing out" the target pitch curve. As ever, you should let your ears be your guide to selecting the proper value for a particular performance.

The default Retune Speed is 20. Double-clicking the Retune Speed knob will reset it to that value.

Note: Slower Retune Speed values may also allow you to use simple horizontal line segments to define the target pitches while still preserving the natural pitch gestures of the original performance. See Chapter 4 for details.

The Use Cursors Button

Normally, Auto-Tune 3 displays different cursor shapes in the Pitch Graph Display to help you grab and drag objects (e.g., the object cursor, the anchor point cursor, etc.). However, some host applications mistakenly think that they own the cursor when it is in a plug-in window. This may cause the cursor to flash as the host and Auto-Tune 3 alternately try to set the cursor shape. If this annoys you, click the Use Cursors button. It will stop the flashing, but you will no longer see Auto-Tune 3's custom cursors.

Note: Some plug-in formats never present this problem. In those versions of Auto-Tune 3, the Use Cursors button does not appear.

Chapter 4: Auto-Tune 3 Tutorial

This chapter introduces you to how Auto-Tune 3 works by guiding you through a a number of brief tutorials.

The Auto-Tune 3 installer installs a number of tutorial files which, depending on your plug-in format and host application, may be provided as separate audio files or together in a project file. (We will assume that you are familiar with loading audio files into your host application.)

Tutorial 1: Automatic Mode

This tutorial will guide you through the basic Automatic Mode functions using the file "A2-A3-A2 sweep." This is a simple synthesized waveform sweeping slowly from A2 up to A3 and back to A2. While it is unlikely that you'd ever need to process such an input with Auto-Tune 3, it provides a very clear example of what each of the main Auto-Tune 3 controls do.

Begin the tutorial by doing the following:

1. Load or import "A2-A3-A2 sweep" into a track of your host program. Play the track so that you are familiar with the original audio.

2. Set up Auto-Tune 3 to be an insert effect on that track.

3. Set Auto-Tune 3 to Automatic Mode.

4. Set the Key to "A" and the Scale to "Major."

5. Set the Retune Speed to zero.

6. Set "A2-A3-A2 sweep" to loop continuously and put your host program into Play mode.

What you will hear is an A major scale. This is because Auto-Tune 3 is continuously comparing the input pitch to the notes of the A major scale and instantaneously correcting the output pitch to the nearest of the scale tones.

Now do the following:

1. In the Edit Scale Display, click the Remove buttons next to the notes B, D, F# and G#.

2. Play "A2-A3-A2 sweep" again.

You will now hear an arpegiated A Major triad because you have removed all the other notes from the scale.

To continue:

1. In the Edit Scale Display, click the Bypass button next to E.

2. Play "A2-A3-A2 sweep" again.

You will now hear the effect of not correcting the E. During the time that Auto-Tune 3 would normally be tuning the input to E, Auto-Tune 3 instead enters bypass mode and passes the input through uncorrected.

To continue:

1. Set the Retune Speed to about 30.

2. Play "A2-A3-A2 sweep" again. Compare the 30 setting to the 0 setting.

3. Try various other Speed settings.

The setting of 0 is fast: Auto-Tune 3 makes instantaneous pitch changes. The setting of 30 is slower. Auto-Tune 3 makes gradual pitch changes. This parameter controls how rapidly the pitch correction is applied to the incoming pitch. The units are milliseconds. A value of zero will cause instantaneous changes from one tone to another and will completely suppress a vibrato (note that related volume changes will remain). Retune values from 10 to 50 are typical for vocals.

To continue:

1. Set the Retune Speed to 0

2. In the Edit Scale Display, click the Remove buttons next to to all the notes except F#.

3. Play "A2-A3-A2 sweep" again. As the sound is playing, move Scale Detune knob.

The output pitch will be locked to F#, however, you will hear the output pitch change with the Detune slider movement. This is because the Detune knob is changing the pitch standard of the scale.

Finally:

1. Select "sine wave" from the Vibrato Type pop-up.

2. Play "A2-A3-A2 sweep" again.

3. Experiment with the vibrato controls to hear their effects.

Tutorial 2: Graphical Mode

This tutorial will introduce you to the basic Graphical Mode functions, again using the "A2-A3-A2 sweep" file from Tutorial 1.

Begin the tutorial by doing the following:

1. Load or import "A2-A3-A2 sweep" into a track of your host program. Play the track so that you are familiar with the original audio.

2. Set up Auto-Tune 3 to be an insert effect on that track.

3. Set Auto-Tune 3 to Automatic Mode.

4. Set the Key to "A" and the Scale to "Major."

5. Set Auto-Tune 3 to Graphical Mode.

6. Click the Track Pitch button.

7. Play the sweep signal through Auto-Tune 3.

8. Stop playback (depending on your host application, you may also have to click the Track Pitch button again to stop the tracking function).

A red curve will appear in the Pitch Graph. This is the pitch contour of the sweep signal.

To Continue:

1. Select the Zoom/Select tool and drag out a box on the Pitch Graph that encloses the red curve. The result will be something like the following:
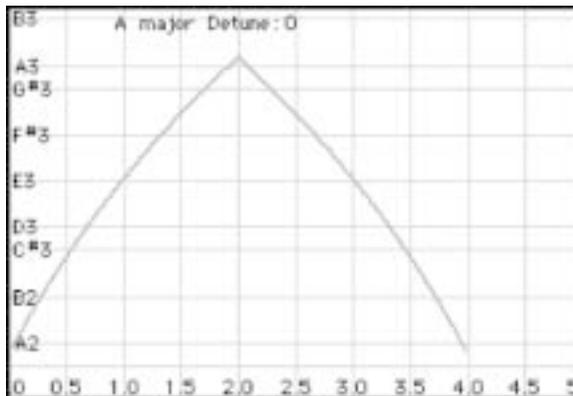
2. Select the Line tool and enter a line similar to that below. By clicking multiple anchor points on the Pitch Graph, line segments joining the points will be drawn.
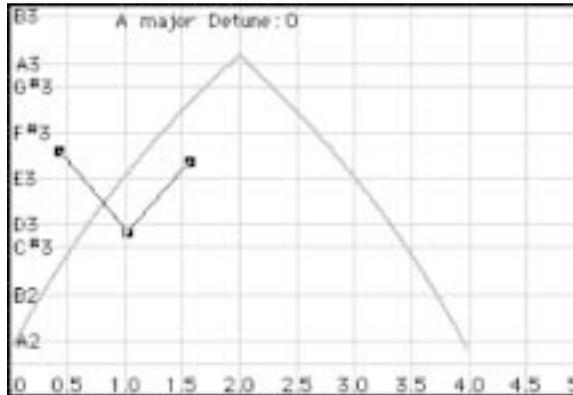
When done, double-click the last point or press <esc> on the keyboard.

To erase the last point entered, press <delete> on the keyboard (you can press <delete> repeatedly to erase back to the first anchor point).

3. Set the Retune Speed to 0. Click the Correct Pitch button and play back the sound to hear the effect.

4. Select the Curve tool and create a curve similar to the one shown below. Click and hold the mouse button and drag to draw the curve. When done, release the mouse button.
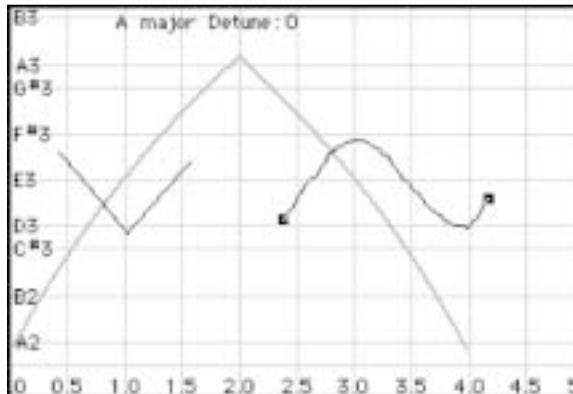
5. Press Correct Pitch and play back the sound to hear the effect.

6. Vary the Retune Speed between 0 and 50 and note the effect.

Now that we have some yellow lines and curves on the Pitch Graph Display, this would be a good time to become familiar with the functions of the Pointer Tool. (Refer back to Chapter 3 for a detailed description of the Pointer Tool's behavior.)

7. Select the Pointer Tool.

8. Drag the Pointer Tool across the Pitch Graph to select objects.

9. Move the cursor over curves and anchor points. Practice selecting entire curves and individual anchor points.

10. Use the Pointer Tool to drag selected curves and individual anchor points. Option/Alt-drag to constrain movement to vertical only.

11. Press Correct Pitch and play back the file to hear the effect of each movement.

12. Select one or more objects and play with the Edit Buttons (Undo, Cut, Copy, Paste, Select All).

This would also be a good time to see if the Edit Button keyboard equivalents:

Command/Control-Z	undo/redo
Command/Control-X	cut
Command/Control-C	copy
Command/Control-V	paste
Command/Control-A	select all

work in your host application.

Tutorial 3: Precision

This lesson is actually more of a demonstration to show the extraordinary precision with which Auto-Tune 3 can track and correct intonation problems. If this doesn't sound interesting, feel free to proceed to Lesson 4 below.

(By this time, we'll assume you're comfortable loading files and calling up Auto-Tune 3.)

1. Arrange the files "C2 Ahhh v3" and "C2 Ohhh v1" so that they are on separate tracks and can be played simultaneously.

2. Assign a separate instance of Auto-Tune 3 to each of the two tracks and select Automatic Mode for each of them.

3. In each Auto-Tune 3, set the Retune slider to 0.

4. In each Auto-Tune 3, set the Key pop-up to B-flat.

5. Do whatever your host application requires to bypass both instances of Auto-Tune 3.

6. Play back the files so you can hear them together without processing.

Believe it or not, these vocal samples from a sample CD are supposed to be the same pitch. Yikes!

7. Now enable Auto-Tune 3 on each of the tracks and play the files again.

If you've done everything right, you will hear the samples so well in tune that they sound like one voice.

Tutorial 4: The Make Curve Function

This tutorial will introduce you to the Make Curve function. The Make Curve function gives you by far the most precise control over pitch accuracy and inflection.

1. Setup to process the file "Crowd All" through Auto-Tune 3.

2. Select Graphical Mode.

3. Press the Track Pitch button.

4. Play the "Crowd All" file.

5. Select the Zoom/Select tool and drag out a box on the Pitch Graph that encloses the red curve for the "-gether" part of the last word, "to-gether." You will see something like the following:
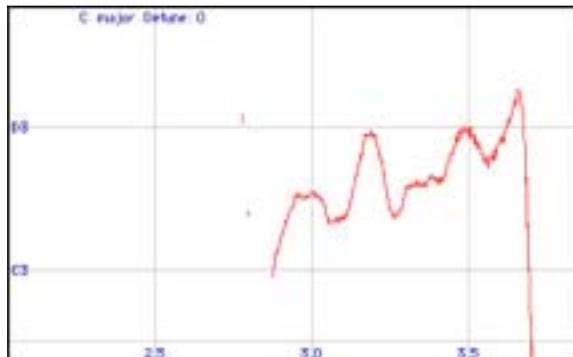
6. Use the Zoom/Select tool to drag a selection of "-gether" in the Envelope Graph. The result will be something like the following:
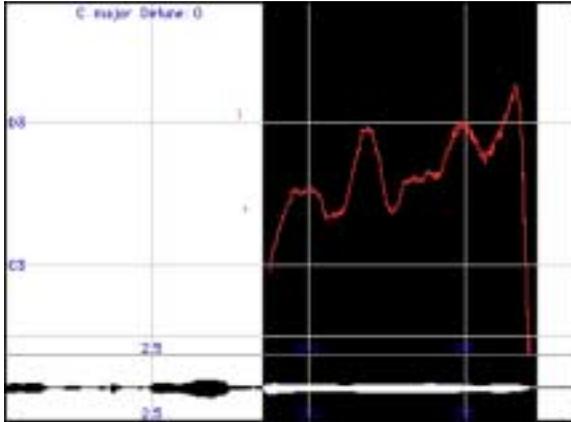
7. Click the Make Curve button. Auto-Tune 3 will compute a new yellow curve object from the existing pitch data. (The new curve may be difficult to see at first because it will exactly overlay the red curve.) Click the Zoom/Select tool on the background of the Envelope Graph to cancel the area selection.

8. Both anchor points of the new curve will be selected. Select the Pointer Tool and click precisely on the left end of the curve to select only the left anchor point (you'll know you're over the anchor point when the cursor changes to the four-pointed arrow cursor). Drag this straight up, stretching the curve so it is centered around the D3 graph line. (If you press Option/Alt on your keyboard before clicking the anchor point, your movement will be constrained to the vertical, assuring that you maintain the time relationship of the curve.)

9. Move the Pointer Tool over the body of the yellow curve so that the cursor changes to the horizontal bar. Press and hold Option/Alt on your keyboard (to constrain movement to the vertical) and click and drag the curve straight down so it is centered on the C3 graph line. The Pitch Graph should now appear as follows:
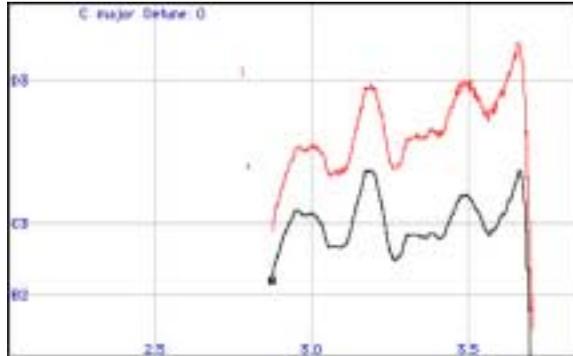
10. Set the Retune Speed to 0 and play back the sound. Note that the errant note is now in tune.

To continue, here is an alternative approach to the same pitch problem using the Line Tool.

1. Click the Select All button and then the Cut button to delete the yellow curve created above.

2. Use the Line Tool to draw a horizontal line as shown below (press the Option/Alt key to constrain the line to horizontal):
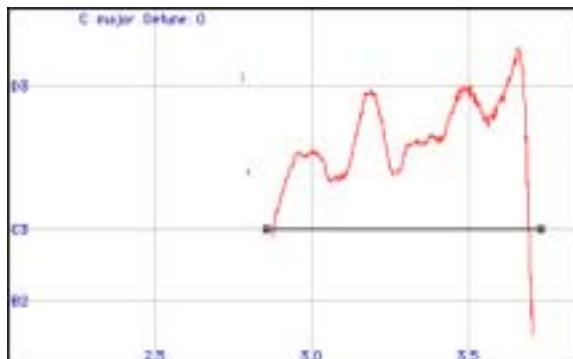
3. Set the Retune Speed to 20 and play back the sound. Experiment with other Retune Speeds to hear their effects.

Vibratos and other pitch gestures typically occur with related loudness gestures. Specifically, with vibratos, some vocalists produce mostly pitch variations and little loudness variations while others produce small pitch variations and a lot of loudness variations (the latter is often called tremolo). Nonetheless, almost all voices seem to produce a combination of both pitch and related loudness variations. Therefore, trying to take an existing vibrato and change it (say speed it up) often sounds unnatural

because the new pitch variation does not correspond to the original (and still present) loudness variation.

These considerations are also important when correcting pitch. It's rarely effective to draw in a new pitch gesture at the desired pitch, even though that gesture may have worked well in another performance.

As this tutorial has demonstrated, the following two techniques are the most commonly successful approaches to Graphical Mode pitch correction:

• The first technique uses the Make Curve button to create a curve of the existing pitch, allowing you to drag that curve up or down, or stretch it by dragging one end vertically. The Retune slider can then be set very fast (0 to 5). This will force a precise re-tuning, but will sound extremely natural since the target pitch curve will precisely synchronize with the original loudness gestures of the voice.

• The second technique is to draw a flat line segment across the duration of a tone at the desired pitch and then set the Retune Speed in the range of 20 to 40. This has the effect of gently moving the input pitch towards the desired pitch. The slower values of 20 to 40 will let through a vibrato but still draw the overall pitch closer to being in tune. The average pitch will eventually settle to the given line and the pitch gestures will occur both sharper and flatter relative to that line. The settling time is about twice the Retune Speed setting (in milliseconds). 20 to 40 will let through about one-half of a typical vibrato. Slower settings will let through more vibrato but will cause the new pitch to be reached more slowly.

Tutorial 5: The Make Auto Function

The Make Auto function allows you to display and edit the pitch corrections that would result from specific Automatic Mode settings.

1. Setup to process the file "Crowd All" through Auto-Tune 3.

2. Select Automatic Mode and set the Key and Scale to C Major and the Retune Speed to the default of 20.

3. Select Graphical Mode.

4. Press the Track Pitch button.

5. Play the "Crowd All" file.

6. Select the Zoom/Select tool and drag out a box on the Pitch Graph that encloses the red curve for the words "crowd all rushed." You will see something like the following:
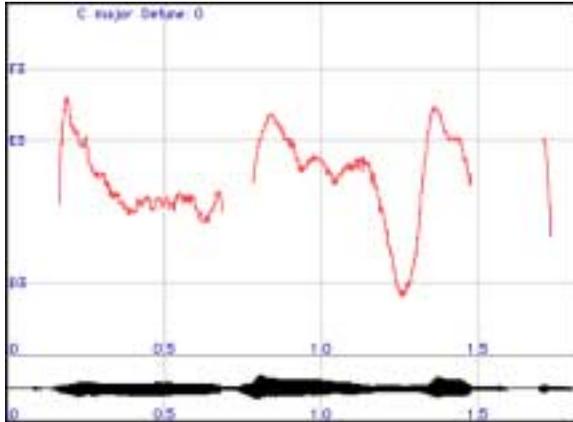
7. Use the Zoom/Select Tool to drag a selection in the Envelope Graph as shown:
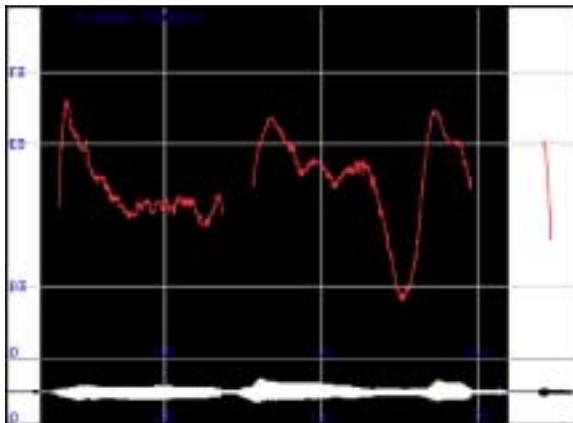
8. Click the Make Auto button. Auto-Tune 3 will compute a new yellow curve object from the existing pitch data:

PITCH DRAWN TO
NEIGHBORING
TONE
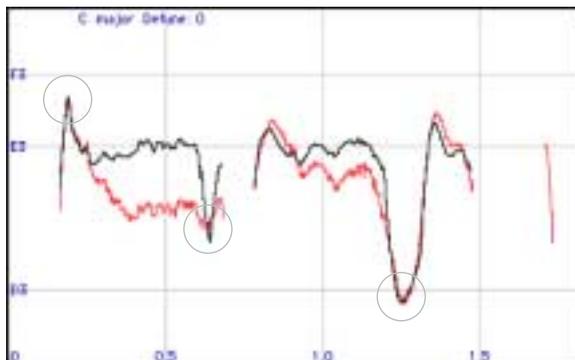
Assuming that this entire phrase should be centered around E3, there are several problem spots, indicated above, where the pitch is being incorrectly adjusted towards neighboring tones.

9. To hear the pitch corrections that would be produced in Automatic Mode, set the Graphical Mode Retune Slider to 0, (fast) and play back the file.

10. Switch to the Automatic Mode and click the Remove buttons next to C, D and F.

11. Return to the Graphical Mode and use the Zoom/Select tool to drag out a selection in the Envelope Graph, as in Step 7.

12. Press the Make Auto button. Auto-Tune 3 will compute a new yellow curve from the existing pitch data:
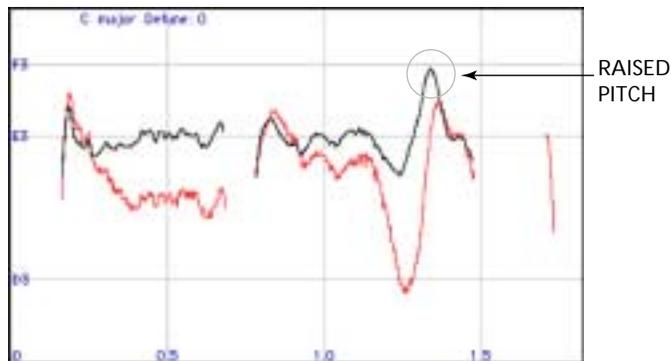
RAISED PITCH

Note how the pitch errors from the previous curve have been removed. Also, note the "raised pitch" indicated above. This occurs because the Automatic Mode Retune slider value of 20 is slow compared to the rapidly increasing pitch that is occurring at that point in time. But even with the raised pitch, the average output pitch is centered on E3 and the phrase sounds in tune.

Chapter 5:
Creative Applications for Auto-Tune 3

Auto-Tune 3 works on vocals so well you may think that's all it can do. Actually, lots of instruments can use it to great advantage. Fretless bass, electric violin, trombone, even the theremin, all feature continuous pitch potential, unconstrained by frets or keys. Here are some other ideas for using Auto-Tune 3:

- **Produce instant double tracking in one take!** Record onto two tracks, processing only one of the tracks through Auto-Tune 3. If you're going for a tight double track, set Retune Speed rather fast and Detune Auto-Tune 3 slightly. Increase both of these parameters to broaden the doubled effect. You can also use some Vibrato to make a more dynamic effect (small depth and rate values are best, with medium delay). Of course, you can also decide to record a single virgin track, and bounce that to another, processing through Auto-Tune 3. This way you can dial in the effect while auditioning the mix.

- Recording with two mics (as above) while improvising can also **produce heterophonic effects** (the effect of two players and instruments playing the 'same' melody, which actually varies with some different pitch material). The more constrained your scale is in Auto-Tune 3, the more variation there will be between the two performances.

- **To set up a drone or ambient aura** behind a melodic performance, try sending some of the signal to Auto-Tune 3 with an extremely constrained scale (for example, in the key of C: C, F, G, A#) and then on to a lush, long reverb. The effect produced will be a steady backdrop of chanting tones behind the main melodic material.

- Don't be afraid to **use just as little of Auto-Tune 3 as you need.** It's quite possible that a performer has really quite good intonation, but fails consistently on one or two notes. In this case, use Auto-Tune 3's individual Bypass function (in the Edit Scale display) to bypass all the notes except the one(s) which need the retuning. This way, Auto-Tune 3 is working in a completely transparent mode, and only when needed.

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