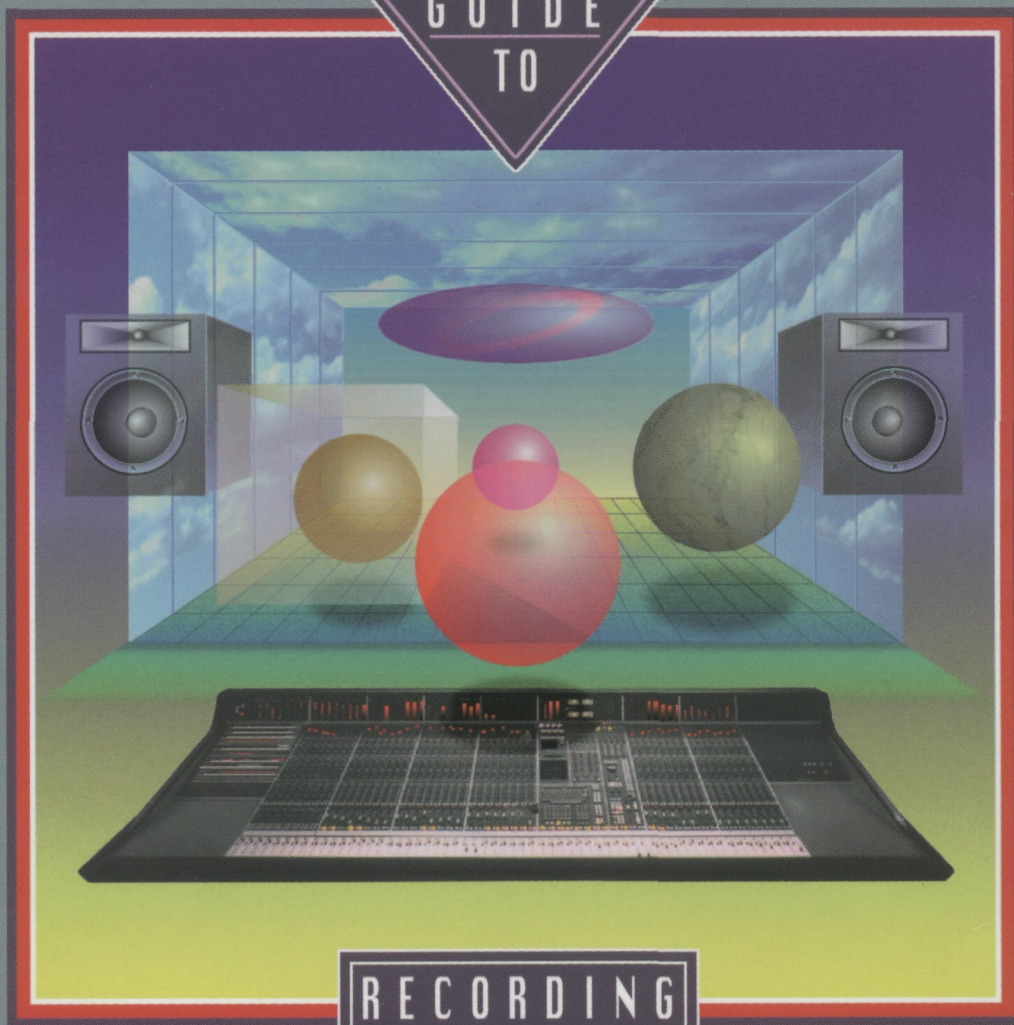


THE ART OF MIXING

A

VISUAL
GUIDE
TO

MIX
PRO
AUDIO
SERIES



RECORDING
ENGINEERING
AND
PRODUCTION

TECHNICAL EDIT BY
George Petersen

by

DAVID GIBSON

THE ART OF MIXING

A Visual Guide to Recording,
Engineering, and Production

by **David Gibson**

*Technical edit by
George Petersen*



236 Georgia Street, Suite 100
Vallejo, CA 94590

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DEDICATION

This book is dedicated to all those who just want to
know how to make it sound better.

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Preface

This book has been designed to answer the elusive questions, "What makes a great mix?" and "How do you go about creating a great mix?" Although most people know what they like, they often don't know how to achieve what they want when they're in the studio.

To answer these questions, I explain and use visual representations of sounds as a tool for understanding the whole world of dynamics that an engineer can create with the equipment in the studio.

It's easy to learn the function of each piece of equipment in the studio; you can read user's manuals or the tons of good books available that explain the equipment. The difficulty lies in knowing how to *use* the equipment and learning what combinations of equipment are used to create great sounding mixes. Once you know what the knobs do, which way do you turn them?

In other fields of art, there is no shortage of books that attempt to explain the whole world of aesthetics. From music to finger painting, scholars have tried answering the question, "What makes great art?" But recording is a relatively new field, and very little has been written about the aesthetics of mixing.

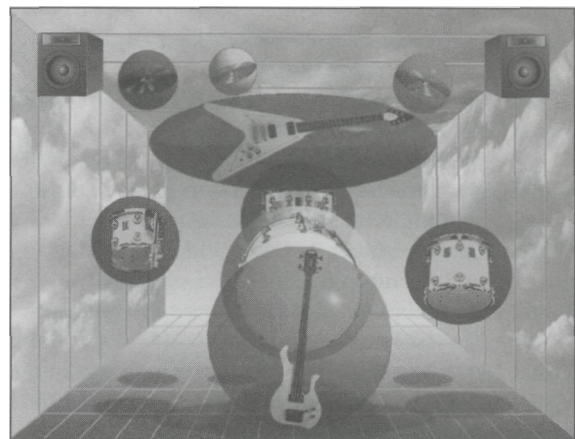
This is one of the first books that attempts to explain the aesthetic side of creating a great mix. This is no simple feat, as there are many musical styles based on any number of different instruments, all of which are recorded differently. Each style of music has its own world of values that are changing constantly. The number of variations is endless. Perhaps no one has attacked this complex subject of mixing due to the lack of a framework to analyze the process. Without a framework, it is difficult to explain what is going on and hard to remember all the different things that can be done in a mix. In music, music theory provides this framework. This book introduces a framework for understanding everything that engineers do in mixing.

The primary goal of this book is to give you a perspective on how the equipment works together to create every mix in the world. Once you have a perspective on what can be done, you can be truly creative on your own.

It has been said that there are no rules when it

comes to recording. After all, the perfect mix to one person may be the worst mix to another. However, most bands want mixes that sound like their style of music, and for some styles of music—such as big band, acoustic jazz, and even certain types of rock 'n' roll—the rules are actually quite strict.

In the recording industry, there are certain high-level values that are commonly held. We know this because there are certain professional engineers who can create a great mix every time they sit in front of a console. These engineers command exorbitant fees because they are capable of coming up with something that most people perceive as great, every time. So what is it they are doing? It isn't magic. They are only doing some very specific things. If you could simply understand and learn what they do, you could start down the path to becoming a great engineer. Getting there might be a long process—but once you know where you're going, you'll get there faster! And once you understand what the successful engineers are doing, you can create your own style. This book will help you develop and recognize your own values through visuals, because visuals help us to remember. After all, *a picture is worth a thousand sounds*.



Visual 1. Sound Imaging (see color Visual 1C)

This book will help you discover the high-level values that major engineers have and help you do the most difficult job of all: make art out of technology. The recording engineer makes the relationship

between the equipment dynamics and the musical dynamics work. This is the art of mixing.



Visual 2. Structuring Mix (see color Visual 2C)

Acknowledgments

There is a wide range of people that helped me along the way to this point where I am writing this book. The truth is that in this book I have simply gathered together a large amount of information from a huge number of contacts and sources—and then there are those divine inspirations, and who knows where they come from?

First, I probably would have never gotten into this business without the suggestion of my brother Bill. He was the first to say, "Ever thought about being a recording engineer?" Then, there were my various music instructors and all of my recording instructors, including Bob Beede and John Barsotti. There was also Herbert Zettl, whose book on video aesthetics helped to inspire the structure of this book. Craig Gower was also another inspiring force in learning about working with music. And then there was Chunky Venable who was kind enough to have the faith in me to run his studio even though I was so green.

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And finally, I would be amiss if I didn't thank all of my students from over the years for the innumerable suggestions and inspirations that they have brought to me. They are the real reason for this book. May this book begin an ongoing dialogue about what makes a great mix, to light the way for students in the future, so none of us are "all mixed up" ever again.

Introduction

This book is designed to explain how to create great mixes. However, the mix is only one aspect of what makes a great recording. Other factors also contribute to what is perceived as a quality recording and mix.

Chapter 1

"All Aspects of a Recorded Piece of Music" begins by covering the eleven aspects of a great recording: concept, melody, rhythm, harmony, lyrics, arrangement, instrumentation, song structure, performance, quality of the equipment/recording, and the mix.

Each of these aspects must be at least of basically good quality. If even one of them isn't, the recording will suffer. The mix is only one of the eleven aspects, but it is one of the most powerful because it can hide some of the weaker aspects or highlight the magic in the stronger aspects.

In the first chapter, we explore what the recording engineer can do to help refine each of these components. The rest of the book continues with what can be done with only the aspect of the mix.

Chapter 2

"Visual Representations of 'Imaging'" introduces the visual framework for representing "imaging," the apparent placement of sounds between the speakers.

Section A shows the difference between the perception of physical sound waves coming out of the speakers and the imagined perception of imaging. This is important because the two are sometimes confused, and the visuals represent only imaging, not physical sound waves.

Section B introduces volume, frequency, and panning visually and then defines the boundaries of imaging (the limited space where a mix occurs between the speakers).

Section C explains how and why specific visuals were chosen for each sound and effect in the studio.

Chapter 3

"Guides to a Great Mix" explains all of the reasons for creating one style of mix or another.

Section A explains how the style of music affects the way a song is mixed.

Section B describes how the song and all of its details dictate the way a song is mixed. It goes through every detail within a song and explains how each aspect might affect the placement of volume, EQ, panning, and effects.

Section C discusses how the people involved—the engineer, the band, the producer, and the mass audience—contribute to the way a song is mixed. It explains the most difficult job of all for the engineer: to take the values, suggestions, and ideas of everyone involved in a project; decide which ones are best for the project; then diplomatically work with everyone to bring about the best recording and mix possible. It also covers the extraordinary human dynamics that go into balancing the values of everyone involved.

Chapter 4

"Functions of Studio Equipment and Visual Representations of All Parameters" utilizes the images outlined in Chapter 2 to describe the function of each piece of studio equipment in the mix. It briefly, but technically, explains what each piece of equipment does. (As you will see, the visuals make the details of complex functions easily understandable.)

Section A explains the basic functions of faders, compressor/limiters, and noise gates and how to set them for different instruments in various styles of music and songs.

Section B explains the differences between various types of equalizers—graphics, parametrics, and rolloffs—and describes all the frequency ranges found in sounds.

Besides the individual frequencies, it is also important to understand how different frequencies work together to create sounds, or timbres. This harmonic structure is the basic building block of sound. It is important because when you use an equalizer, you are changing the harmonic's volume in that sound.

Most importantly, this section gives you a step-by-step process for using an equalizer to make something sound good—or just the way you want it to sound!

Section C covers the basics of left to right placement in a mix.

Section D describes each of the common functions and parameters of delays, flangers, choruses, phase shifters, reverbs, and harmony processors.

At this point, all of the details of the equipment will have been covered visually. Now the visual representations will be utilized to show how all of the equipment is used together to create different styles of mixes.

Chapter 5

"Traditions and Common 'Musical Dynamics' Created With Studio Equipment" first discusses the different dynamics found in music and the incredibly wide range of possible dynamics that different people perceive in music, including feelings and emotions; thought forms; psychological, physiological, and physical reactions; visual imagery; cultural and even spiritual connotations.

The mixing board and the rest of the equipment in the studio can also create musical and emotional dynamics. Therefore, the engineer must not only know what all of the equipment does but he or she must also become familiar with the dynamic complexities that can be created with the equipment in a mix.

This chapter embarks on an in-depth survey of how each piece of equipment in the studio creates musical and emotional dynamics based on the style of music, the song and its details, and what the people want. The chapter begins by defining the three levels of dynamics that can be created with each of the tools in the control room—volume, EQ, panning, and effects. Then it describes each tool in the control room, explaining what it does based on three levels of dynamics for volume, equalization, panning, and time-based effects: individual placement and relative settings, patterns of placement, and changing settings.

Once you see all that can be done with the equipment in the studio, a whole new world will open up for you

Chapter 6

"Styles of Mixes" is an exploration of the dynamics that can be created with all of the equipment together. It explains how high-level dynamics can be created using combinations of a variety of multiple settings.

Once you have created a context or a particular style of mix, the most intense dynamic that can be created is to completely change all of the settings on all of the equipment at once to create a completely different type of mix or context. There is nothing so intense and powerful when it comes to engineering. This chapter discusses that technique.

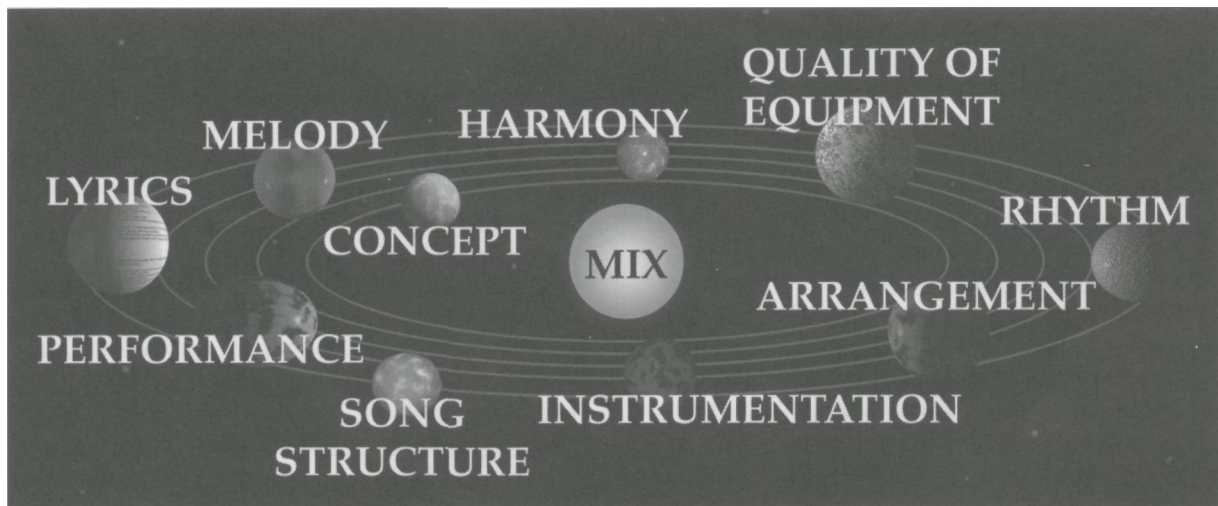
Chapter 7

"The Relationship of Musical Dynamics Created by Equipment to the Musical Dynamics Found in Music and Songs" is designed to set you on your way in this lifelong exploration of all of the relationships between the dynamics you can create in a mix and the dynamics that are found in music. After all, relationships are what it's all about.

At this point, you will have a framework for understanding and remembering all that can be done in a mix. You can then use this framework to understand exactly what engineers are doing in the mix of every song you hear. Ask yourself, "Do I like what they are doing?" And after a while, you will develop your own style and you can confidently do whatever you want.

CHAPTER 1

All Aspects of a Recorded Piece of Music



Visual 3. 11 Aspects of Recorded Piece of Music (see color Visual 3C)

When I did my first album, the mix sounded great but the band and the song weren't that hot. Everyone who listened to it agreed that it wasn't that great—they couldn't separate the mix from the music. Most people don't differentiate between the individual parts that make up a recorded piece of music.

An engineer, however, will often make comments about aspects of a recorded piece of music other than the recording or the mix. If there is a producer, he or she is actually responsible for the details, but most often there isn't a producer, so the engineer takes on that role. Even when there is a producer, he or she will rely heavily on the values and critiques of the engineer. In fact, groups often go to major studios solely because of the production assistance they get from professional recording engineers. This chapter covers the aspects that go into creating a

quality recorded piece of music.

All of these eleven aspects contribute to what is perceived as a quality recording and mix. Every aspect of a song should meet at least the minimum requirements of perfection. If any one of them is lacking, it will show through as the weak link in the whole recording. Even though each aspect is only a small part of the overall song, any single flawed aspect could destroy the whole song. If all of the eleven aspects are incredible or perfect, the chances of a song becoming a hit are probably a million to one. If any one of these components is less than perfect, the chances for success go down exponentially. Therefore, it is necessary to critique and refine each of these aspects whenever possible. You wouldn't think the job of an engineer would include working on things like the concept of the song, the melody,

rhythm, and harmony; after all, aren't those things the responsibility of the band? Besides, if the music or band is bad, it isn't the engineer's fault; and making comments in these sensitive areas could be hazardous to your health and/or job security. However, the big secret is that professional engineers do more than just getting sounds on tape and mixing them down. Professional engineers help refine all these aspects whenever possible. This is a secret for obvious reasons: If you call engineers "producers," they get a lot more money. In fact, the engineers who are really good at it often become producers.

There are plenty of great books and no shortage of classes on how to refine these aspects. Therefore, we'll briefly examine each of these components in order to put "the mix" into perspective. The rest of this book is about the mix.

Quality is defined in different ways by different people, so it can take awhile to learn all the ways in which songs can be refined. But if you pay attention, you will develop your own values. If you ask yourself every step of the way, "Do I like this or not?" you will naturally develop your own perspective on what you like and what is "good." When it comes to values, the only one that's really bad is "no values at all." If you don't have an opinion, you're in the wrong business. If you don't know what you like, just listen.

The definition of what constitutes "good" and "quality" is extremely subjective and ever changing for each of the eleven aspects. People have very strong opinions; therefore, the only way to approach this emotionally charged subject is to list commonly held values and preferences. You can use this list to begin your lifelong study of people's values. It is important to recognize where people's values and preferences lie, so that you know where they are coming from. It makes it easier to work with them, please them, and negotiate with them. With this in mind, let's discuss each of the aspects of a recorded piece of music that can be refined and common suggestions that recording engineers make in each area.

Aspect #1: Concept or Theme

The concept or theme can be defined as the combination of the other ten components. It is also known as "the mood," "the flow," or "the aura," depending on your perspective. It is usually defined as the feeling or idea that is conveyed most consistently and strongly in the most number of aspects of a recorded piece of music.

Songs vary in the consistency or cohesiveness of the concept. In some songs, the concept is quite strong and cohesive, while in other songs it might be non-existent (although the concept could be "no

concept"). As an engineer, you might suggest ideas that help make the concept stronger and more cohesive. Such a comment might be made when something in a song just doesn't seem to fit. For example, you might point out that a screaming heavy metal guitar just doesn't fit the mood of a love song, or a spacey flange effect might not fit a straightforward rock 'n' roll song. Perhaps someone wants to use a sound or effect that they heard in another song, but it isn't appropriate for the current song. It is the engineer's responsibility to point out these inconsistencies (with kid gloves, of course).

Discovering how each aspect relates to and contributes to the cohesiveness of the whole song can often reveal inconsistencies and deficiencies that might need to be fine tuned. Even more importantly, such a detailed analysis can sometimes provide inspiration and lead to the creation of new ideas.

Positive values for the concept or theme can be its existence, cohesiveness, color, or complexity. Negative values can be that it is rote, uncreative, or predictable.

Aspect #2: Melody

Commenting on someone's melody line can be especially dangerous. Statements such as, "The melody sucks," does nothing for the creative process, much less your relationship with the band. The truth is that there isn't too much that you can say about a melody line. You might point out that it is too busy or too simple, but in both cases it might just be what the band really wants.

In order to avoid copyright problems, you would want to comment if you find that the melody line is exactly the same as another song. As an engineer, you would probably point out a bad note in a melody, but it might turn out to be intentional. You might also come across a case where the band is improvising around the melody in the choruses of a song (especially in jazz). You could mention that it might be a good idea for them to go ahead and sing or play the melody line straight in the first chorus in order to establish the melody.

Positive values for a melody can be that it is catchy, hummable, beautiful, or interesting. Negative values can be that it is busy, banal, simplistic, annoying, or chaotic.

Aspect #3: Rhythm

Those of you who know a lot about the complexities of rhythms, might make some suggestions if you feel it is appropriate. There are entire worlds of rhythm that are taught in music theory classes. However, even if you know nothing about rhythms, there is still one thing you could critique: Is the rhythm too busy or

too simple? Anyone can tell if the rhythm is boring or too complex. If you are falling asleep, it could probably use some spicing up. If you can't keep up, the rhythm might need to be weeded out a bit.

When one rhythm part is not working with another, you might want to inform the band. Perhaps the guitar part is stepping on the keyboard part. If so, say something. In fact, if any part is bugging you, you might just quack (then duck).

It is also a good idea to check out the variation in rhythm parts from section to section in the song. For example, you might suggest that the drum pattern be changed a bit for the lead break or bridge. A change in the guitar part might be appropriate for the choruses. Perhaps the way that the rhythm parts change from section to section doesn't work for you or is distracting. If so, you might say, "Hey, is that really the way you want it?"

You might comment on the tempo of the song if it seems to be Russian or dragon (hee, hee). Often listening to the vocals can be a good clue as to whether the tempo is right.

Positive values for rhythm can be that it is too intricate or too simple. Negative values can be that it is too simple, too busy, has the wrong tempo, or is disjointed.

Aspect #4: Harmony

First, if you can arrange the harmony parts for the band, they will normally think you are God—that is, if they can sing them. Even if you don't know anything about chord structures, inversions, or voicing, most people can tell if it just doesn't sound right somehow. If so, squawk.

Besides critiquing the actual notes in the harmony parts, you can also make suggestions about the number of parts and their ultimate placement in the mix. A band may not be aware of all the different ways that background vocals can be recorded.

You could record a three-part harmony on one microphone and place them in the left speaker in the mix, then record the same three parts on another track and place them in the right speaker, creating a full stereo spread of harmonies. You could also record the three parts with three separate mics and place them left, center, and right between the speakers; then record the same three parts again and place them so that you have two parts of each left, center, and right. You could also record a three-part harmony ten times on ten different tracks so that you have thirty vocals. Then "ping-pong" (bounce) the thirty parts down to two open tracks. Once you have mixed the thirty tracks down to only two tracks, you can then erase the original ten tracks and reuse them. You end up with thirty vocals on two tracks in full

stereo for that Mormon Tabernacle Choir effect.

Many bands don't realize all the possibilities for recording background vocals, so it is the responsibility of the engineer to suggest these possibilities when they might be appropriate. I will commonly have the band at least double the background vocals (record them twice).

Positive values for harmony could include it having multiple parts or unique chord structure. Negative values could be that it is too simple, too full, or has an inappropriate chordal arrangement.

Aspect #5: Lyrics

Telling someone that their lyrics are lame is not good for your health. It is amazing how many hit songs have stupid lyrics. Therefore, I recommend that you be especially careful when making comments about someone's lyrics, unless you know the people well.

If you add one word to a song, you then own half of the song by law. As you can imagine, this makes some songwriters quite wary of taking any suggestions. Therefore, because of copyright laws, an engineer should be extremely careful when making suggestions in this area. Instead of coming up with some new lyrics, it is always better to try to get the band to come up with new ideas themselves.

One of the most important things to watch out for is that the lyrics are rhythmically correct. In certain types of music, such as rap, it is critical that the lyrics fit the music rhythmically. If you hear lyrics that have too many or too few syllables, you might say something. Ask the band if they are happy with the way the lyrics work with the music rhythmically. If they're not, try to get them to come up with something else. Going out on a limb to help refine any weak lyrics could mean the difference between a hit or just an overall great song.

Positive values for lyrics can be that they are heartfelt, sincere, thoughtful, rhythmic, poetic, or lyrical. Negative values can be that they are banal, cliched, corny, or nonsensical.

Aspect #6: Arrangement

The term "arrangement" is used here to refer to the density of the arrangement, the number of sounds in the song at any single moment, including how many sounds are in each frequency range.

The main aspects to evaluate in an arrangement are the sparsity or density. If the band is obviously trying to create as full a mix as possible, you might make some suggestions to help. Adding more sounds or notes is the best way to fill out a mix. Therefore, you might suggest doubletracking (recording the same part twice) or even tripletracking. You could recommend doubling a part with a different instrument or

even suggest that someone play a busier part. You can also mention that adding time-based effects, such as delays, flanging, or reverb, will help to fill out the arrangement. And recording a part in stereo with multiple microphones will add to the fullness of the song.

However, a more common problem with arrangements is that they are too full and need weeding out. There are some bands that would record 48 tracks if available, just because they are there and they can! Even worse, when it comes to the mix, they want all 48 tracks in the mix because they have become attached to their parts. After all, they spent so much time recording them. Even if there isn't enough room between the speakers for all of the sounds, they want it all in there because they did them.

It often becomes your duty to try to weed out the arrangement, for clarity's sake. An engineer will often suggest turning off (muting) certain tracks in particular sections of the song. Dropping out parts like this can make certain sections of the song seem more personal and will contribute to the overall clarity.

Bands often don't think about dropping out sounds from the mix because they are used to playing live onstage. It might never occur to them to actually stop playing in certain parts of the song: "What do you mean stop playing?!" Often, simply demonstrating what it would sound like will convince the band. It is especially common when mixing hip hop or techno to turn various tracks on and off throughout the mix.

On a more detailed level, the engineer might point out when too much is going on in a specific frequency range. You might suggest playing a part at a different octave or in a different inversion.

Positive values for an arrangement could be that it is sparse, full, builds and breaks down, or changes in interesting ways. Negative values could be that it is too busy or full, has too many instruments in a particular frequency range, or is too thin.

Aspect #7: Instrumentation

As the engineer, you're responsible for making sure that the sound of each instrument is good, even though it is the band who has chosen the instruments. If there is something wrong with an instrument sound, you can only do so much to fix it in the mix, no matter how much you process or effect it. Therefore, it is important to recognize bad sounds in the first place, so you can replace them. If you can't replace them, point them out so that the band realizes the instrument sound was bad, not the mix.

For example, if you have a drum kit that doesn't sound so great, see if you can rent another set. In addition, make sure all the heads are new. Let the band know that there is nothing in the control room

that can fix a drum head that's held on with duct tape. Also make sure that there is nothing wrong with the guitar sounds. Each guitar should be set up so that the intonation is right. There is no reason for a guitar player to use the one guitar they have for the entire album. Beg, borrow, or steal a selection of guitars for the project. The album will normally sound much better with a variety of guitar textures.

Make sure all the amps sound good. Again, there is no reason for you to have only one amp sound on an album. It is especially effective to use a "Y" cable, so one guitar can feed two different amps. Recording the two amps on two different tracks gives you a variety of sound combinations, creating a totally unique sound.

You should also become familiar with all of the sounds within each synthesizer in the studio you are working in, so that the band won't have to spend two hours going through all 5000 presets. You can easily direct them to the banks with the types of sounds they are looking for. An engineer will commonly suggest unique sounds to incorporate into a song. There is a huge number of totally unique and bizarre sounds that could be used. There is a world of different ethnic percussion instruments available these days. You might even suggest designing a new sound altogether with a synthesizer or computer. You might also think about sampling some unusual natural sounds and using them as instrument sounds. When placed low in the mix, some very unusual sounds can actually fit in quite well, even in the most normal type of song.

The recording engineer is quite commonly the most knowledgeable person in the studio when it comes to being aware of all the types of musical instruments and sounds available. Professional engineers get to know the difference between different brands and types of instruments intimately. Often the engineer is the most qualified person to make suggestions on the appropriateness of a particular instrument for a song. In fact, producers commonly rely on the engineer's expertise when it comes to instrument sounds.

Positive values for instrumentation can be that it is unique, unusual, bizarre, or new. Negative values can be that it's the same old same old.

Aspect #8: Song Structure

The song structure refers to the order and length of the song sections (intro, verse, chorus, lead break, bridge, vamp). As an engineer, you wouldn't normally say very much about the structure of someone's song, unless you knew the songwriter well. However, if the structure somehow bothers you, or if you have an idea to make it better, you might ask the band what they think.

For instance, you might point out that a five-

minute lead break is a bit long, and a record company might not be patient enough to listen to an introduction that is longer than ten seconds. You might suggest that they do two different versions or that you edit the final mix to make a shorter version.

A positive value for song structure can be that it is different from the norm, while a negative value can be that it is too simple or normal.

Aspect #9: Performance

The recording engineer—whether there is a producer on the project or not—is most often responsible for critiquing and refining a performance. There are five main aspects of performance that a recording engineer may be involved in: pitch, timing, technique, dynamics, and greatness (the goosebump factor).

PITCH

Normally, the recording engineer is ultimately responsible for all instruments being in tune and every note of a performance being in pitch.

There are two levels of pitch perception. Perfect pitch is when you can recognize the exact note or frequency of a sound. Some people can tell you the frequency (such as 440Hz) when they hear a note. This skill, although great to possess, is fairly rare.

Relative pitch, the ability to tell if a sound is in tune with previous sounds in a song, is much more common and is extremely important. It is critical for a recording engineer to develop good relative pitch perception. Although some people are born with it, if you are not, it *is* a skill that can be learned. There are some very good computer programs and study courses on tape that teach this skill.

I know from personal experience that just about everyone interested in this business has very good pitch, though they might not be quick at it. The trick is to become skilled at hearing the pitch of every single note in a string of notes at a fast tempo. Ultimately you need to be able to hear the pitch of each note as well as the relative pitch of the beginning, middle, and end of each note. It all comes down to simply concentrating on finer and finer moments. And, of course, this amount of concentration becomes easier with practice.

The hard part is getting to the point where you can remember which note is out of tune in an entire riff. It is great if you can also tell if a note is flat or sharp, but it is not absolutely necessary. It is enough to know simply if a note is out of pitch and which one it is.

TIMING

Another important skill for a recording engineer to master is being able to tell if the timing is stable. Some people are born with perfect timing percep-

tion. However, most of us have to listen closely. Some people pat their leg. Others keep time with one finger in the air. Some just tilt their head in a funny way. Regardless of the technique, it takes serious concentration to hear variations in tempo.

There are certain points when timing typically varies in performances. Drummers commonly speed up when they do a tom roll, so it is critical to listen closely to tom rolls. Also, a band will often speed up at the end of a song as they get rocking.

Some people are fanatics about stable tempo and go out of their way to get tempos to be as stable as possible. Therefore, it is critical to find out if the band's values lie in this area, so that you can give the necessary added attention and focus to the timing. If a band doesn't care, work with them to get them to focus on it more. One interesting technique is to have them play to a click track for awhile. Only if the drummer has practiced with the click track for weeks can he or she actually play with one in a recording session, so take the click track out of their headphones when they are ready to record. They will now be more focused on timing.

Do what you can, but there is only so much you can do before they get irritated. Always try to calculate how far you can push them.

TECHNIQUE

There are specific techniques that musicians must learn for each instrument; these will vary depending on the style of music being played. Any tips or techniques you can offer to a musician can only help. Of course, you can't be expected to know the right thing to say to a musician for each and every instrument; but the more you work in the business, the more tricks you pick up.

For example, there are specific techniques for playing each of the drums in a drum set. The kick drum should be "popped" with the foot. For some styles of music, it is best to really whack the snare drum. For guitar players, there are many little things to watch out for, such as not causing any string buzz or not causing the strings to squeak as you move up and down the neck. All that is necessary is to point out the problems.

There is a wide range of comments that you can make to help singers (as well as a wide range of comments that don't help). Suggestions such as, "Sing out," or "Project more," can be helpful if given at the right moment and with sensitivity. Often it helps to get the singer to focus more on using their diaphragm. Some people will even have a vocal coach come into the studio during the recording session to really help out.

It is especially important to pay close attention

when an experienced producer or professional musician makes a comment or suggestion that works. After awhile, you will learn an entire range of tips and techniques that you can use to help musicians play better.

DYNAMICS

There are two main types of dynamics that you can critique and help refine. First, it is a good idea to keep an eye on simple changes in volume dynamics in a performance. You might find them to be too dynamic when they vary too much. Or you might find them to be too stable in volume, so that it sounds like a synthesizer or drum machine. It is important to make sure that the volume dynamics fluctuate in a way that is musical or appropriate for the song.

The second dynamic to critique is the level of emotional intensity at every moment in the song. Just as with volume dynamics, you might find them to vary too much, be too boring, or be inappropriate. For example, singers occasionally sing out too intensely at the beginning of a song when perhaps they should be saving it for the end of the song. On the other hand, maybe they need to put more emotion and feeling into the performance right up front.

Checking out the performance dynamics at each moment in the song can help you fashion it in exactly the way you want.

GREATNESS

This is the "goosebump" factor. You should never let a performance go ... until it turns you on. There is a wide range of values that people hold. Common values include sincerity, heartfelt feelings, and emotions. Most likely, you are in this business because you know what you like. At the very least, don't let a performance that you don't like go by. If you make sure that every single performance is incredible, at least in your eyes, chances are that the overall performance of the song will be great.

The Limits of Perfection: The problem with perfection is that it has no limits. Normally, once you obtain perfection, you realize how it could be better.

There are a number of factors that contribute to the decision of how much time you spend trying to get a great performance. After all, it is the engineer's responsibility to gauge the amount of time spent on refining a particular performance. Regardless of the circumstances, everyone wants a basic level of quality. However, after obtaining this basic level of perfection, there is only so much you can do to get a perfect performance. This will be dependent on:

Budget

If the band can't afford the time to perfect a performance, there is nothing you can do unless you are rich or own the studio and are extremely generous. If the band is trying to do a ten-song demo for \$100, you just might have to move the session along.

Deadlines

A deadline, such as a meeting with a record company, an appointment to have a project mastered or pressed, or even Christmas (especially when a project is rushed to be ready for holiday sales), is one of the primary destroyers of project quality. It can often help to point out to the band how detrimental deadlines can be. However, sometimes they cannot be avoided, so if a group has a limited amount of time, an engineer might have to accept a performance that is less than perfect.

Purpose of a Project

Obviously, if a project is destined to be a CD, much more refinement is in order. Vinyl is final, and every album is a part of your reputation. If the project is being done as a demo, then the engineer might let less-than-perfect performances pass as acceptable. Generally, an engineer will try to obtain perfect performances on drums because of the amount of setup time involved. If the demo is accepted by a record company, the drums could then be kept as basic tracks for the album.

Expertise of Musicians

The quality of musicianship makes a big difference in the amount of time it takes to get an acceptable performance. You would think that the worse the players are, the longer it would take. But this is often not the case. Many times great musicians take even longer because they know how good they can be. At some point, you might need to suggest hiring professional musicians (if you have a bulletproof vest). One good idea is to present this idea, then tell the band that if they like their own playing better than the professional's, you'll pay for it. I've never had to pay for it yet.

Apparent Musical Values

Different people hold different values for their music. For example, a punk band might focus on energy instead of perfect tuning. An R&B band might care about the spatiality of the sound. A rap group may be mostly concerned about the "boom." A jazz combo might emphasize the interaction between the players. Often, these values will determine whether a performance is acceptable or not. It is often fruitless to spend too much time on an aspect that the band

could care less about. On the other hand, it is critical to pay extremely close attention to the aspects that the band obviously values the most.

Determination

The amount of determination that a band brings to a project affects the time spent working on a part and the quality of the final project. Often band members don't realize how much work it takes to get a performance perfect or great. Musicians can easily get frustrated or fatigued to the point where they say, "Good enough." You should always try to inspire everyone to work harder and longer until it is as good as possible, but you can only push musicians so far before they become irritable. It might help to simply point out that it is normal for it to take a long time to get things right and that professional musicians often take days to get a performance perfected. This can help to inspire people to push themselves to be great.

On the other hand, some musicians are so determined to get a performance perfect that they never stop. In the beginning, these people can make you nuts, but you'll soon realize that with this kind of perfectionist, you will end up with an incredible performance. Subsequently, when people listen to the project they will say, "Wow, you recorded that?" Therefore, you come to appreciate the obsessive ones.

Aspect #10: Quality of the Equipment and the Recording

The quality of the equipment refers to the recording equipment, as opposed to the instruments (which were covered under "Instrumentation"). The engineer should make sure that all of the equipment is of the best quality possible and, even more importantly, that it is in good working order.

The quality of the recording includes things like getting good levels on tape (not too low or too hot), good miking techniques, and no distortion or excessive noise. Obviously, these are the recording engineer's responsibility.

Newness is a positive value for equipment, while age is a negative value.

Positive values for recording quality can be that it is present and clean; therefore, negative values can be that it is noisy, distorted, and unclear.

Aspect #11: The Mix

The mix may only be one small part of everything that goes into creating a great overall recording; however, it is one of the most powerful aspects because the mix can be utilized to hide weaknesses in other areas.

The rest of this book is about the mix.

CHAPTER 2

Visual Representations of "Imaging"

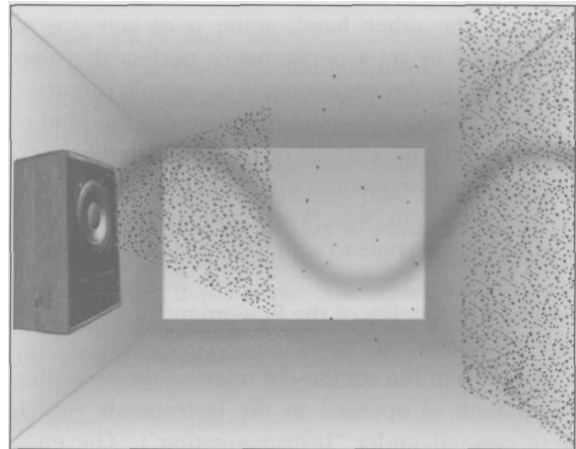
SECTION A

Physical Sound Waves vs. the Imagined Placement of Sounds Between the Speakers

We relate to sound in two ways: We feel (and hear) the physical sound waves that come out of the speakers, and we imagine the apparent placement of sounds between the speakers.

Physical Sound Waves

Whether in the control room or living room, sound first comes out of the speakers in sound waves and travels through every molecule in the room, hitting all parts of your body. Just as waves travel on water, sound waves travel through the air. When the speaker pushes out, it creates compressed air (denser air with a higher air pressure) in front of the speakers. This compressed air corresponds to the crest of a wave in water. When the speaker pulls back in and the sound doesn't return, it creates "spaced out" air (rarefied air). As we all know, when you have a water fight in the pool and you push the water and pull your hand back, the water doesn't come back. Instead, a trough is created. In the air, this trough corresponds to spaced out air. Therefore, sound travels in waves consisting of alternating compressed and rarefied air. This is one way that we perceive sound.

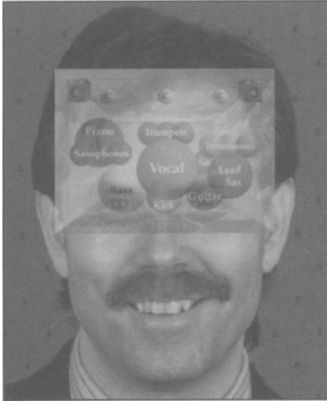


Visual 4. Sound Waves: Traveling Compressed and Spaced Out Air

"Imaging"

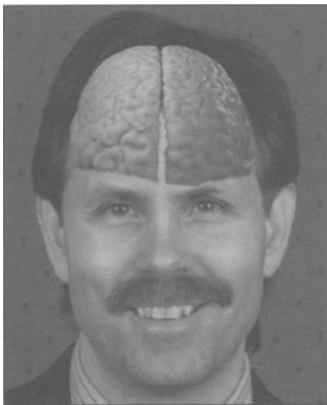
The second way we perceive sound is by imagining sounds between the speakers. The apparent placement of sounds between the speakers is called "imaging" because it is a figment of our imagination. So you see, we're not talking about reality here. When we imagine a sound, like a vocal, to be between the speakers, there is, in actuality, no sound there. The same sound is coming out of both speakers, traveling throughout the room, and we just imagine the sound to be between the speakers.

The same thing happens when you listen to headphones: When you hear a sound in the middle of your head . . .



Visual 5. Imaging in Head

. . . there's no sound there. Your brain's there!



Visual 6. Brain in Head

With no imagination process, such as when you are asleep, there's no imaging. If you aren't paying attention to a mix or if you are off to the side of the speakers, imaging does not exist. On the other hand, physical sound waves still hit your body when you are asleep. Even if you aren't paying attention, sound waves are still slapping every cell in your body. You feel sound waves even if you aren't listening.

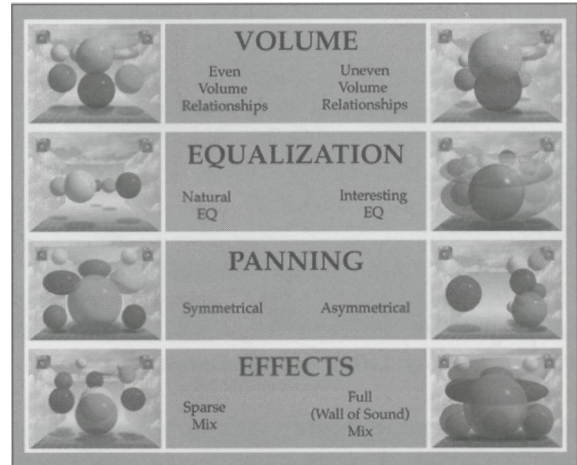
Imaging requires active imagination to exist. Sound waves do not.

Some people do not hear imaging. There are those who are simply not conscious of it. But there are also people who don't hear imaging because the shape of their outer ears actually causes phase cancellation. This physical difference destroys their ability to place a sound between the speakers.

People relate to sound in two ways: they *feel* the sound waves and/or they *perceive* imaging. Although professional engineers utilize both modes of percep-

tion to gain as much information about the mix as possible, they are often more concerned with the dynamics that exist in this imaginary world of imaging.

A wide range of dynamics are created by different placements of sounds between the speakers, and these dynamics are utilized to create all the various styles of mixes that fit all types of music and songs.

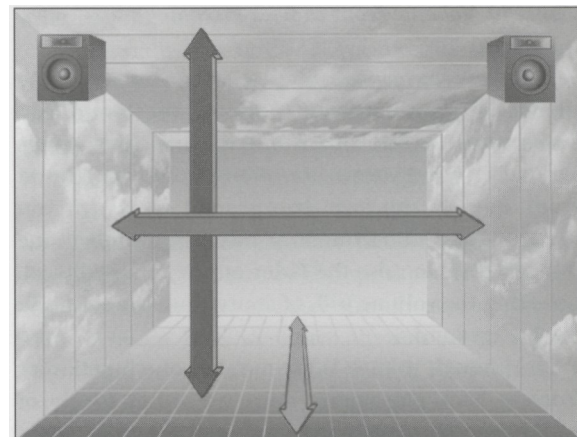


Visual 7. Dynamics Created With Studio Equipment

SECTION B

The Space Between the Speakers

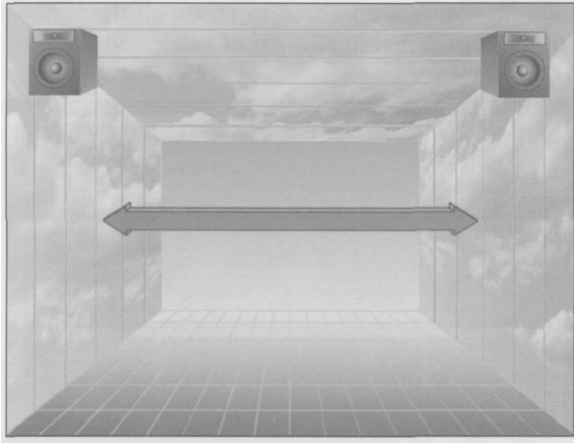
Mapping Volume, Frequency, and Panning Visually
In order to explain different styles of mixes, let's map out how each piece of equipment affects imaging, the apparent placement of sound between the speakers. There are three basic parameters of sound corresponding to the X, Y, and Z visual axes.



Visual 8. Sound to Visuals: X, Y, Z Axes

Panning as Left to Right

Panning, the left/right placement of sounds between the speakers, is shown as a left to right placement visually.



Visual 9. Panning: Left to Right Placement

Volume as Front to Back

Sounds that are closer to us are louder and distant sounds are softer, therefore the volume of a sound in the mix can be shown as front to back placement.

Visual 10. Volume: Front to Back Placement

As you have probably noticed in mixes, some sounds are right out front (normally vocals and lead instruments), while other instruments, like strings and background vocals, are often in the background (consequently, the term background vocals). If you want a sound out front in a mix, the number one thing to do is to raise the fader on the mixing board. Lowering the volume will, of course, put the sound in the background.

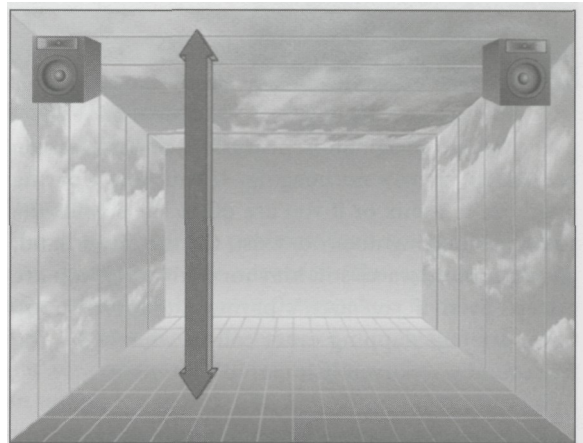
Although volume is the number one function of front to back placement, there are other pieces of equipment or factors that can make sounds seem more out front, such as compressor/limiters, equal-

ization boosted in the presence range, short delays less than 30 milliseconds (ms), and any effect that makes a sound seem "unusual" so that it sticks out. Reverb and long delay times tend to make sounds more distant. These effects are discussed further in Chapter 4, "Functions of Studio Equipment and Visual Representations of all Parameters."

NOTE: You need other cues, such as delays and reverb, to help gauge the distance a sound is from you. If you happen to be hanging out in an anechoic test chamber (a room that absorbs all sound so there are absolutely no reflections off the walls), you can't tell the distance of a sound by volume alone. However, for the purposes of this book, volume is still shown as front to back. After all, the louder the sound, the more out front it will appear in the world of imaging and mixing.

Pitch as Up and Down

There is an interesting illusion that occurs with high and low frequencies in the world of imaging. Check it out on your own system. Play a song and listen to where high- and low-frequency sounds seem to be between the speakers. Most people agree that highs are higher and lows are lower. Instruments such as bells, cymbals, and high strings always seem to be much higher between the speakers than instruments such as bass guitars, kick drums, and rap booms.

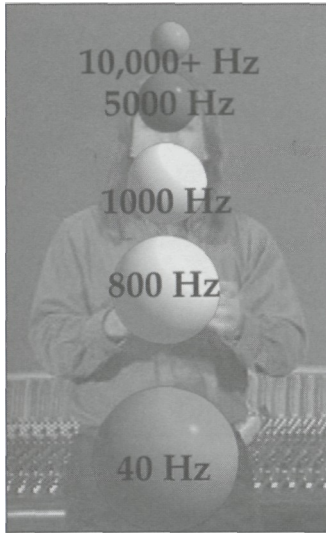


Visual 11. Frequency: Low to High Placement

There are a number of reasons why this illusion exists. First of all, low frequencies come through the floor to your feet; high frequencies don't. No matter how much bass you add to a piccolo, it will never rumble the floor. In fact, professional studios are calibrated to exactly how many low frequencies travel along the floor to your feet. (This is why some engineers like to work barefoot!)

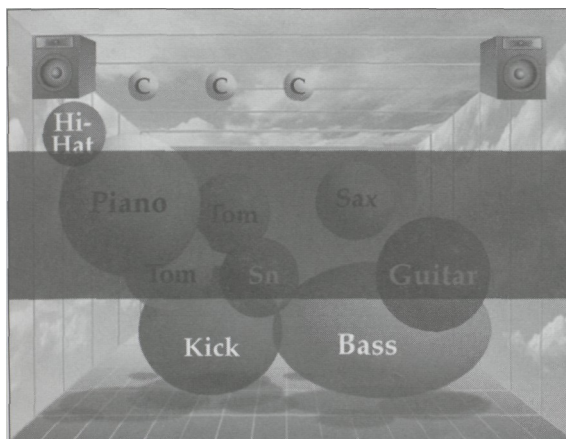
On a more esoteric level, there is a theory in the

field of music psychology that maps out frequencies from low to high in the body, from the base of the spine to the top of the head, that respond to different frequencies.



Visual 12. Frequencies in Us

We're not here to argue the validity of such a system; however, it might contribute to our perception of highs and lows in the world of imaging. But regardless of why it happens, the truth is that high frequencies do seem to appear higher between the speakers than low frequencies. Therefore, we'll put the high frequencies up high and the low frequencies down low in all our visuals.



Visual 13. Song With Highs and Lows Highlighted

You can raise or lower the sound by changing the pitch with harmony processors and aural exciters or by having a musician play their instrument in a higher octave or chord inversion. Since equalization controls the volume of frequencies, with an EQ we can move a sound up and down ... at least a little bit.

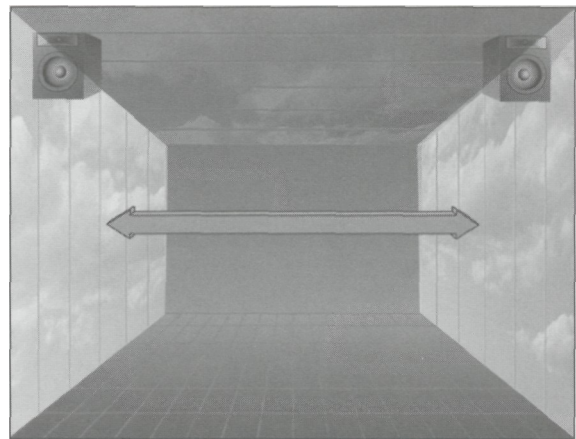
Again, no matter how much bass we add to a piccolo, we will never be able to get it to rumble the floor, and we won't be able to put a bass guitar in the sky.

Defining the Boundaries of the 3D Stereo Field of Imaging

Consider this: The image of a sound never seems to appear further left than the left speaker or further right than the right speaker. Right? Right, unless the room is strange.

Because the exact placement is a figment of our imagination, different people see the left and right boundaries differently. Some say that it can't be further left or right than the speaker itself. Some people see sounds just a little bit further outside of the speakers, maybe an inch or two. Check it out for yourself. Pan a sound all the way to the left and listen to see how far left the image seems to be.

The left and right boundaries of imaging are shown like this:

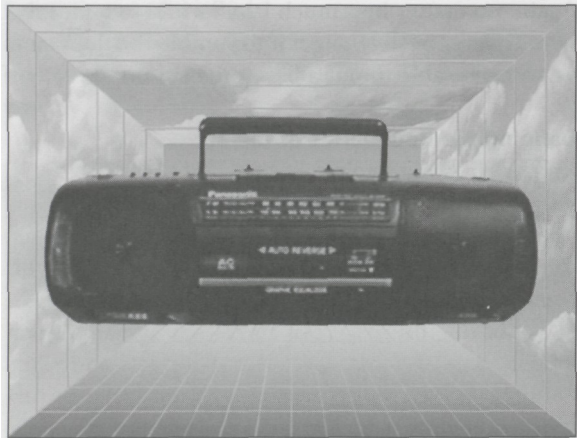


Visual 14. Left and Right Boundaries of Imaging

When you turn the panpot, it's as though you can "see" the sound moving left and right between the speakers. Now, what about front to back boundaries of volume levels?

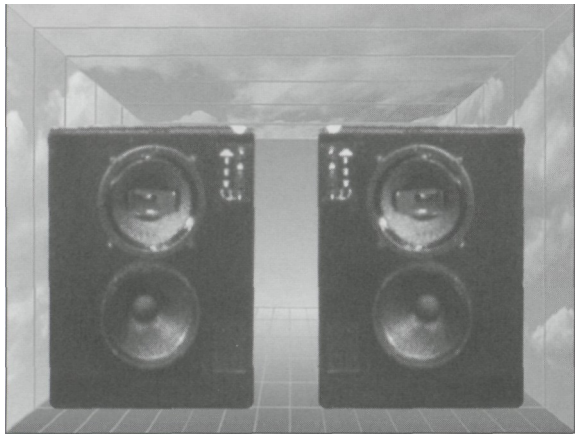
Normally, background vocals and strings are only a few inches behind the speakers. As you reduce the volume of a sound, it seems to recede into the distance. The question is, "How far behind the speakers is a sound before it disappears altogether?"

Most people seem to imagine sounds to be about six inches to two feet behind the speakers, depending on the size of the speakers. It is interesting to note how the speaker size affects the illusion. With a boom box, we normally don't hear sounds more than a couple of inches behind its speakers.



Visual 15. *Imaging Limits Around Boom Box*

Whereas, when listening to a huge PA at a large concert, the image seems to be as much as six feet behind the speakers.



Visual 16. *Imaging Limits Around Large PA*

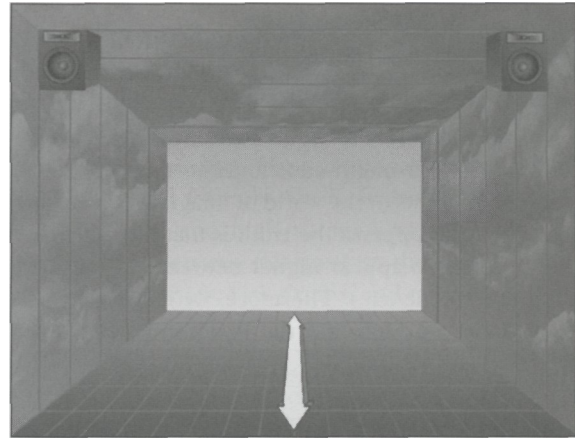
Check out how far back the sound seems to be around various speakers. Normally, sounds are only a short distance behind the speakers.

NOTE: There is a psychoacoustic phenomenon based on previous experience wherein certain sounds appear to be even further behind the speakers than the normal imagined limit. For example, if you place the sound of distant thunder between the speakers, it can seem to be miles behind the speakers. The sound of reverb in a large coliseum or a distant echo at the Grand Canyon might also seem to be way behind the speakers. This is a good illusion to remember when trying to create unusually expansive audio worlds between the speakers.

Now, as previously mentioned, when you turn a sound up, it appears to be more out front in a mix. But how far out front will it go? First, no matter how

loudly you raise the volume of a sound, you can't make it come from behind you. In fact, sounds rarely seem to be more than a short distance in front of the speakers. Most people imagine sounds to be only about three inches to a foot in front of the speakers. Again, it depends on the size of the speakers. A loud sound in a boom box will appear only about two inches in front, whereas sounds in a huge PA might appear as far out front as six to ten feet. (Check it out on your own speakers.)

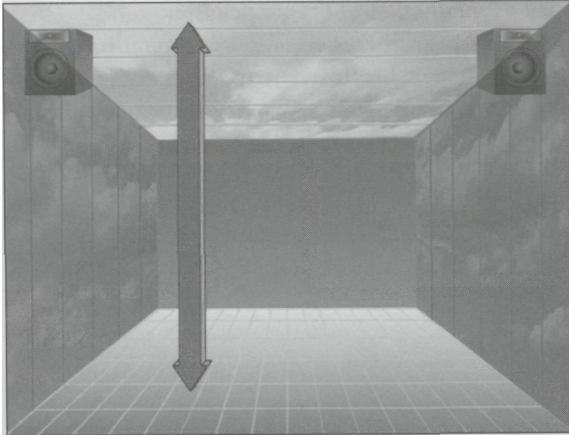
Regardless of our perception of the exact limits of imaging from front to back, it is easy to imagine the placement of sounds from front to back, with volume being the main factor that moves a sound. Therefore, *the normal stereo field is actually three-dimensional!* We'll show the rear boundaries of imaging like this (the front boundaries aren't shown because they would just get in the way):



Visual 17. *Imaging Front and Back Boundaries*

Finally, what about the upper and lower limits of imaging? As discussed earlier, high frequencies seem to be higher between the speakers than low frequencies. The questions are: How high are high frequencies? And how high do the very highest frequencies we hear seem to be between the speakers? Some people say sounds never seem any higher than the speakers themselves. Some say sounds seem to float a few inches above the speakers. Again, the exact limit depends on the size of the speakers and the imagination of the listener. Regardless of the exact limit, sounds never seem to come from the ceiling. Imaging is limited to somewhere around the top of the speakers.

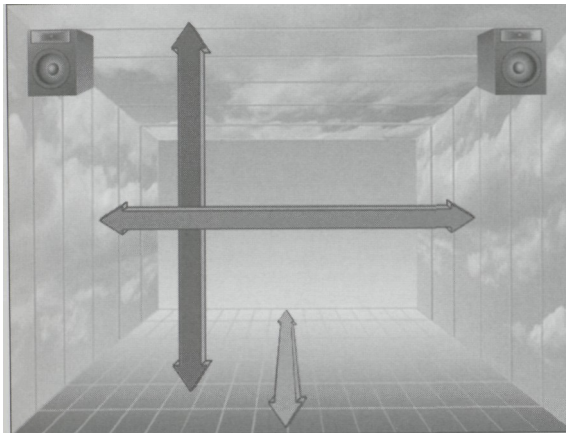
Now, what about the lower limit? Low frequencies commonly come through the floor to our feet. Therefore, the floor is the lower limit. The upper and lower limits can now be shown like this:



Visual 18. *Imaging Top and Bottom Boundaries*

No matter how far we pan a sound to the left, it will never sound like it is coming from much further left than the left speaker. Likewise on the right. We "see" sounds only a little bit in front of and behind the speakers. We don't hear sounds higher than the speakers, but they do come through the floor.

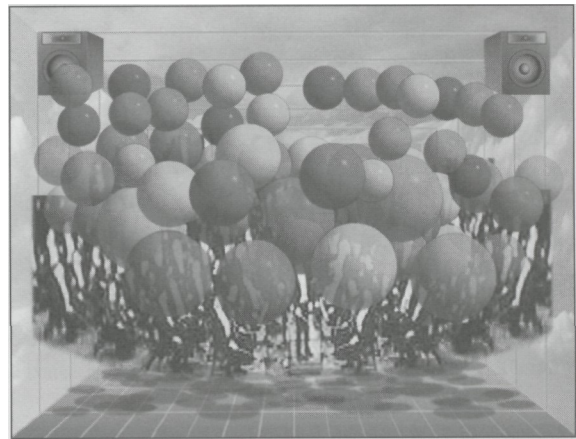
The limits of imaging can be shown with this one visual:



Visual 19. *Only Place Mix Occurs*

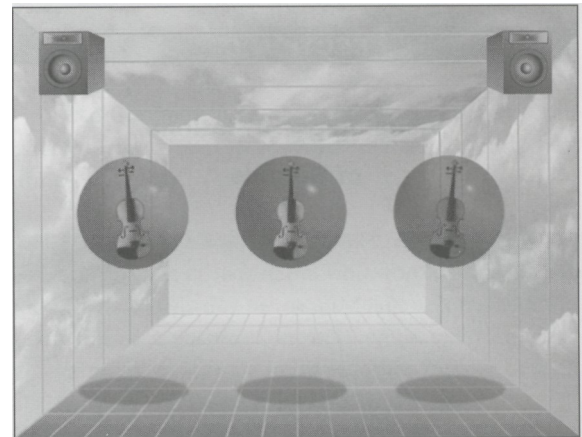
This is the space where a mix occurs. In the world of imaging, sounds do not occur anywhere else in the room. Most importantly, you must realize that this space is limited.

Therefore, If you have a 100-piece orchestra between the speakers, it's going to be crowded.



Visual 20. *Large Orchestra Crowded Between Speakers*
(see color Visual 20C)

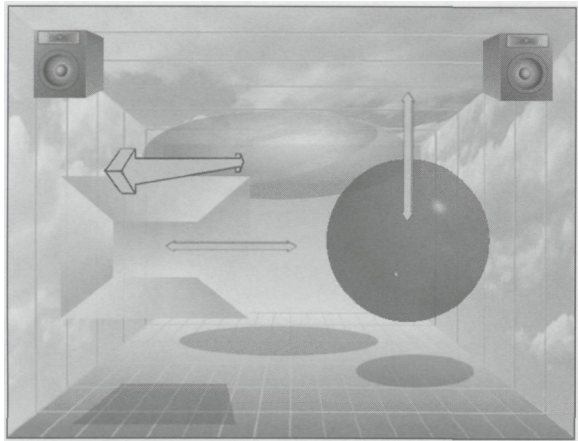
You can't hear each individual violin in the mix because it is too crowded; you only hear a violin section. Whereas, if you have only three violins, you can hear each one quite clearly.



Visual 21. *3 Violins With Plenty of Space in Between*
(see color Visual 21C)

Because the space between the speakers is limited and masking is a major problem in a mix, the whole issue of mixing becomes one of . . . *crowd control!*

As you can see, a sound can be moved around in the space between the speakers by changing the volume, panning, and pitch (equalization will make small changes). These same three parameters are used not only to move sounds around between the speakers, but also to place and move effects, including delay, flanging, and reverb.



Visual 22. *Movement of Sounds With Volume, Panning, EQ*

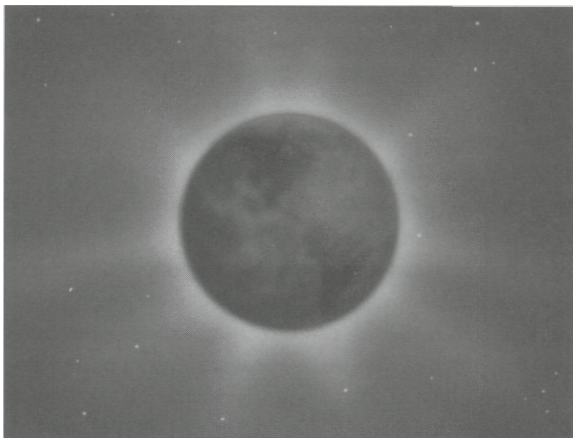
This limited space between the speakers where imaging occurs is the stage or pallet where we can create different structures of mixes. The trick is to creatively place the sound images.

Now, let's discuss the elements, instrument sounds, and effects that we can place between the speakers.

SECTION C

Visual Representations of Sounds

Just how big is each sound in this world of imaging? The goal here is to show how much space each sound takes up between the speakers, so we can deal with the big problem of masking. The more space a sound takes up, the more it will hide other sounds in the mix.

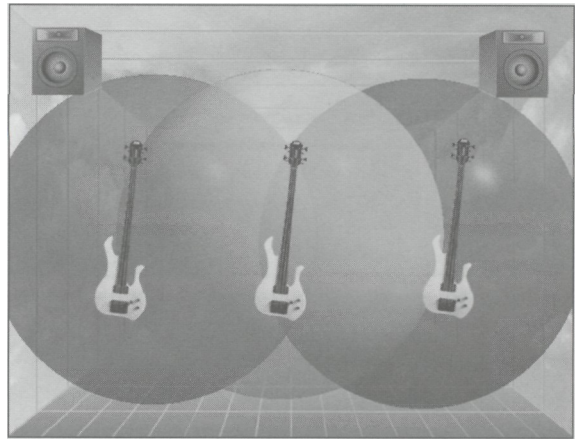


Visual 23. *Solar Eclipse: Natural Masking*

As there is a limited space between the speakers, we need to know the size of each member of the crowd. How much space does the image of a sound take up in the mix between the speakers?

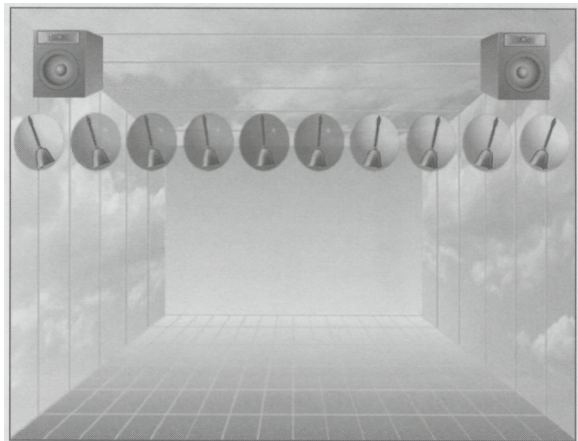
Size as a Function of Frequency Range

First, bass instruments seem to take up more space in the mix than treble instruments. Place three bass guitars in a mix and you'll have a muddy mix.



Visual 24. *Mud City*

Bass sounds take up a lot of space. Being bigger, they also mask other sounds more. However, place ten bells in a mix and you can still discern each and every bell distinctly from each other—even if they are all playing at the same time.



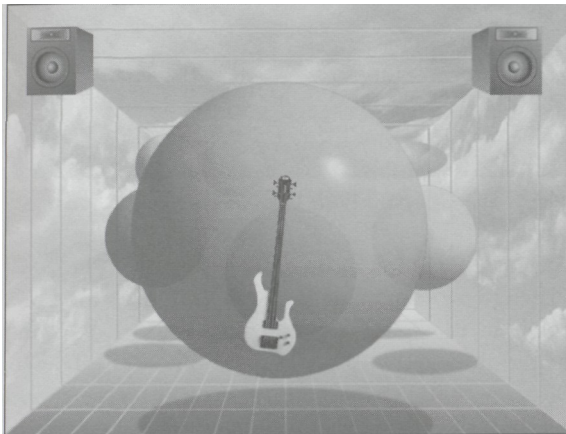
Visual 25. *10 Bells Playing at Same Time*

High-frequency instruments will be placed higher and will be smaller than the low-frequency instruments, which will be represented by larger shapes and placed lower between the speakers.

NOTE: Technically, it is very difficult to tell exactly where low frequencies, below 400Hz, are coming from. Low frequencies are extremely difficult to localize between the speakers. Therefore, a more realistic visualization would have the low-frequency spheres less defined—they would spread out to cover the entire lower portion of the visual—creating even more masking. However, in order to be able to show the specific volume, panning, and EQ of bass, we will continue to use large, defined spheres.

Size as a Function of Volume

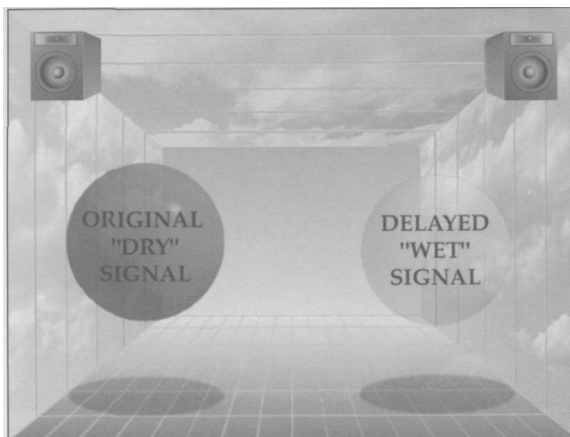
The louder a sound is in the mix, the more it will mask other sounds. Therefore, louder sounds are larger. A guitar that is extremely loud will tend to mask the other sounds a lot more than if it were soft. A bass guitar, already large, will hide other sounds even more when turned up loud.



Visual 26. Loud Bass Guitar Masking Rest of Mix

Size as a Function of Stereo Spread

When you have a delay longer than 30ms, you hear an echo, which looks like this:



Visual 27. Delay Longer Than 30ms

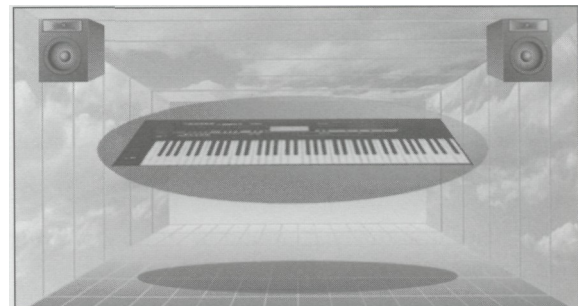
An unusual effect happens when we put a delay on a sound less than 30ms (1000ms = 1 second). Because our ears are not quick enough to hear the difference between delay times this fast, we only hear one fatter sound instead of an echo. When you place the original signal in the left speaker and the short delay in the right speaker, the effect is such that it "stretches" the sound between the speakers. It doesn't put the sound in a room (like reverb), it just makes it "omnipresent" between the speakers.

The same effect can be created by placing two microphones on one sound. Because sound is so slow (around 770 mph), you get about 1ms of delay time per foot. Therefore, two mics are commonly used to create a stereo sound.



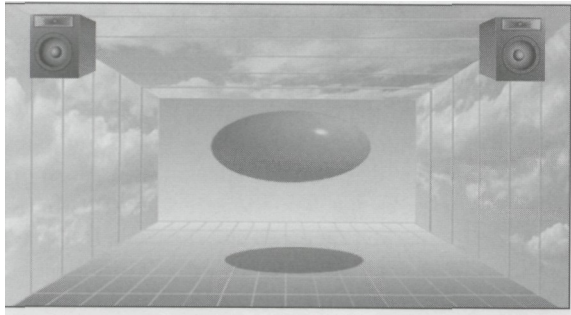
Visual 28. Close to 1ms Delay Time Per Foot

Additionally, sounds in synthesizers are commonly spread in stereo with these same short delay times.

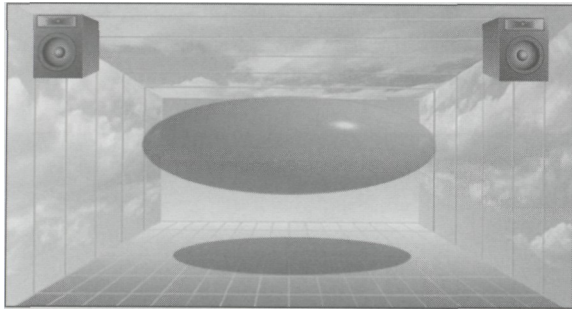


Visual 29. Fattening: <30ms Delay Time (see color Visual 29C)

Just as we can use volume, panning, and EQ to place and move spheres, we also have control over the placement of the oblong sphere, or "line," of sound created by fattening. We can place the line anywhere from left to right by panning the original signal and the delayed signal to a variety of positions. The wider the stereo spread, the more space the sound takes up and the more masking it causes.

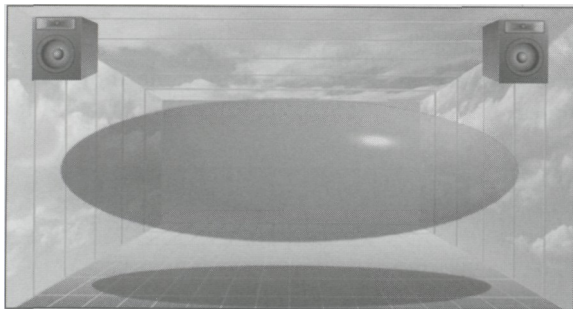


Visual 30. Fattening Panned 11:00-1:00



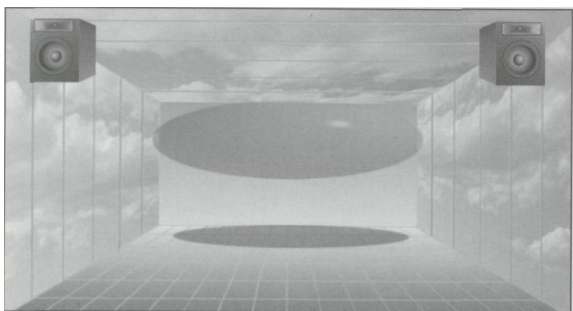
Visual 31. Fattening Panned 10:00-2:00

We can also bring this line of sound up front by turning the volume up ...



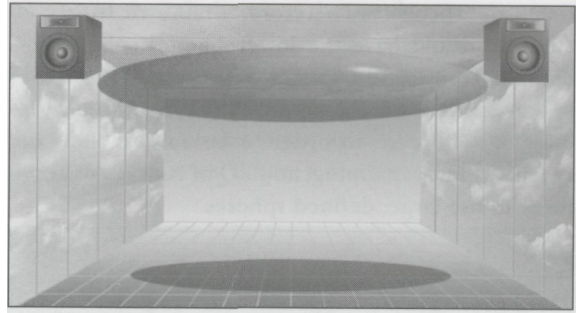
Visual 32. Loud Fattening Right Up Front

... or place it in the background by turning the volume down.

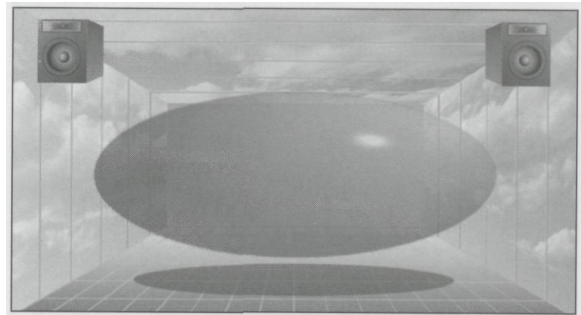


Visual 33. Low Volume Fattening in Background

We can also move it up or down a little bit with more treble or bass EQ.



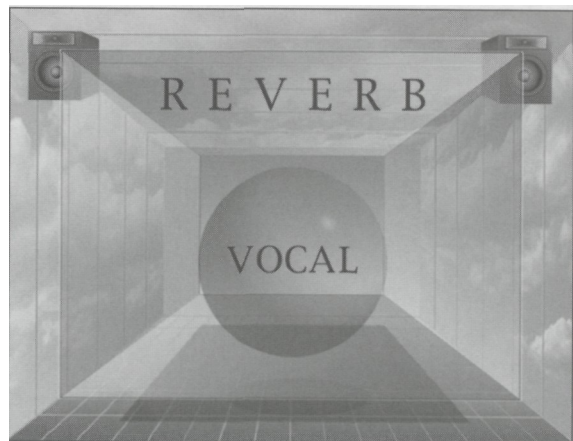
Visual 34. Fattening With High-Frequency EQ Boost



Visual 35. Fattening With Low-Frequency EQ Boost

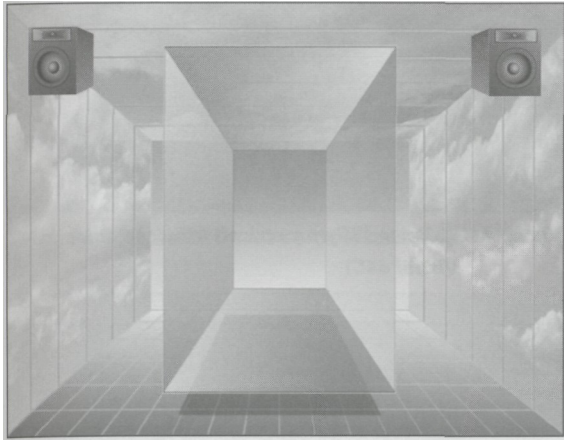
Size as a Function of Reverb

Placing reverb in a mix is like placing the sound of a room in the space between the speakers. A room, being three-dimensional, is shown as a 3D, see-through cube between the speakers. Because reverb is actually made up of hundreds of delays, it occupies a huge amount of space when panned in stereo. It is like placing hundreds of copies of the sound at hundreds of different places between the speakers. This is why reverb causes so much masking!

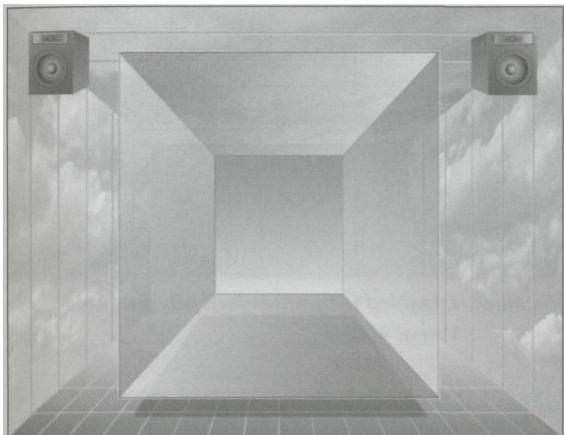


Visual 36. Stereo Reverb on Sound (see color Visual 36C)

Just as spheres and lines of sounds can be placed and moved around in a mix, we also have control over the placement and movement of reverb with panning, volume, and EQ. We can place reverb anywhere from left to right by panning the two stereo outputs of the reverb in a variety of positions. The wider the stereo spread, the more space reverb takes up and the more masking it causes.

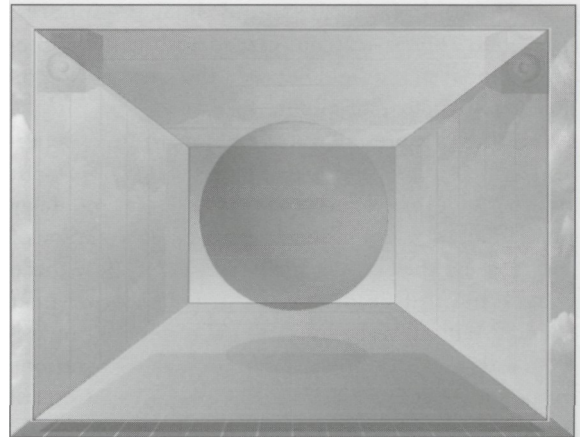


Visual 37. Reverb Panned 11:00-1:00



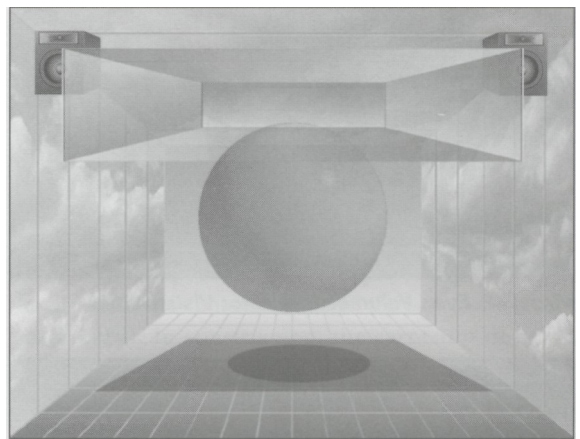
Visual 38. Reverb Panned 10:00-2:00

When we turn the volume level of the reverb up (normally done by turning up the auxiliary send on the sound going to the reverb), it comes out front in the mix.

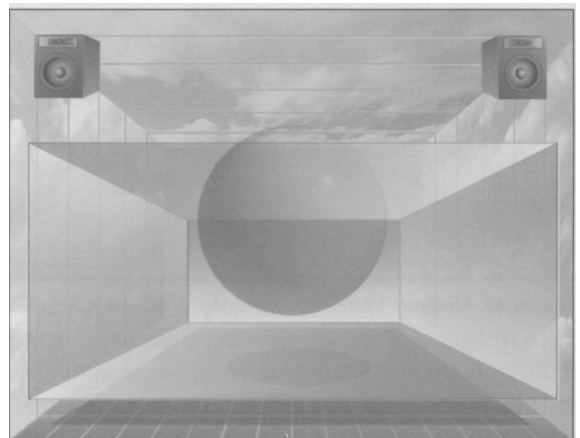


Visual 39. Loud Reverb

With EQ, we can raise or lower the placement of the reverb a little, which makes the reverb smaller (more trebly) or larger (bassier).



Visual 40. Reverb With High-Frequency EQ Boost

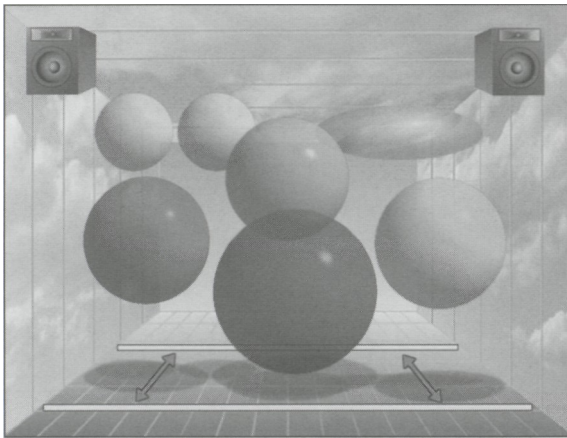


Visual 41. Reverb With Low-Frequency EQ Boost

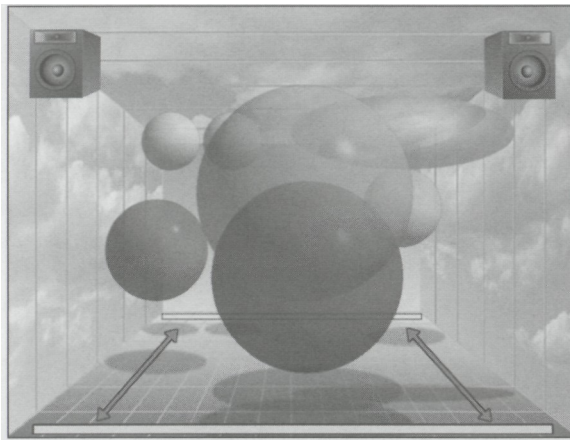
These three basic sound images—spheres, lines, and rooms—can be placed within the three-dimensional stereo field between the speakers to create every structure of mix in the world.

Spheres represent sounds, oblong spheres represent fattening, and translucent cubes of light represent reverb. All other effects, including different delay times, flanging, chorusing, phasing, parameters of reverb, and other effects, are variations of these three images and will be described in detail in the next chapter. With these various sound images, we can create a wide range of mix styles appropriate for various music and song styles. For example, we can create even vs. uneven volumes . . .

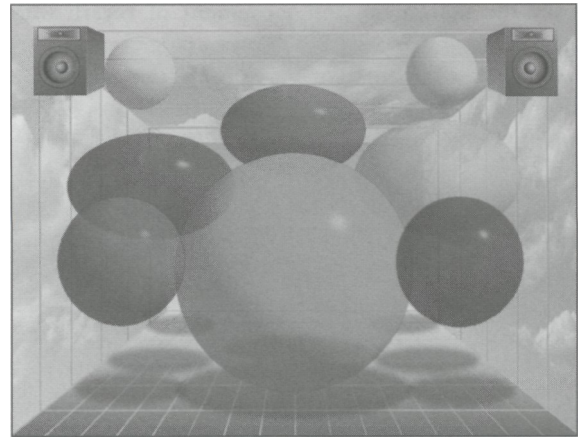
. balanced vs. unbalanced mixes



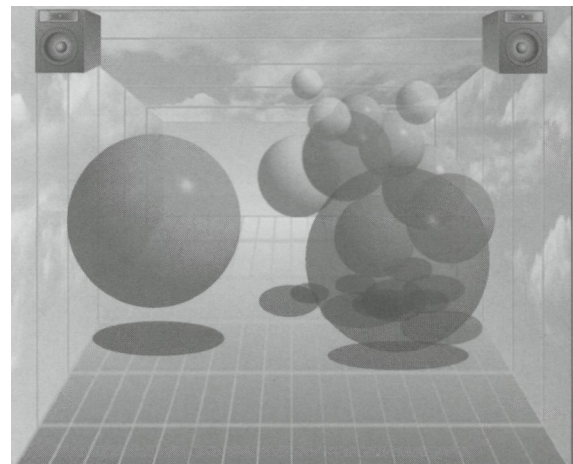
Visual 42. Even Volumes (see color Visual 42C)



Visual 43. Uneven Volumes (see color Visual 43C)

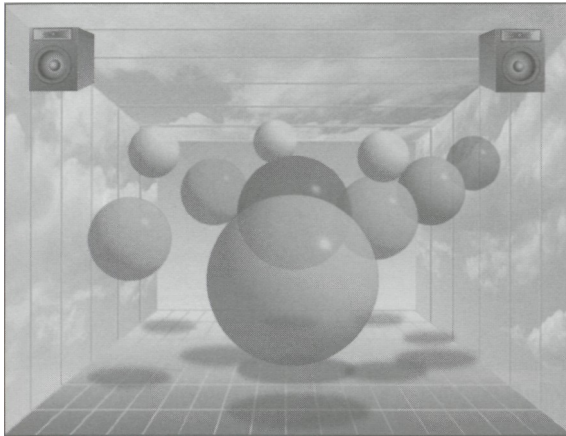


Visual 44. Balanced (Symmetrical) Mix (see color Visual 44C)

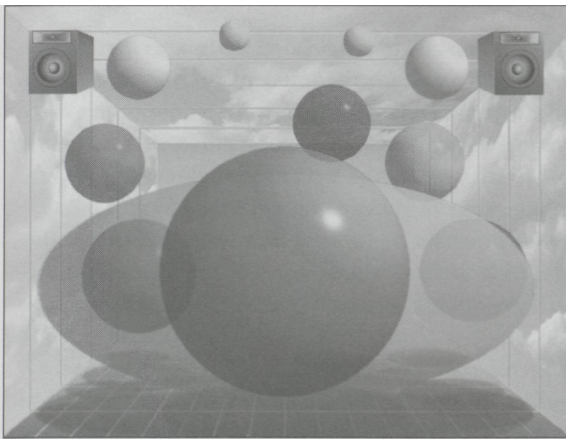


Visual 45. Lopsided (Asymmetrical) Mix (see color Visual 45C)

. . . natural vs. interesting EQ . . .

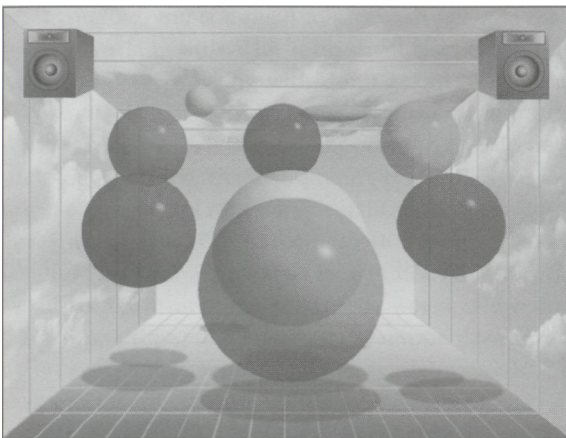


Visual 46. Natural EQ (see color Visual 46C)

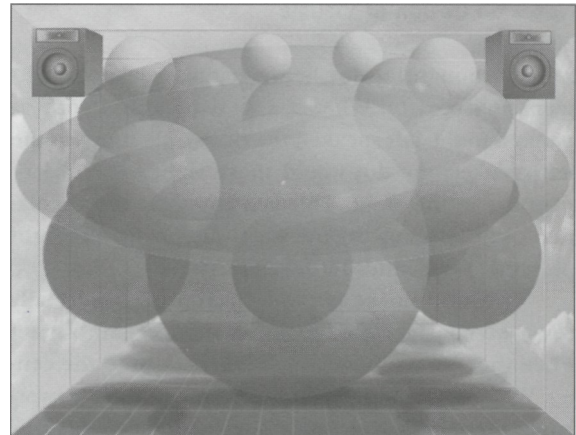


Visual 47. Interesting EQ (see color Visual 47C)

. . . and sparse vs. full (wall of sound) mixes with effects.



Visual 48. Sparse Mix (see color Visual 48C)



Visual 49. Full (Wall of Sound) Mix (see color Visual 49C)

The art of mixing is the creative placement and movement of these sound images. Just as a musician needs to explore and become thoroughly familiar with all the possibilities of his or her instrument, so must an engineer be aware of all possible dynamics that the equipment can create. And he or she must be adept at coming up with any of the structures and patterns that can be conceived.

NOTE: An engineer has the same range of control as the sculptor: Both are working in 3D. In sculpture, the artist deals with shaping the images in a three-dimensional space. In photography and painting, the artist deals with color tones and the way they relate to each other. In construction, the carpenter deals with first building a strong foundation. In Feng Shui, the consultant deals with placement of elements in a 3D space. Here we are dealing with the Feng Shui of mixing.

The mix can be made to fit the song, so that the mix becomes transparent or invisible. Or the mix can be used to create musical dynamics of its own. It can be a tool to enhance and highlight, or it can create tension or chaos. A great engineer uses the mix to push the limits of what has already been done.

We now have a framework with symbols for each parameter of sound. Chapter 4 will go into the details of each piece of equipment in the studio. Chapters 5 and 6 use the visuals to discuss how each piece of equipment can be utilized in the mix to create all the dynamics that the "engineer as musician" wields. But first, we'll explore all of the reasons for creating one style of a mix or another in Chapter 3.

Notes on Design of Visuals

SHAPE

At first thought, a dot between the speakers might seem appropriate. When a sound such as a vocal is panned to the left speaker, the dot would move to the left speaker; the dot would move right to represent panning to the right. This is a common representation used by many people when discussing left/right placement of sounds in the stereo field.

A round image is most appropriate, especially when we consider the way two sounds seem to meet when they are panned from left and right to the center. When they are brought together and start to overlap in the middle, the image suggests that the sounds should be round and symmetrical. If we were to use an image of a guitar, the neck of the guitar would puncture the adjacent sound first because they are both panned toward the center, unlike the way two sounds actually meet and then overlap.

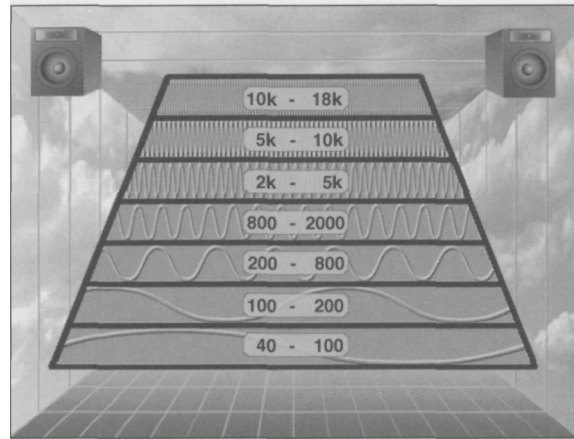
A solid dot has its faults, though. Two sounds can be in the same place in a mix yet still be heard distinctly. Therefore, it makes sense to make the sounds transparent or translucent. If we use transparent spheres to represent the sound field of the image as it appears between the speakers, then two sounds can be seen and heard in the same spot.

COLOR

People all over the world have tried to figure out which frequencies correspond to which colors. Of course, only psychics and space aliens really know. Any instrument can be any color. Therefore, you can assume the colors that we have chosen are perfect.

The primary function of color is to differentiate between different types of sounds. Different colors could be made to correspond to different sound colors, types of waveforms, or frequency ranges. But since I don't want to require people to learn such a system to be able to understand the visuals, I will only use color to help differentiate between sounds in the mix.

When harmonic structures and equalization are discussed, colors will be assigned to specific frequency ranges.



Visual 50. Virtual Mixer EQ (see color Visual 50C)

CHAPTER 3

Guides to a Great Mix

(Reasons for Creating One Style of Mix or Another)

So what makes a great mix? As a professional engineer, it is important to be able to answer this question. Many engineers—even great ones—simply fly by the seat of their pants. They know how to create great mixes, but they might not know how to explain them.

Knowing what makes a great mix has its advantages—some obvious, some not. First, when learning about recording, it is good to know where you are going. If you can define what you are trying to attain, it is easier to get there.

Second, it is helpful to be able to explain to a band what makes a good mix, especially when they are booking a session. This can be tricky. There is always the possibility that no matter what you come up with, the band might have opposite preferences.

There is very little that everyone agrees on when it comes to mixing. Everybody has their own ideas, and ideas seem to change daily. Even if you know what you like, you still need to please the people that you are working with. This is no small task. Often the people you are working with don't really know what they want. Even if they do know what they want, they often can't explain it because they don't know the terminology or what the equipment does. The whole world of music and recording is so incredibly complex and diverse that it is difficult to find any common ground. There are almost as many different styles of mixes as there are people in this world. However, there is one thing that just about everyone does agree on: *The mix should be appropriate for the style of music, the song and all of its details, and the people involved.*

It is difficult for the band to disagree if you tell them, "The mix should be appropriate for your style of music, especially the particular song and all of its details, but we will also take into consideration (ha, ha) what you want and all of your ideas."

These three aspects are valuable guides in choosing the type of emotional and musical dynamics that you create with the tools in the studio. Let's take a look at each of these guides in more detail.

SECTION A

The Style of Music

Most bands that come into the studio want the mix of their music to sound like the style of music they do. For some bands and some styles of music, the rules are very strict and tight. For example, if you turn up the kick drum too much or put flanging on a big band mix, you could go to jail. There are some bands who don't want their music to sound like any other. These are the ones who commonly end up having the most specific ideas of how they want the mix to be—even though at first, they say they don't care.

Additionally, within each type of music, there are often numerous styles. Country music is a good example. In country music, there are at least twenty different typical styles of mixes, ranging from Hank Williams Sr. to Hank Williams Jr. to Garth Brooks. Furthermore, people who are into country music have often been listening to country all their life, so they know when it doesn't sound exactly like what they are used to. Rock is the same way. There are probably a hundred different rock styles, and anyone into rock usually knows in their heart and soul exactly what it should sound like. But they can't necessarily tell you how to get the sound they want with the studio equipment.

Most bands do subscribe to having their music sound like a specific genre of music; however, there

are aliens out there. Your next session just might be a big band that wants the Pink Floyd mix (with lots of effects and mixing tricks). It is critical to know just how strictly the band subscribes to having their mix sound like their style of music. You then know how much you can play.

SECTION B

The Song and All of Its Details

Sometimes it is obvious to make a mix fit the style of music. But more commonly, engineers (and the band) forget to make sure that the mix fits the song and all of its details. The details include the concept, melody, rhythm, harmony, lyrics, arrangement, instrumentation, song structure, performance, and even the quality of the equipment. Each one of these aspects could provide the reason for structuring the mix in some particular manner or creating a certain type of mix. Each aspect might prompt you to use one of the four tools (volume, panning, equalization, or effects) in a certain way. The mix might be used to enhance each and every detail found in the song, or equipment can be used to create tension between the mix and the song. Regardless of how the mix interfaces with all of the components of the song, you should at least be aware of the relationship. It should be appropriate. Let's go through each aspect and see how it could affect the way a song is mixed.

Concept

The concept is a combination of the relationships of each of the other aspects, so it is one of the most important clues to the overall mix style. The multitude of various song concepts can create a wide range of different mix styles. For example, a song about chainsaw murders might be mixed with edgy EQ, some unusual cutting effects, and shocking dynamic volume and panning changes. Whereas, a song about stable love might be mixed with more natural EQ, balanced panning, even volumes, and nice, mushy effects.

Melody

The nature of the melody line can easily affect what the engineer does in the mix—overall and at any specific point in the song. For example, if the melody is a major component of the song, you might consider making it bigger and more appealing with various time-based effects, such as delay, flanging, or reverb. If the melody is simple (or boring, for that matter), it

might be a good idea to make it stereo with some type of fattening (short delay time) or reverb. On the other hand, if the melody is extremely busy, it might be better to use fewer effects and turn it up more, so you can hear the detail. Occasionally, engineers will change panning or effects based on what happens in the melody line.

Rhythm

The nature of the rhythm has a direct effect on the mix. The busier the rhythm, the cleaner and clearer you make the mix, so you can hear more of the detail. You don't want to cloud the precision of an intricate rhythm.

Each of the tools in the control room can be used to make a cleaner and clearer mix when you have a busy rhythm. You would probably use fewer time-based effects because there is not enough room for the additional delays. Instruments are normally equalized a bit brighter so that the detail of the rhythm is more distinct. The volume of a complex rhythm part might be boosted just a bit in order to make the details clearer.

Of course, not all busy rhythms are mixed to be more present. A rhythm might be too busy to be mixed clearly and out front. It may be equalized a bit dull and placed in the background because it is too overwhelming for the song. (This might be a good time to ask if the musical part is appropriate in the first place.)

On the other hand, if a rhythm is more basic—slow and simple—there might be more room for effects and playing around with EQ, panning, and volume.

Harmony

The nature of the harmony parts and how they fit into the overall song also contributes to a different handling of the mix. Differences in the number of harmony parts and their chord structure can provide important clues as to what might be done in the mix. For example, the more harmony parts, the wider the sounds might be panned. Whereas, a single harmony part is rarely panned all the way to one side. The type of musical chords that are created with the harmony parts could affect their placement. A dissonant type of chord might be placed back in the mix; a sweet, angelic chord might be mixed with spacey delays and reverb. When the harmonies are not harmonies but simply the melody sung in unison, they might be spread wider in stereo to make them sound fuller and bigger. And the volume might be lowered because they might not be interesting enough to be put right out front. One way people decide how to mix the harmonies is based on how good the harmonies are.

Many people will turn them up if they are really cool. None of these ideas are rules; they are simply reasons for creating one type of mix or another.

Lyrics

Lyrical content is a major guide to how a recording engineer mixes a song. The nature of the lyrics often affects the overall mix because they help set the tone of the song. Particular lyrics can often trigger the engineer to create and place various effects in the mix. A line such as "Living on the Edge" is just begging to be placed far left or right in a mix. A line about psychotic behavior might make you boost some irritating frequencies in an instrument. A line like "In the Halls of Love" might call for some sort of reverb effect. Effects might also be removed based on the lyrics. For example, it is common to take off effects (especially reverb) when the lyrics are more important and personal to make them sound more up front and close to your heart.

Arrangement

The density of the arrangement is often a valuable clue as to how to mix the song. If an arrangement is extremely full, then there are two different plans of attack: weed it out or fill it out even more.

The first plan would be to not make a full arrangement muddier by adding additional effects. The idea is to try and make the mix sound cleaner and clearer so that you can hear the busyness of the arrangement. Besides using fewer effects, sounds are commonly EQ'd brighter overall. When there are a large number of sounds and notes in the mix, the higher frequencies are masked more. As low frequencies take up more space between the speakers, brighter EQs will make the sounds appear to take up less space, so there is more room for each sound to be heard.

On the other hand, for some songs and styles of music, it might be appropriate to use the mix to help fill out the arrangement, making the massive "wall of sound" effect even more pronounced. Adding time-based effects (like delay, flanging, or reverb) actually adds more sounds to the mix. You might also pan things wider with a busy arrangement. With so much going on in this limited space between the speakers, it often becomes necessary to utilize the entire stereo field.

If an arrangement is very sparse, there are also two approaches. You could help keep the arrangement sparse by not adding effects or you could try and fill out the mix by adding various types of time-based effects. When there are fewer sounds, you have more room to play around with various effects.

Instrumentation

If the instrument sound is good, you might turn it up and you might make it into stereo with a time-based effect. If it sounds nice, interesting, unique, or complex, show it off. On the other hand, unique and interesting sounds can be quite intriguing when low in the mix so they just seep through. One cool effect is to make a sound stereo and then place it in the background.

If the sound is not happening, don't highlight it by turning it up too much. Instead you might put some sort of effect on it. If you can't polish it, bury it.

Song Structure

The structure of the song often affects what an engineer does in each section of the mix. Some bands will actually create a structure where each section of the song is completely different from the previous section. Frank Zappa, Pink Floyd, Mr. Bungle, and even The Beatles had songs where the mix was drastically different from one section to the next. It is a good idea to be on the lookout for bands who have created songs in which you could create different mixes to accent each section of the song—just because these types of mixes are so much fun to do.

Even when different sections of a song are not that different, you might accent each section a bit differently. For example, commonly a chorus will have a bit more reverb on the vocals. A lead break is often spiffed up by boosting the volume of the kick, snare, or bass and sometimes by adding more reverb to the snare. The same is commonly done in the vamp at the end of the song when the band is rocking out (or doing whatever they are doing). A bridge section might have a different type of reverb or a different type of panning on the instruments in order to create some variety.

Performance

The performance is often one of the most important aspects affecting the mix. For example, a particular type of guitar lick just might induce you to pan it from left to right in time to the lick. You might also consider adding an effect like reverb to correspond to the riff.

Most importantly, the quality of a performance will often affect how the song is mixed. If it is an incredible performance, you just might turn it up in the mix and bring it out front to show off the talent. On the other hand, if it isn't incredible, don't put it out front, especially without any effects on it. You don't want to highlight something that isn't incredible. At least turn it down a little in the mix or put a bit of reverb or some other time-based effect on it to smooth out (or hide) the rough edges. However,

don't bury a bad performance too much. Don't put too much reverb on it and don't turn it down too much. Bury it, but not too deep. You would then not only have a bad performance, but also a bad mix.

Quality of the Recording Equipment and the Recording

If you have cheap equipment, you shouldn't make the mix too bright and crispy because it will show off any noise and distortion. With better equipment, you can often make your mixes cleaner and clearer. Also, if you are careful with miking and levels to tape, you won't have to fix it in the mix later.

Commonly, it is the lyrics and the performance that play the biggest parts in determining what is done in a mix. However, this can vary drastically from song to song. Often, one aspect or another will dictate the mix more than the others. Perhaps the best type of mix is where all of these values play an equal part (more or less).

So, where do your own values lie? Which one of these ten aspects of the song would you think is the most important in determining the eleventh aspect: the mix?

SECTION C

The People Involved

The tricky part is to balance your own values with the rest of the people involved. Engineering is balancing the desires of the client with your own values in the music. The job of the engineer is to take the values, suggestions, and ideas of everyone involved and decide which ones are best for the project. The professional engineer listens to all ideas and compares them with his own values and the values of the mass audience. He or she then discusses those feelings about the idea, often does a test run on the idea, and then works with the client to make a final decision. This balancing act is one of the most difficult jobs of the recording engineer.

The problem arises when the band asks you to do something that will decimate the mix. They will often ask very nicely, "Could you please make the mix suck?" They might want their instrument louder or too low. They might want someone who is in the band (but who has bad pitch) to be louder: "They're in the band; they've got to be in the mix." Regardless of how obviously wrong they are, the problem is that they are paying for the session. When first starting out, it is much safer to go with whatever the band wants. Then the band can't blame you for a bad mix if it is their

fault. The problem is that you end up with bad mixes, and you can't exactly put a disclaimer on the album!

Therefore, it is worth your while to go out on a limb and make suggestions to fix things for the good of the project, for the good of the band, and for your own good. The worst case is when the band tells you to do something that is obviously wrong, and then a couple of weeks later they come back to you and are unhappy, displeased, or even angry, having forgotten it was their request in the first place.

When you know you are right, you should try to make a case for it; but be sure you are right. The absolute worst thing that could happen is to convince the band that you are right when you aren't. The band is going to listen to the project hundreds of times after they leave the studio—in a wide range of places, with all different kinds of ears. Later, they will know for sure if something is not right. Therefore, if you are going to try and convince someone that you are right, you had better be right.

Once you have gained the experience to know you are right, you need to become skilled (and diplomatic) at explaining logically why one idea is better than another. This means knowing real reasons why something should be one way or another. Saying things like, "Trust me," or even worse, "I've been doing this for years," does just the opposite when trying to convince people that you are right.

The professional engineer develops a repertoire of realistic, logical reasons for the specific ways that sounds are placed in a mix. And if a situation happens when you can't think of the right thing to say to the band to make them understand . . . don't go to sleep that night until you figure out the thing that you could have said. Then, don't ever forget this reasoning because there is nothing worse than having the same situation happen again and still not be able to explain to the band why they might be wrong.

The ideal engineer is one who not only knows what is best for the project, but also knows how to explain why to the clients.

Here are some examples of explanations or reasoning that make sense. Say the band is asking you to turn up the kick drum too much. There is a wide range of levels that the kick could be at and still be within the realm of preference. The problem comes when it is obviously outside the realm of preference. You might say something like, "You know, for this style of music and this type of song, it is rare that a kick drum is ever this loud in the mix. Do you really want it to be that loud?"

Or let's say the singer wants you to turn up the vocals volume. Again, you might point out that for

this style of music, it is almost abnormal to have the vocals that loud. You might also point out that when the vocals are turned up that loud, it dwarfs the rest of the band, making it sound wimpy. Ask them if that's what they really want.

When doing rap or hip hop, the band often wants the 808 rap boom sound to be so loud that it rumbles the windows. This is usually because they are used to listening with the bass EQ cranked all the way up (either in their car, at home, or at clubs). Therefore in the studio, the rap boom might not seem big enough to them without this bass boost. Just pointing out how it is going to be boosted more with EQ in the real world can make them realize that they shouldn't boost it too much in the studio—otherwise it could seriously blow up speakers later.

Another example involves the reverb level placement in a mix. The problem occurs when you listen to reverb in solo. Once you have heard it alone, your mind recognizes it better when it's in the mix. Therefore, it seems bigger in the mix than it did previously. Because of this psychoacoustic effect, the band often wants the reverb lower than what you commonly hear on the radio. Explaining this phenomenon to them can help you get reverb up to a more appropriate level and help them understand the reason why.

Here's one final example. Perhaps the band wants to put an effect like reverb or delay on a sound like a bass guitar or kick. You might explain that bass instruments already take up a lot of space in a mix. Because reverb is made up of hundreds of delays, it really takes up a lot of space. When reverb is extra bassy, it takes up even more space, thereby masking other sounds tremendously. Explaining this to the band will help them realize how much these sounds are masking the other sounds in the mix.

As you can see, it becomes critical to truly understand the dynamics that go on in a mix, so you can logically explain to a band why one move makes more sense than another. Of course, there are times when you just might be wrong. After all, it takes all types for the world to go 'round. Therefore, it is important to not be too attached to your ideas. If someone is still adamant about their ideas after you have discussed everything, then give it up. It's good to be confident about your opinions and present them strongly, but don't get too attached. It is important to remember that the band may not be able to explain why they want what they want, but their ideas are still cool. Often if they hear it, they will realize it doesn't work. Also, just as often, when you hear it, you might realize it is actually cool, or it might help you think of another idea that makes more sense. If they still want it after they have heard it, keep it. You can always make two mixes, one with your ideas and one with

theirs, but do this only as a last resort. Not only does it take more time, but you are also putting yourself at odds with the client. It is good to be certain that it is necessary before you take the time to make two mixes.

Values of the Engineer

The experienced engineer must attain a highly developed set of values to justify making certain decisions. Once you have gained the experience to really know what is (probably) right, you can then command that respect.

Some engineers are more intense than others and are less prone to listen to someone else's ideas. The extreme case is the engineer who won't allow the band in the room during the mix. These engineers may be talented, but they don't understand their art enough to explain it to someone else. On the other hand, some engineers have paid their dues and are so experienced they have earned the right to be intense. The problem occurs when a recording engineer's ego or intensity is not backed up by experience.

Values of the Clients

The experienced engineer knows the importance of paying special attention to other people's ideas, even if they are out of the ordinary (or completely nutty). It is important for the client to realize that you care about their ideas. The trick is to get very quick and sharp at weeding out bad ideas (or less than great ideas) from good ones without hurting their feelings.

Usually, the client is not as experienced as the engineer. The client normally does not know all the capabilities of the studio equipment. This is not to say that they don't know what they like; they just don't know how to achieve it.

However, the band and the songwriter do have a major advantage over you as the engineer. First, they have already spent a lot more time with the song and know it much more intimately. Fresh ears on a song are nice, but intimacy helps. Second, the songwriter might have ideas that no one else could possibly come up with because he or she is so intimately involved with the creation of the song. If we think of a song as an extension of a person's personality—of his or her feelings and emotions—then it makes sense that the person who wrote the song would have more cohesive or holistic ideas for the mix.

It is the job of the engineer to pick up on the heart and soul of the song, the feel, in order to create a mix that is most appropriate for the song—whether that means sweetening it or creating tension. Paying close attention to the band and the songwriter's ideas can help you access this heart and soul.

It is, therefore, important to figure out the values and desires of the client. Engineers often ask the client about their values and then listen closely for any clues as to what kind of mix they might like. One of the trickiest predicaments occurs when you are working with someone who is extremely inexperienced or unclear about the recording and mixing process. The problem is that someone who knows nothing about recording can, out of the blue, come up with a completely ingenious idea. Often, bizarre requests, seemingly devoid of any reason, can be pure genius. In fact, I imagine that whoever first worked with David Byrne must have wondered about him at first.

On the other hand, you can't count on someone who is extremely experienced but has an incredible ear to always come up with ingenious ideas. You never know when the next thing that comes out of their mouth will be nonsense. To quote a few lines, "Don't judge a book by its cover," and "Out of the mouths of babes can come true wisdom." In other words, never judge someone based on preconceived ideas of who they are. Meet them on a creative level. Genius can easily be masked by nervousness. In fact, take it as a challenge. Remain on your toes at all times—ready to weed out the genius from the B.S. with one fell swoop of logic and aesthetic values. Actually, it is often more like a slow tug of war than a fell swoop.

The truth of the matter is that if you simply gather all of the ideas from everyone involved in the project, you will end up with a plethora of cool ideas. In fact, as the engineer, you should be gathering these ideas from the second the band walks in the door. Whenever anybody (including yourself) comes up with a good idea, store it in your creative bank. Write them down, so you don't forget any of them.

You should be on the lookout for any good ideas that pop up throughout the session no matter how small or off the cuff. You might overhear someone talking to someone else saying that they would like to put an echo at the end of one of the vocal lines. Snag it out of the air and put it in your creative bank. What commonly happens is that during mixdown, both you and the band will forget the idea. Then, a couple of weeks after you've mixed the song, the band member who had the idea will be listening to the project and say, "Dang it, the engineer forgot to put that effect on the vocal. I'm going to another studio next time." No matter how off the cuff, don't forget any idea. Of course, you don't have to use every one, but it's nice to have a bunch of them to choose from.

Most importantly, don't forget to gather your own ideas as well. Put them in your creative bank, so you can cash them in on the mix.

Values of the Mass Audience

Often a band comes into the studio, and they just want their music to sound like a hit. Some people see this as blasphemy, selling out, and the death of pure heart and feeling in music. This may be true for songwriting, but in mixing, this is not necessarily the case. Often the most creative types of mixes appeal to the largest audience. Some of us would be very happy to be able to create mixes similar to what is currently on the radio.

As an engineer, it is helpful to listen and stay on top of current music industry trends. The way that each style of music has been mixed throughout the history of recording often plays an important role in how a particular project should be treated. Therefore, it is important to check out how each specific style of music has been commonly mixed.

Whenever you hear a song, note everything that is going on in the mix (if you have the time and are actively listening). Note the volume, panning, EQ, and effects of every instrument in the song.

Ask yourself, "Why did the engineers do what they did? Why is the volume the level it is? Why was it panned where it is? Why that silly EQ? What caused them to use those effects in that way?" And even, "What were they thinking, anyway?" Then, most importantly, ask yourself, "Do I like where the engineer placed each sound? Would I have put it there?"

The first time you hear a sound, you may not have an opinion. But the next time you hear it, note how it is different. Once you hear the sound a third time, if you are listening closely, you will probably be able to tell which of the three sounds seems to be the best to you. After you have done this for a few years, you will gain an incredible perspective on what others are doing and you will know what your own values are! Then you can do whatever you want. When you go to do a mix, you will set each instrument exactly where you want it. And if anyone disagrees, you have the experience and confidence to tell them that you really think it should be this way. It could be argued that it is better for the engineer to use personal experience and intuition to set new trends instead of following them. And if you can feel it, go for it. But until then, it's a good idea to check out what others are doing, so that you can develop your own perspective.

NOTE: The equipment that the music will eventually play on is another minor but important factor that will influence the way it is mixed. If the project is going to play on a cheap car radio, it is important that there is enough bass in the low mids. It will do no good to boost the low bass; it won't be heard. Also, when mixing for movies, you might add more sub-bass at certain critical moments. When mixing techno

music for a rave (or party), you might bump up the bass. You are locked to the container that the project will play on, so take it into consideration.

It is obvious that the mix should fit the style of music—in fact, it almost goes without saying. But in addition to the style of music, the more the people involved pay attention to the song as the primary guide in determining the mix, the more cohesive the mix will be. The mix is normally much better when everyone involved is basing their opinions on the song instead of their own personal desires. It's really great when everyone in the room is listening to what the song is telling them to do in the mix. Yet, you never know when a person might have some inspiration from another world—whether it comes from God, angels, or space aliens—that is pure genius. Such ideas might be more appropriate than basing the mix on the song itself. However, it is usually best to use the song with all of its details to determine what you do in the mix.

CHAPTER 4

Functions of Studio Equipment and Visual Representations of All Parameters

There are three components to sound: volume (or amplitude), frequency, and time. That's it. To simplify the operations of a huge variety of studio equipment, I have broken down the equipment into categories based on the function of each piece in the recording studio:

1. Sound Creators: all instruments, acoustic to electric, voice to synths
2. Sound Routers: mixing boards, patchbays, splitters
3. Sound Storers: recorders, tape players, sequencers, samplers
4. Sound Transducers: mics, pickups, headphones, speakers
5. Sound Manipulators: processing, effects

As every sound manipulator used in the studio controls either volume, frequency, or time, each can be categorized based on the main component(s) that they control:

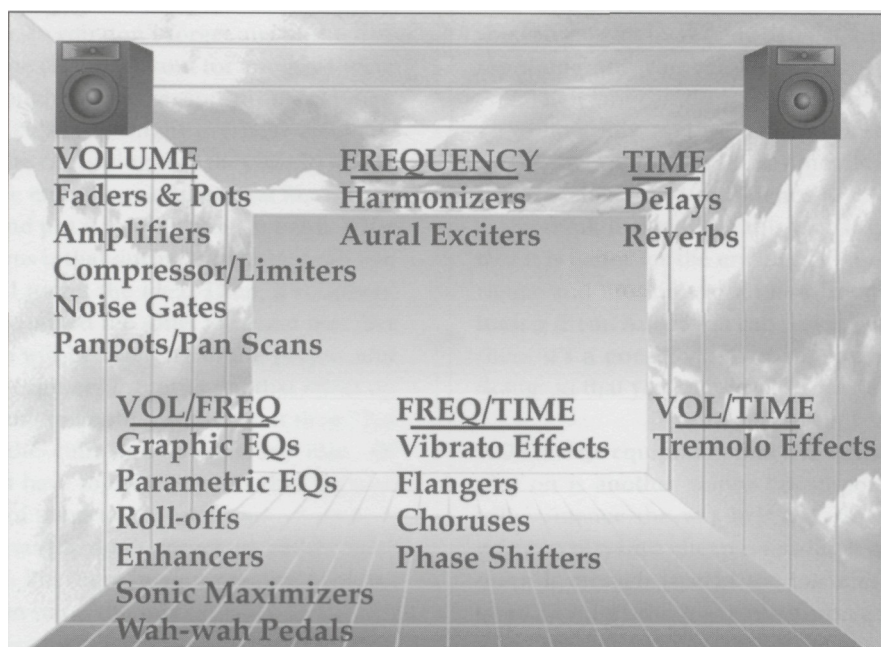
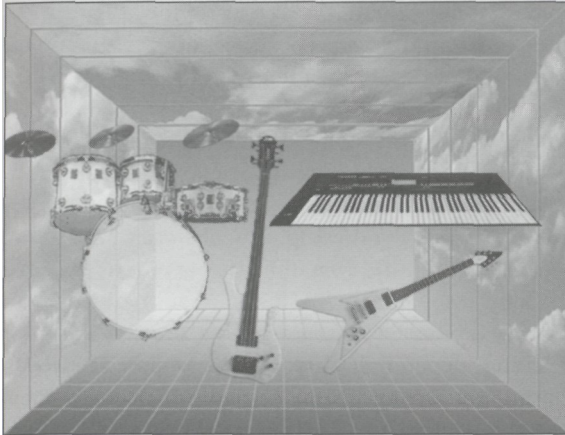


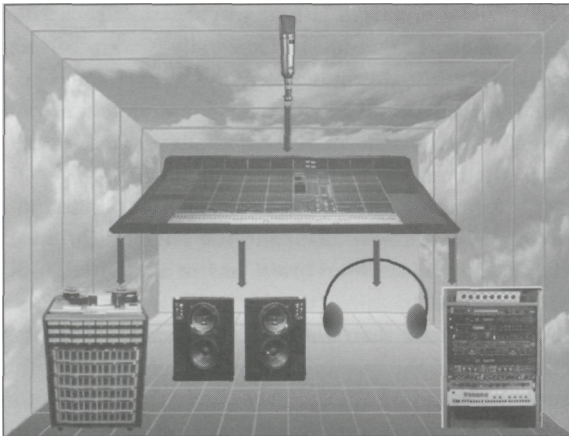
Chart 1. All Sound Manipulators

Sound creators range from acoustic to electric instruments, from voice to synthesizers.



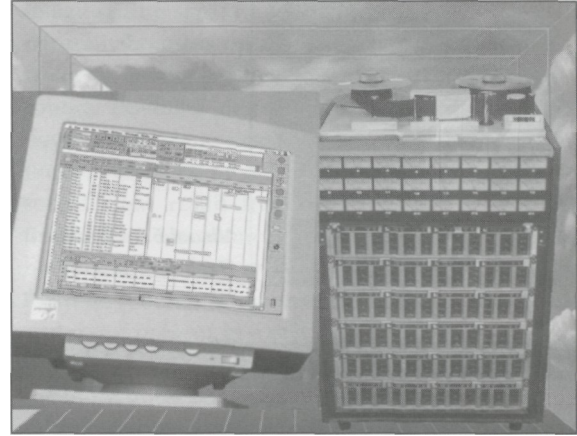
Visual 51. Sound Creators

Sound routers route sound from one place to another. Mixing boards route the signal to four places: the multitrack, the monitor speakers, cue headphones (for the band out in the studio), and the effects (so we can have a good time). Patchbays are just the back of everything in the studio—the back of the mic panels, the back of the multitrack (inputs/outputs), the back of the console (ins/outs), and the back of the effects (ins/outs)—located next to each other so we can use short cable to connect them.



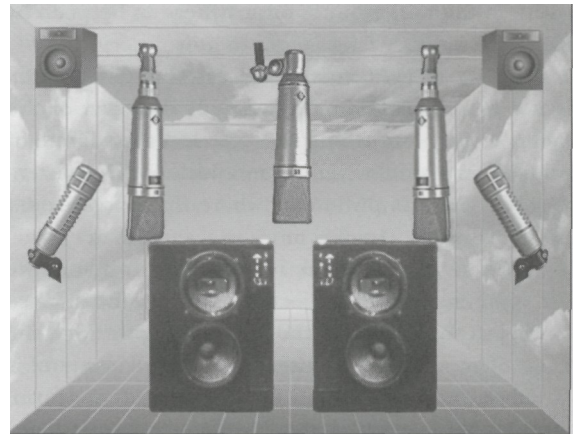
Visual 52. Sound Routers

Sound storers store sound and play it back. Tape players store digital or analog sound; sequencers store MIDI information. Some sound storers can be used to edit the sound while it is stored.



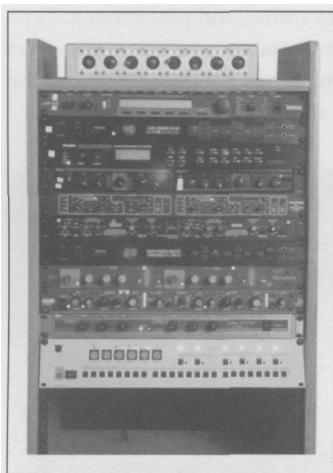
Visual 53. Sound Storers

Sound transducers take one form of energy and change it into another. Microphones take mechanical energy, or sound waves, and change it into electrical energy. Speakers take electrical energy and change it into mechanical energy, or sound waves.



Visual 54. Sound Transducers

Most of this chapter will be spent on sound manipulators. This includes processing that is used to change a sound (or effect) by adding an additional sound (or effect) to an existing sound.



Visual 55. Effects Rack

SECTION A

Volume Controls

FADERS

Volume faders control the volume of each sound in the mix, including effects. The set level of each sound is based on its relationship to the rest of the tracks in the mix. When volume is mapped out as a function of front to back, we can place any sound or effect up front, in the background, or anywhere in between by using the faders.

However, the level that we set a sound in the mix is not based solely on the fader. If the level of the faders was the only thing that affected the volume of a sound in a mix, we could mix without even listening. We could simply look at where the faders are set on the console. There is more to it than that.

When we set volume relationships in a mix, we use apparent volumes to decide on the relative balance—not just the voltage of the signal going through the fader. The apparent volume of a sound in a mix is based on two main things, fader level and waveform, and another minor one, the "Fletcher/Munson Curve" (see description next column). First, the level of the fader does affect the volume of the sound. Change the level of the fader and the sound gets louder or softer.

Fader Level

When you raise a fader on a mixing board, you are raising the voltage of the signal being sent to the amp, which sends more power to the speakers, which increases the "sound pressure level" (SPL) in the air that your ears hear. Therefore, when you turn up a fader, the sound does get louder. So, obviously, if you want something louder in a mix, turn it up.

We use the decibel (dB) to measure the ampli-

tude of the signal at each stage of this circuit. In fact, there are very specific relationships between voltage, wattage, and sound pressure level. Decibels are the main variable that we use to control the apparent volume of a sound. However, there is another important factor: the waveform of the sound.

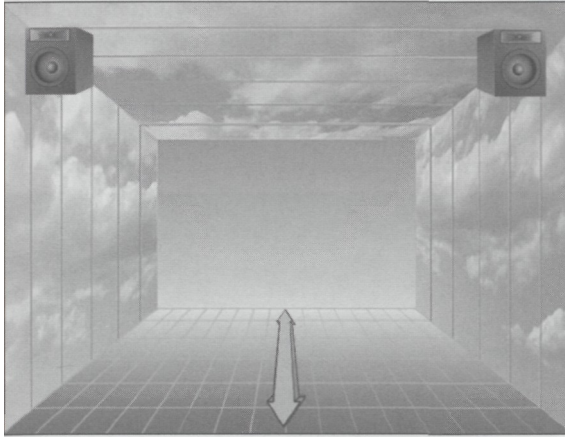
Waveform (or Harmonic Structure)

The waveform, or harmonic structure, of a sound can make a big difference as to how loud we perceive the sound to be. For example, a chainsaw will sound louder than a flute, even if they are at exactly the same level on the VU meters. This is because the chainsaw has harmonics in the sound that are irritating—or exciting, depending on your perspective. These odd harmonics scream at our psyche, which make them seem louder to us. Therefore, a screaming electric guitar will sound louder than a clean guitar sound, even if they are at the exact same volume in the mix. A minor factor contributing to the apparent volume of a sound is the Fletcher/Munson Curve.

The Fletcher/Munson Curve

The biggest problem with the human hearing process is that we don't hear all frequencies at the same volume—especially those at low volumes. (Fletcher and Munson did a study that shows just how screwed up our ears are.) This is why there are loudness buttons on stereos. However, most people like extra lows and highs, so they leave the switch on all the time. The main point here is that you should check your mixes at all volume levels. Especially beware of mixing at very low volumes all of the time because you won't be hearing bass and treble as much as you should. Also, whenever you do a fade at the end of a song, the bass and treble will drop out first.

"Apparent volume" is, therefore, a combination of decibel level, waveform, and the Fletcher/Munson Curve. But relax. Our brain has it all figured out. Most people have no trouble telling whether one sound is louder than another. Our brain quickly calculates all of the parameters and comes up with the apparent volume. All we have to do is listen to the overall apparent energy coming from each sound in the mix. You use apparent volume to set volume relationships in the mix. You don't look at the faders; you listen for the relative volumes. As previously discussed, apparent volume is most naturally mapped as a function of front to back.



Visual 56. Volume as Front to Back

COMPRESSOR/LIMITERS

Compressor/limiters were originally introduced into the studio to stop the loud peaks from distorting or saturating. Compression and limiting are volume functions; their main purpose is to turn the volume down. They turn down the volume when it gets too loud—that is, when it goes above a certain volume threshold. When the volume is below the threshold, the compressor/limiter does nothing (unless broken or cheap). The difference between compressors and limiters is explained later.

Compressor/Limiter Functions

Compressor/limiters have two main functions (and three other minor ones). The first function is to get a better signal-to-noise ratio, which means less tape hiss. The second function is to stabilize the image of the sound between the speakers, which means more presence.

Better Signal-to-Noise Ratio: Less Hiss

Recording extremely dynamic sounds, with a wide variation from soft to loud, requires turning the volume down so that the loud sounds don't overload and cause distortion. Distortion is against the law. Get distortion, go to jail. But when you turn the volume down, the soft portions of the sound barely move the needles on the tape player. And if the needles are hardly moving on the multitrack, you hear as much tape hiss as you do signal. This condition is known as a bad signal-to-noise ratio and sounds very similar to an ocean: "shhhhhhhhhhhhh."

By using a compressor to turn down the volume when the signal gets too loud, you can then raise the overall volume above the tape noise. By turning down the peaks, you can record the signal hotter on tape. Then, the softer portions are loud enough so that you don't hear the tape noise.

Stabilizing the Image of Sounds: More Presence

After years of using compression to get rid of hiss, people realized that sounds often appeared more present when compressed. By evening out the volume peaks on a sound, a compressor/limiter stabilizes the image of the sound between the speakers. A sound naturally bounces up and down in volume, as shown by the bouncing pointer on a VU meter. When several sounds fluctuate naturally, their bouncing up and down can become extremely chaotic. A compressor/limiter stabilizes, or smoothes out, the movements of sounds that result from these moment-to-moment fluctuations in volume. Once compressed, the sound no longer bounces around much, so the mind can focus on it better. Therefore, the sound seems clearer and more present in a mix.

The busier the mix (the more instruments and the more notes per instrument), the more the sounds in the mix are normally compressed. This is because the more sounds and notes, the more chaos. It is difficult to keep track of a large number of instruments in a busy mix in the first place. By stabilizing the sounds, the entire mix becomes clearer.

Once a sound has been stabilized, you can then turn up the overall volume and put the whole sound right in your face. This is commonly done in radio and TV commercials to make them sound louder, so that they jump out and grab your attention. This might be annoying in radio and TV commercials, but it's great for a lead guitar or any other instrument you want extremely present in the mix.

This also works when putting sounds in the background. The problem with low volume sounds is that they can easily be lost (masked by the other sounds) in the mix, especially if the volume of the sound fluctuates much. Therefore, it is common to seriously stabilize sounds that are going to be placed low in the mix with compression. They can then be placed extremely low in a mix without fear of losing them.

NOTE: A better signal-to-noise ratio is obtained by compressing the signal on its way to the multitrack. However, many engineers will also compress the signal on its way back from the multitrack during mix-down to stabilize the sound even more.

Sharper or Slower Attack

Besides less hiss and more presence, a compressor/limiter also makes the attack of a sound sharper. Once you turn down the louder part of a signal, a sound reaches its maximum volume much quicker.

With a shorter and sharper attack, sounds are much tighter, punchier, more distinct, and more precise, which makes them easier to dance to. On the other hand, a higher quality, fast compressor will

actually help to remove sharp "spikes" on the attack of a sound—softening the sound. A good compressor can mellow out the sound of a sharp guitar.

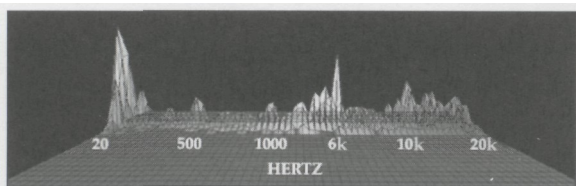
More Sustain

A compressor/limiter is also used to create more "sustain." This is commonly used on a guitar sound. Just as a compressor is used to turn down the volume peaks to raise a sound above the tape noise, it can also be used to turn down the louder parts of a guitar sound, so the guitar can be raised above the rest of the mix. Sustain is also especially helpful for obtaining feedback (when the guitar is held directly in front of a guitar amp).

Compressors are sometimes used in the same way to create more sustain on tom and cymbal sounds. The sounds seem to last longer before they lade out or are absorbed into the mix. However, the trade-off is that compressing toms and cymbals will bring their level down, so that you actually hear the bleed more. However, depending on your musical values and the project you're working on, you may want to give this a try.

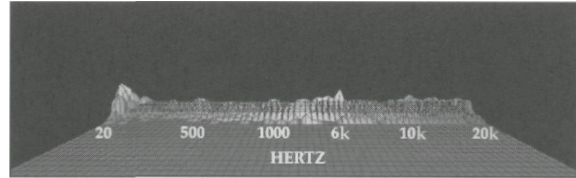
Less Resonance

A final function of a compressor/limiter is that it evens out resonances in a sound. Resonances occur in two places in instruments: hollow spaces and materials. When a hollow space (like the body of an acoustic guitar) has two parallel walls, it will boost the volume of particular resonant frequencies. Materials (like the neck of a bass guitar) will also resonate at certain frequencies, boosting the volume of those frequencies.



Visual 57. Actual EQ Curve of Resonance (Silicon Graphics "AMESH" Spectrum Analysis)

Therefore, certain notes on the instrument will actually sound louder than others. A compressor/limiter evens out the volume of these resonances by turning down the loudest part of a sound, which just happens to be the resonances.



Visual 58. Resonance Flattened Out

This is why compressor/limiters are so commonly used on resonant instruments like bass guitar, acoustic guitar, and voice.

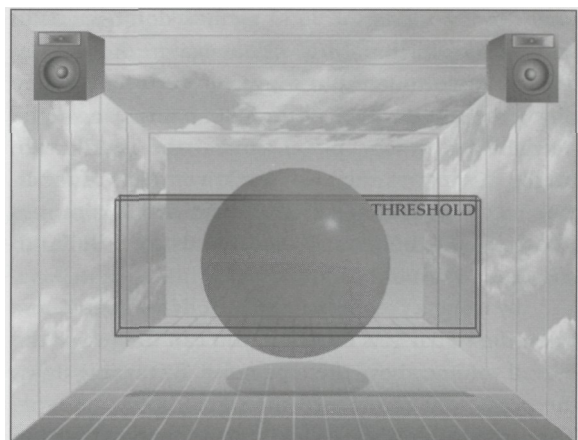
Compressor/Limiters: How to Set Them

Most compressor/limiters have two main controls, commonly known as the threshold knob and the ratio knob. On some units the threshold is called "trigger gain," "input," or "compression."

Ratio Settings

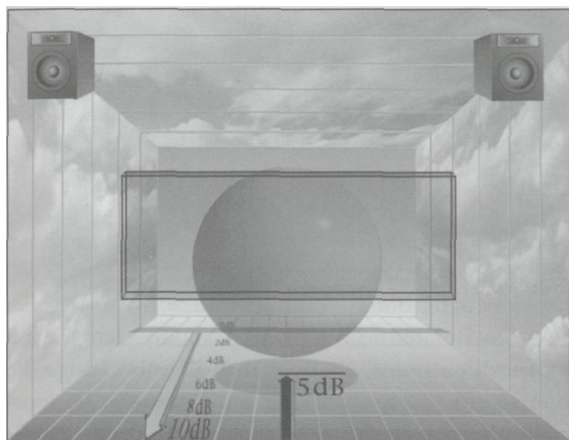
The ratio settings control how much (by percentage) the sound volume will be turned down when it goes above the threshold. For example, if a sound is 10dB above the threshold and the ratio is set to 2:1, it will be turned down 5dB. If a sound is 30dB above the threshold, it will be turned down 15dB. Ratio settings normally range from 2:1 to ∞:1 (infinity to one).

Visuals are especially effective in explaining the functions of the threshold and ratio knobs on compressor/limiters. If volume is shown as a function of front to back, the sphere will bounce back and forth based on the VU meter. It will then come out front and slam into the threshold.



Visual 59. Sound Smashing Into Threshold on Compressor/Limiter (see color Visual 59C)

The difference between a limiter and a compressor is that a limiter stops the volume from getting any louder than the threshold. The problem is that when a sound is steadily rising in volume then suddenly stops cold at the threshold, it doesn't sound natural to our ear. It sounds squashed. A compressor on the other hand, allows the volume to get a bit louder than the threshold based on a ratio, or percentage. If we set the ratio to 2:1, it will go this far:



Visual 60. 2:1 Ratio on Compressor/Limiter

A good starting point is the ratio of 4:1; this will still turn the volume down, but won't squash it. You can set the ratio wherever you like, but most people just starting out can't hear the difference between ratio settings very well. Until you can, 4:1 is a good place to start.

Threshold Settings

As the threshold is lowered on a compressor/limiter, the volume, or gain, of the sound is reduced. The compressor/limiter meters or LEDs labeled "gain reduction" will then bounce backward, showing the exact amount of volume reduction at each moment.

When adjusting the threshold, don't look at the threshold knob; rather, watch the gain reduction meters, because the threshold directly affects the amount of gain reduction. Turn the threshold knob until you get a maximum of 6dB gain reduction. If you set the threshold lower so you get more gain reduction, it will sound like it is squashed.

However, for some instruments, like lead guitar, percussion, or extremely dynamic screamer type vocals, the threshold is commonly set to provide a maximum of 10dB of gain reduction. Background vocals are also commonly compressed at 10dB max.

Again, once you can hear the nuances of various compression settings, you can set ratio and threshold the way you want for the style of music, the song, and

the sound itself. Until then, try setting the ratio at 4:1 and the threshold for 6dB of gain reduction.

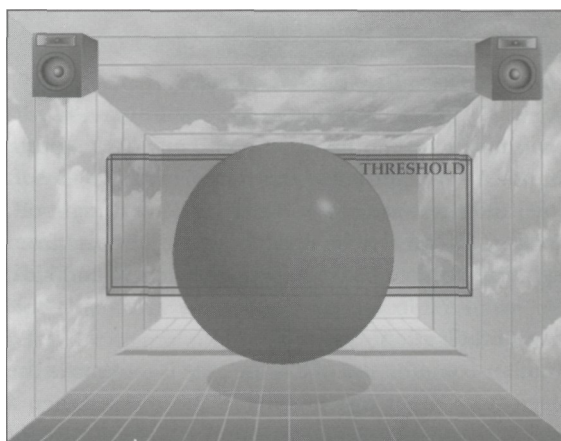
How Much Compression?

There are two main things (and several other minor ones) that determine how much you compress. The first thing is that the more instruments and the more notes you have in a mix, the more you generally compress because otherwise the mix gets too chaotic and busy. The second determining factor is the style of music; certain types of music, such as pop, are commonly compressed more.

You can also use a compressor/limiter on some sounds as a special effect. Heavy compression or limiting tends to make a sound seem unusually up front—almost as if it is inside your ear.

NOISE GATES

Operating similarly to a compressor/limiter, a noise gate turns the volume down (therefore, compressor/limiters and noise gates are often packaged together in one box). The difference is that a compressor/limiter turns the volume down above the threshold, while a noise gate drops the volume when the volume falls below the threshold.



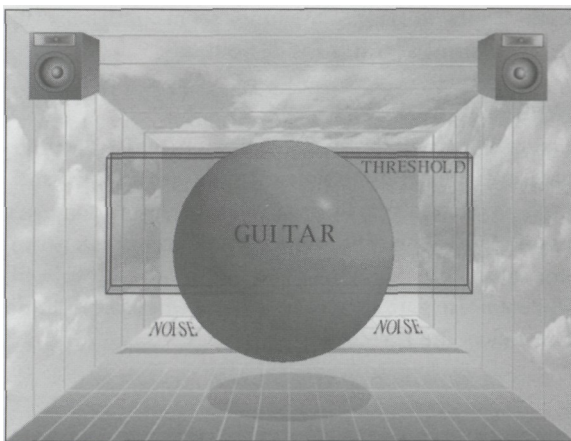
Visual 61. Sound Fading Out Past Threshold on Noise Gate (see color Visual 61C)

Noise gates have three main functions: to get rid of noise, to get rid of bleed, and to shorten the duration of a sound.

Noise Eradication

The first function of a noise gate is to get rid of noise, hiss, or anything annoying that is low in volume. However, noise gates only get rid of background noises when a sound is not playing. Noise gates don't get rid of noises while the main signal is present; however, you normally can't hear the noise when the sound is playing.

For example, one function of a noise gate is to get rid of amp noise when a guitar is not playing. Say you have a guitar amp set on "11" with lots of distortion. When not playing, the amp makes this huge "cushhhhhh" sound (when the guitar is playing, you don't hear the amp noise because the guitar is so incredibly loud). You set the noise gate by having the guitar player hit a note and sustain that note until it fades. Then the noise of the amp takes over. The threshold of the noise gate is set so as soon as the volume fades enough to hear the amp noise, it's cut off. This way, the amp noise is cut off whenever the guitar player is not playing.

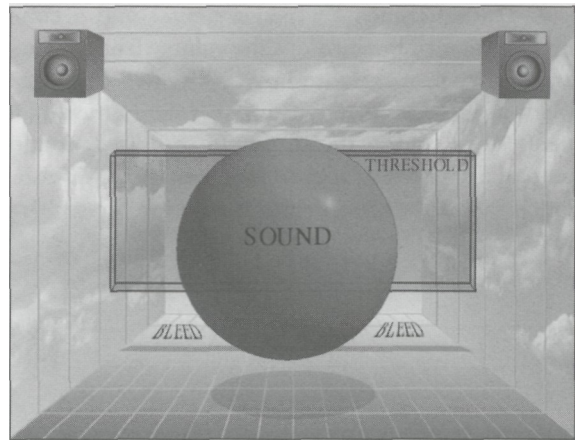


Visual 62. Noise Gate on Guitar Sound

It is important not to chop off any of the guitar sound. All it takes is for the musician to play a soft note, and the noise gate will chop the sound right off. Noise gates can also be used to get rid of noise from tape hiss, cheap effects units, dogs, crickets, and kids.

Bleed Eradication

Another common use of a noise gate is to remove the bleed from other instruments in the room. When a mic is on an instrument, the sound of that instrument will be loudest in the microphone. Therefore, it is easy to set the threshold of a noise gate between the sound and the bleed, so that the bleed gets turned off.



Visual 63. Noise Gate: Threshold Set Between Sound and Bleed

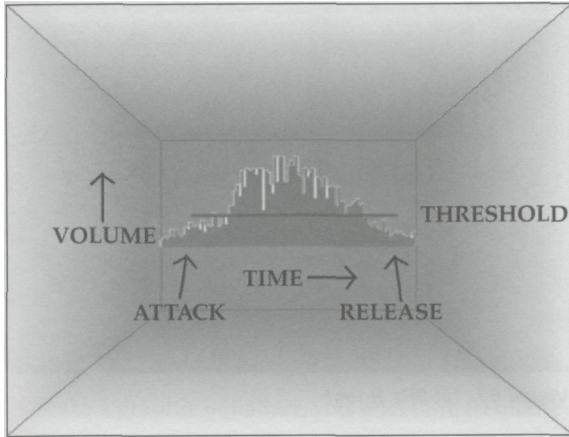
The obvious advantage of isolating a sound like this is that you have more individual control over volume, equalization, panning, and effects. Once a sound is isolated with a noise gate, any changes you make with a sound manipulator will only change the one sound you are working on. Gates can be especially effective on drums to isolate each drum. This is especially important on a snare when you have a lot of reverb. Without the gate, you end up with reverb on the hi-hat as well. Another advantage of isolation is that it helps to eliminate phase cancelation (we'll discuss this more later).

But most importantly, by removing the bleed, you will then hear the sound in only one microphone. This has the effect of putting the instrument in one precise spot between the speakers, instead of being spread in stereo. For example, consider the miking of a hi-hat cymbal. Besides being picked up by the hi-hat mic, the hi-hat is also being picked up by the snare drum mic. If the hi-hat mic is panned to one side and the snare mic (with the hi-hat bleed) is panned to the center, the hi-hat then appears to be spread in stereo between the speakers. It is no longer clear and distinct at a single spot in the mix. A noise gate can be used on the snare mic to get rid of the hi-hat bleed. The isolated image of the hi-hat will now appear to be crystal clear and precisely defined wherever the hi-hat mic is placed in the mix.

It is true that sometimes a stereo effect is desirable on a sound. However, normally you would not use the bleed from a second microphone on another instrument; instead you would put two mics on the same sound. Even so, it is rare that individual drum sounds are spread in stereo. Staccato sounds are just too bulky when recorded or mixed in stereo.

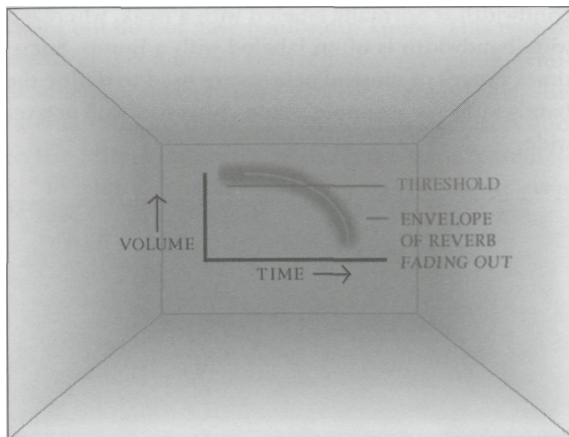
Shortening the Duration

You can also use a noise gate to shorten the duration of a sound. The noise gate will cut off both the attack and release of a sound because these are commonly the softest parts of the sound. This can be quite an unusual effect.



Visual 64. Noise Gate Cutting Off Attack and Release of Sound

A noise gate can also be put on reverb to chop off the release, resulting in the well-known effect referred to as "gated reverb."



Visual 65. Envelope (Change in Volume Over Time) of Gated Reverb

Visually, when volume is shown as front to back and the volume is less than the threshold setting, the sound will disappear. If the low volume sound is noise, bleed, or the attack and release of a sound, it gets cut off.

SECTION B

Equalizers

EQ is a change in the volume of a particular frequency of a sound, similar to the bass and treble tone controls on a stereo. It is one of the least understood aspects of recording and mixing probably because there is such a large number of frequencies—from 20 to 20,000Hz. The real difficulty comes from the fact that boosting or cutting the volume of any one of these frequencies depends on the structure of the sound itself: Each one is different. But even more complex is the fact that different sounds are equalized differently depending on the type of music, the song, and even the people you are working with.

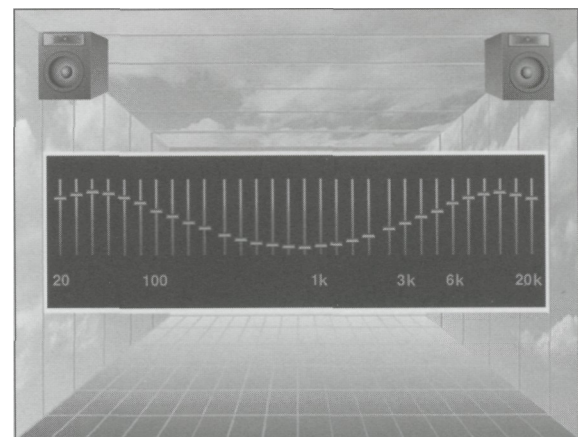
First you must learn all the frequencies or pitches by name. Then, you will see how boosting or cutting a certain frequency affects different instruments in different ways.

Types of Equalizers

There are three main types of equalizers found in the recording studio: graphics, parametrics, and roll-offs (highpass and lowpass filters).

Graphics

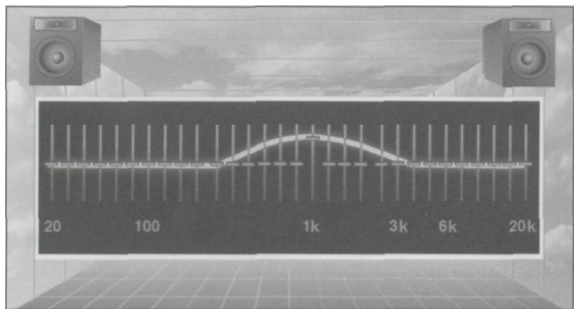
Each frequency can be turned up or down by using the volume sliders on a graphic equalizer. There are different kinds of graphic equalizers that can divide frequencies from five bands up to thirty-one bands. Five-band graphic equalizers are commonly found in car stereos (I have a 7-band in my car—at least, the last time I checked). Thirty-one band graphics (which will change the volume at thirty-one different frequencies) are common in recording studios and live sound reinforcement.



Visual 66. 31-Band Graphic EQ

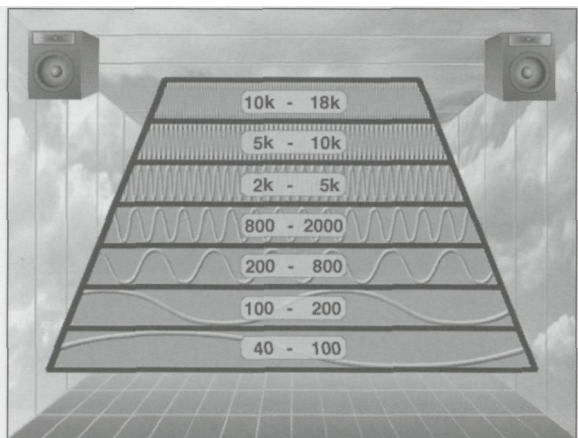
The primary advantage of a graphic equalizer is that you can make changes in volume at a number of different frequencies. Another advantage is the visual display that's easy to read for reference. (In fact, you can instantly tell what type of music someone is into by the curve of their graphic EQ.) Also, since the frequencies are mapped out visually from left to right, it is easy to find and manipulate the volume of any particular frequency.

Many people don't realize that when you turn up a particular frequency on a graphic, you are actually turning up a range of frequencies preset by the manufacturer. For example, if you turn up 1000Hz, you are actually turning up a frequency range from around 300 to 5000Hz.



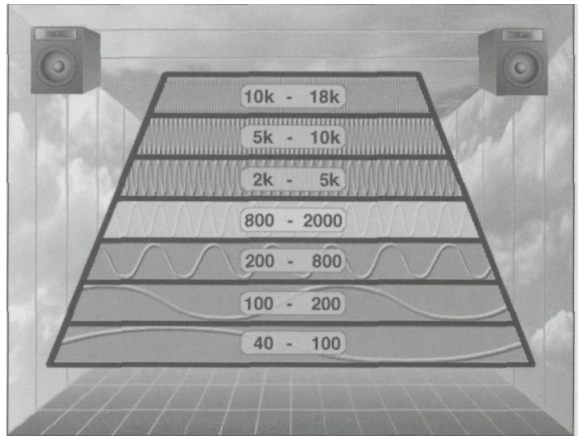
Visual 67. Wide Bandwidth on Graphic EQ

This range of frequencies is called the bandwidth and is preset by the manufacturer. You have no control over the bandwidth on a graphic. Generally, the more bands (or volume controls) there are, the thinner the bandwidth. Therefore, a 31-band graphic EQ will have a more precise frequency range for each slider than a 5-band graphic. If you turn up the volume of 1000Hz on a 5-band graphic, you could be turning up from 100 to 10,000Hz. Visually, frequency is shown as a function of up and down, so highs to lows are shown in a graphic representation.



Visual 68. Virtual Mixer Graphic EQ

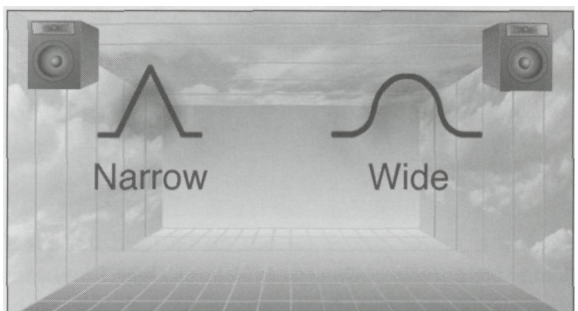
The volume of a particular frequency is shown as the brightness in that band. For example, if you turned up the highs around 1000Hz, you would see it get brighter in that frequency range, like this:



Visual 69. 1000Hz Boost

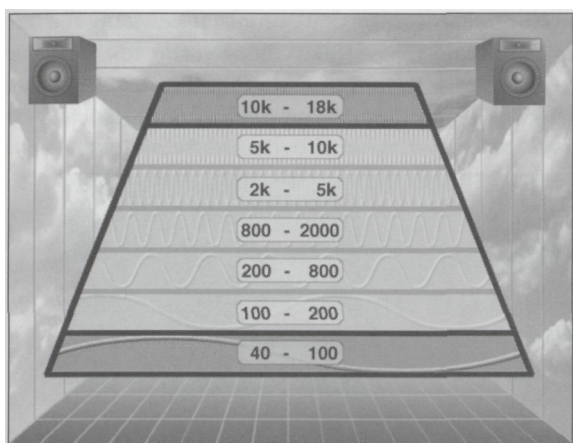
Parametrics

Engineers want to be able to control the range of frequencies, or bandwidth, they are turning up or down. With a parametric, the bandwidth knob gives you control over the width of the frequency range being manipulated. The knob is usually called "Q" because the word "bandwidth" won't fit on the knob. A thin bandwidth is normally labeled with a peak, whereas a wide bandwidth is often labeled with a hump. Sometimes ranges of musical octaves are used to define the bandwidth; for example, from .3-octaves to 3-octaves wide.



Visual 70. Wide and Narrow Bandwidths on Parametric EQ

Using visuals, the bandwidth can be shown with narrower or wider bands of color.



Visual 71. Wide Bandwidth of Frequencies Boosted

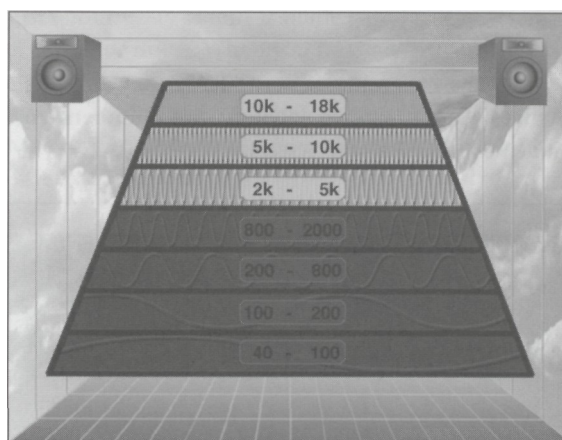
On a graphic equalizer, you select the frequency by placing your hand on the correct volume slider. On a parametric EQ, you select the frequency by turning the "frequency sweep" knob with two fingers. A separate volume knob is then used to turn the chosen frequency up or down.

Paragraphics

Many consoles have equalizers with frequency sweep knobs but do not have bandwidth knobs. This type of equalizer is commonly referred to as sweepable, semi-parametric, quasi-parametric, or paragraphic. Be careful, though, these days some manufacturers and certain salespeople are now using the term "parametric" to refer to a paragraphic or semi-parametric even though it has no bandwidth control.

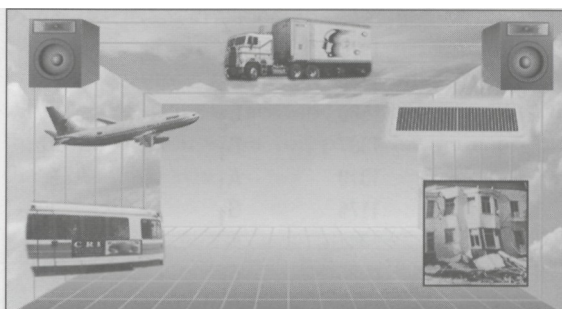
Roll-offs

A roll-off EQ rolls off low or high frequencies. They are commonly found on consoles as highpass and lowpass filters. Larger consoles often have sweepable or variable roll-off knobs, so that more of the lows or highs are rolled off. Smaller consoles often have only a button that rolls off a preset amount of lows or highs. A highpass filter rolls off the low frequencies but does nothing to the highs; it passes them.



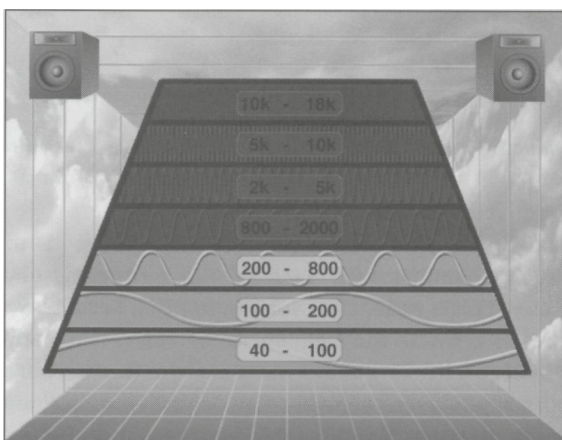
Visual 72. Highpass (Low-Cut) Filter

Highpass filters are especially helpful in getting rid of low-frequency sounds, such as trains, planes, trucks, air conditioners, earthquakes, bleed from bass guitars or kick drums, and serious foot stomping.



Visual 73. Things That Rumble

Highpass filters can be found on microphones and smaller mixing consoles as switches that simply roll off the lows when the switch is engaged.



Visual 74. Lowpass (High-Cut) Filter

A lowpass filter rolls off the high frequencies and is especially helpful in getting rid of hiss, as on a bass guitar.

FREQUENCY (PITCH)

NOTE: The difference between frequency and pitch is that frequencies are labeled with numbers and pitches are labeled with letters.

PITCH	FREQUENCY	PITCH	FREQUENCY
B ₈	7902	E ₄	330
A ₈	7040	D ₄	294
G ₈	6272	C ₄	262
F ₈	5588	B ₃	247
E ₈	5274	A ₃	220
D ₈	4699	G ₃	196
C ₈	4186	F ₃	175
B ₇	3951	E ₃	165
A ₇	3520	D ₃	147
G ₇	3136	C ₃	131
F ₇	2794	B ₂	123
E ₇	2637	A ₂	110
D ₇	2349	G ₂	98
C ₇	2093	F ₂	87
B ₆	1976	E ₂	82
A ₆	1760	D ₂	73
G ₆	1568	C ₂	65
F ₆	1397	B ₁	62
E ₆	1319	A ₁	55
D ₆	1175	G ₁	49
C ₆	1047	F ₁	44
B ₅	988	E ₁	41
A ₅	880	D ₁	37
G ₅	784	C ₁	33
F ₅	698	B ₀	31
E ₅	659	A ₀	28
D ₅	587	G ₀	25
C ₅	523	F ₀	22
B ₄	494	E ₀	21
A ₄	440	D ₀	18
G ₄	392	C ₀	16
F ₄	349		

Chart 2. Frequencies Corresponding to Pitches

Frequency Ranges

The first step in learning to use an equalizer is to become familiar with each of the frequencies by name. This is easier than you might think because we already know all the frequencies by heart. Our body has been checking them out since the day we were born (and even before). Our entire system, our entire psyche, was designed to perceive sound. We are all professional listeners with years of experience at differentiating between frequencies.

When you learn the names of the frequencies, you can begin to remember what boosting or cutting

each frequency does to each instrument. In order to make all the frequencies in the spectrum easier to remember, they can be divided into six ranges. There is no commonly accepted framework for dividing the frequencies into ranges (every book seems to divide the frequencies a little differently), so I've divided them here in the way found in most books on the subject.

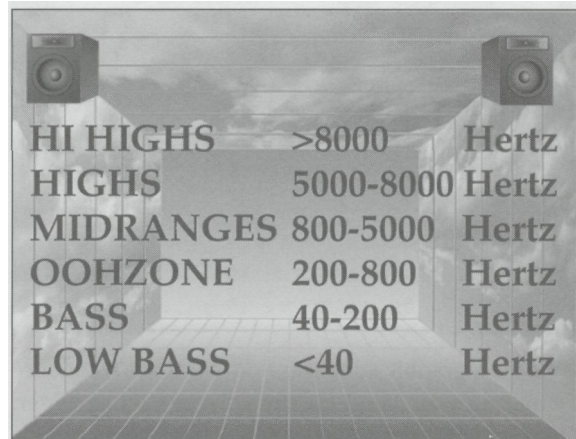


Chart 3. 6 Frequency Ranges

Low Bass: Less Than 40Hz

This range, sometimes called the "sub-bass," is commonly found in rap booms and the low bass of kick drums and bass guitars. Although it is difficult for many people to discern pitch easily at this range, it is often used in movies for earthquakes, rumbles, and explosions.

A normal vinyl LP record has about twenty-three minutes per side, usually the length of five songs. Because the grooves on a record must be wider for bass frequencies than high frequencies, you couldn't get twenty-three minutes on a record with a lot of low bass information without rolling off everything below 40Hz. This is also why you can put more low bass on a 12-inch single record. Of course, this is no longer an issue with CDs.

Bass: 40 to 200Hz

This is the approximate range boosted when you turn up the bass tone control on a stereo.

Oohzone: 200 to 800Hz

When frequencies are boosted too much in this range, they sound extremely muddy and unclear and can even cause extreme fatigue when not evened out. You'll also find that everybody in the room starts getting a bit irritated, and you'll hear people say things like, "Just mix the damn thing; I'm sick of this song anyway."

Midranges: 800 to 5000Hz

We are extremely hypersensitive to this frequency. Boosting a frequency 1dB in this range is like boosting 3dB in any other frequency range. You see, this is where we live most of the time. This is where most of our language is centered. In fact, the telephone is centered around 3000Hz because we can still understand someone when only this range is present. It is critical to be careful when boosting or cutting any frequencies here. This is doubly true on vocals because we are also hypersensitive to what vocals are supposed to sound like.

Other notable frequencies in this range include 1000Hz, which is the frequency of TV stations' test tones when they go off the air. The chainsaw frequency is 4000Hz, and it is the most irritating frequency there is, by far. It is also the frequency of fingernails on a chalkboard—eieeeek!

Highs: 5000 to 8000Hz

This range, the one boosted when you turn up the treble tone control on a stereo, is commonly boosted in mastering to make things sound brighter and more present.

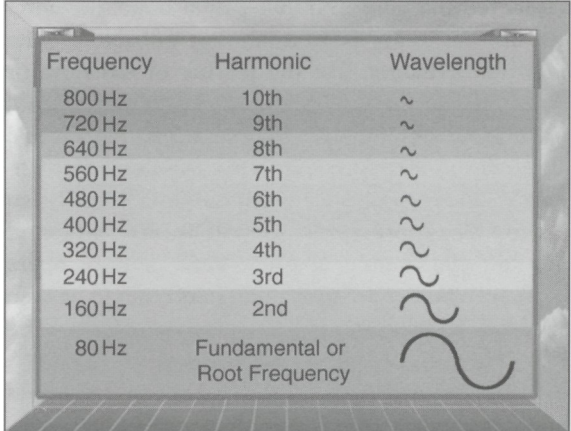
Hi-Highs: More Than 8000Hz

This is where you find cymbals and higher harmonics of sounds. Boosting this range a little on certain instruments can make the recording sound like a higher quality recording, but too much can make it irritating. By the way, that extremely high frequency that old televisions emit is 15,700Hz.

The Complexities of Frequencies: The Harmonic Structure of Sound

Specialists don't agree on how different frequencies affect our psyche, which is quite understandable because of the subjective nature of frequency perception. Psychologists and philosophers have written books on how sounds affect our mind and body and how people organize the ways they perceive frequency differences. Different frequencies affect us differently: physiologically, psychologically, and spiritually. *And even more powerful than the way specific frequencies make us feel is the way the combinations of frequencies make us feel.*

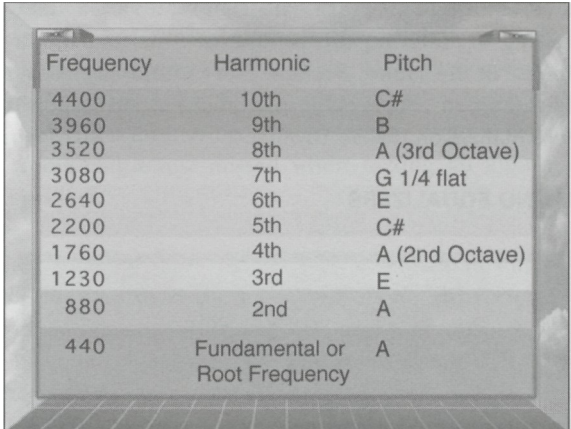
Just about every sound is made up of a combination of tones, or notes. When you hear an instrument play a particular pitch, you are hearing many other notes hidden in that sound. These other notes are called harmonics or overtones. Sounds are combinations of different harmonics.



Frequency	Harmonic	Wavelength
800 Hz	10th	~
720 Hz	9th	~
640 Hz	8th	~
560 Hz	7th	~
480 Hz	6th	~
400 Hz	5th	~
320 Hz	4th	~
240 Hz	3rd	~
160 Hz	2nd	~
80 Hz	Fundamental or Root Frequency	~

Visual 75. Pitches in Harmonic Structure for Note "A"

For example, here is the harmonic structure of the note "A" as on an acoustic guitar. Just look at all the notes present when you play what most people think of as one note:



Frequency	Harmonic	Pitch
4400	10th	C#
3960	9th	B
3520	8th	A (3rd Octave)
3080	7th	G 1/4 flat
2640	6th	E
2200	5th	C#
1760	4th	A (2nd Octave)
1230	3rd	E
880	2nd	A
440	Fundamental or Root Frequency	A

Visual 76. Harmonic Structure of Note "A" As on Guitar

It is the particular harmonics present in a certain sound that account for the differences in sound qualities, or timbres. The term timbre refers to different sounds, such as guitar vs. piano or vocal vs. accordion, as well as the differences in the sound quality of particular instruments. For example: the difference between a Martin and a Gibson guitar.

There are two interesting things about harmonics. First, each harmonic found in a sound's timbre is a pure tone. A pure tone is the sound of a tuning fork or tone generator. It has no harmonics at all. The

most amazing thing is that just about all sounds are made up of a combination of these pure tones. This means that even a screaming electric guitar sound is made of many pure tones.

So, how do you get an edgy sound from a bunch of pure tones? Well, certain combinations of harmonics will create a dissonant chord. These are the odd numbered harmonics. If you play a bunch of notes that are not in key or in tune, they will sound quite edgy and irritating, like the playing of Axl Rose or Tiny Tim (may he rest in peace). On the other hand, certain combinations of harmonics will create a chord that sounds good. These are the even-numbered harmonics. If the pitches of the harmonics combine to create a nice chord, the sound will be nice and round (like the performing of Chris Isaak or most opera singers). Whether an instrument puts out odd or even harmonics is based on the construction of the instrument and how the sound is produced.

The second interesting thing about harmonics is that they're all mathematical multiples of the root, or fundamental, frequency. The root frequency is the basic pitch we perceive when we hear a sound. For example, when we play an "A" on the guitar, even though there are numerous pitches or harmonics present in the sound, we still hear it as one pitch: "A," which is the root frequency.

Therefore, when we raise or lower the volume of a certain frequency with equalization, we are actually raising or lowering the volume of a particular harmonic in the sound. Because every sound has its own harmonic structure, every instrument sound responds to equalization differently.

USING EQUALIZERS

When to Equalize

There are five times when you might equalize a sound in a recording session. First, a sound is equalized individually while in solo when recording onto the multitrack. Second, while the entire band is rehearsing or running through the song, you doublecheck the EQ of each sound relative to all the other sounds. Then during mixdown, each sound can be equalized individually before building the mix. Most importantly, finishing touches are done on the sound's EQ (relative to all the other sounds) when listening to the whole mix at once. Finally, a bit of EQ is occasionally done during the mastering process. This is an overall EQ for the entire mix and is not necessary if a good job was done in the first place.

Equalizing in Solo When Recording Onto the Multitrack

The first step in the recording process is to equalize each sound individually. Most engineers start with the drums.

There used to be a school of thought that said you should not EQ a sound going to the multitrack. This idea was the result of inexperienced engineers screwing up the EQ on the way to the multitrack. At this point, it is very difficult to get a sound back to normal and still be able to make it sound great during mixdown. Therefore, it is important that you EQ the sound correctly onto the multitrack in the first place. The school of thought these days, though, is to definitely EQ on the way to the multitrack. In fact, professional engineers will usually try to get everything to sound like a CD on the way to the multitrack. There are some very important advantages for doing this.

First, it is much better to boost the highs on the way to the multitrack because if you boost them during mixdown you are boosting the hiss from the tape.

Secondly, the sooner you get the EQ in the ballpark, the sooner you can play ball. It is much better when you get to the final mix and the EQ already sounds close to perfect. Instead of spending all your time trying to get the mix to sound normal, you can spend your time refining extremely subtle aspects of the EQ that bring out the finer, magical aspects of the sound.

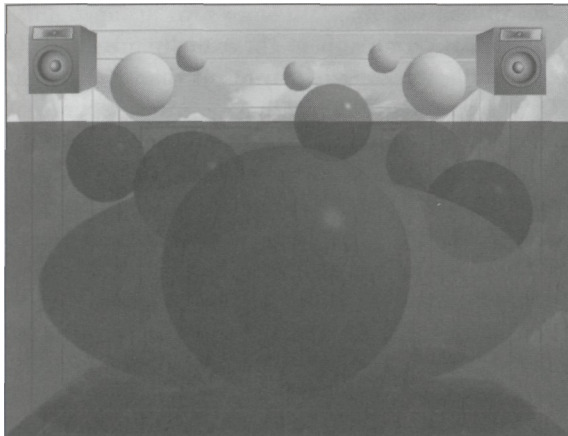
These days, most bands, especially those who have worked in major studios, expect you to get it sounding as close to a CD as possible on the multitrack. So, if you get the project sounding like a CD on the way to the multitrack, then during overdubs, everybody is thrilled with how good it sounds. And the neurons of creativity are firing everywhere because it sounds so incredible. A great mix turns people on creatively. If you don't make it sound good, you'll hear the engineer say things like, "Don't worry guys, I'll fix it in the mix." It is especially important to get things sounding great on the multitrack because overdubs can take months to complete.

The professional engineer gets to the point where he or she can guess what a sound should be alone in order for it to sound right in the mix. To do this, you must visualize what the final mix will sound like and then extrapolate how the sound should sound in solo. However, unless you have heard the band previously, you don't know what the final mix might be like. Most engineers will EQ sounds so that they sound "good" (natural or interesting) individually. The problem is that good is different for different types of music, songs, and people. However, commonly accepted values are to make sure the sound is not too muddy, too irritating, or too dull.

Equalizing in the Mix When Recording Onto the Multitrack

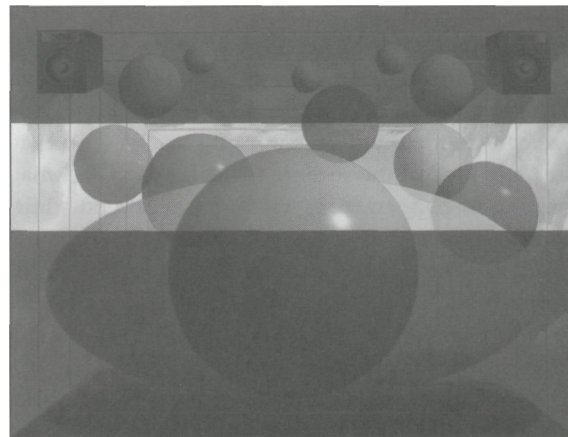
The next time to check the EQ of each sound is when the entire band starts rehearsing the song. At this point, you want to check the EQ of each instrument relative to every other instrument in the mix. You can make sounds more similar to each other or more dissimilar. You can make a lead instrument more cutting and abrasive, to really grab attention. You can give extra bass to a particular instrument to make the song more danceable or to excite the listener.

To make the process a bit easier, follow this procedure: First, scan the high frequencies and check the relative brightness of all the sounds in the song. Make sure all of them are as bright as you want them. They should have a similar amount of brightness, but sometimes you might want some sounds to be brighter or duller than others.



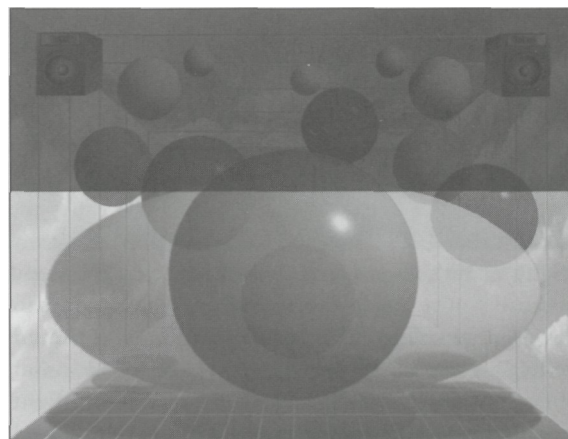
Visual 77. Song With High Frequencies Highlighted

Second, scan the midrange frequencies, checking for the relative volume of these frequencies across all the instruments. Midrange frequencies seem to stick out when boosted too much. Make sure that all instruments have the exact amount of midrange frequencies that you want. The sounds might have a similar amount of midrange frequencies, but sometimes you may want some sounds to stick out more so they grab your attention.



Visual 78. Song With Midrange Frequencies Highlighted

Third, scan the bass frequencies, checking for the relative volume of bass in each sound in the bass range. For example, check the relative amount of bass frequencies present in the kick drum compared to the bass guitar. Listen and make sure that it is the way you want it to be. This frequency range is the one most commonly missed when mixing an album or project.



Visual 79. Song With Low Frequencies Highlighted

It is critical that you check the relative EQ of each instrument in the mix at each frequency range. The amount of time you spend doing this often depends on the band. Some bands expect to be recording within a few hours of the time they arrive and have very little patience (or money). Other bands spend weeks getting the right sound and EQ before recording to the multitrack. It is a good idea to set up the band the day before the session, get all the sounds EQ'd, get a headphone mix, then go home. The next day everything is set to go and everyone is fresh.

It is also a good idea to talk with the band beforehand and let them know that you will be spending a good amount of time working on the sounds at the beginning of the session. If the band knows what is going to happen, they won't get frustrated while waiting to actually begin recording. They should appreciate the fact that you want it to sound as good as possible.

Equalizing in Solo During Mixdown

When you go to mixdown a song, the first step is to EQ each of the sounds individually. If you did your job well during the recording session (that is, if you had time), you might have little or no EQ'ing to do. "If it ain't broke, don't fix it." However, often you will need to EQ the sound again because you know what the band is going for and you have a new perspective—a fresh ear. You also have a major advantage that you didn't have when you began the recording session: You know what the whole song sounds like with all of the instruments playing together. Now you can set the EQ of each sound with the final mix in mind.

People often wonder why things don't seem to sound the same when you come back to do the mixdown. First, when using analog tape (as opposed to digital), you lose highs every time the tape is played back on the multitrack. After a couple of weeks of overdubs, the highs are dampened drastically.

Second, it is easy to think that you have something sounding right simply because you have made it sound so much better. When a band first comes in, often you listen to the sounds (and how bad they might sound), then you EQ them and you're happy because you've made the sound great compared to the original sound. The problem is that you should be EQ'ing the sound based on the real world sound of current CDs. You might have made it sound light years better, but it needed more EQ'ing . . . to sound like a CD. When you come back in to mix the song down, you have been listening to the radio or CDs in the real world. When you put on the multitrack, you automatically compare your recording to the real world and realize it didn't sound as good as you

thought when you did the recording session.

Also, especially with less expensive mixers, you don't have enough bands of EQ so you can't do all of the equalization required while recording the band. In this case, the EQ must be completed during mixdown. This is often the case when you don't have a full parametric EQ.

Equalizing in the Mix During Mixdown

The way the EQ sounds in the mix during the mixdown is the true test. Again, you should check all the sounds relative to each other at each frequency range: highs, midranges, and lows. If it is already pretty good, you can now work on fine-tuning the relative EQs. This is where you do the magical stuff. For example, you might add a tiny bit of 12,000Hz on some of the high-frequency sounds to make the overall mix sparkle. Or you might consider making a guitar solo track a little brighter and edgier, so that it grabs your attention.

At this point, you might actually turn the EQ knobs while the song is playing. Perhaps you might EQ an instrument differently for various sections of the song. Or, to really flip people out, you could change the EQ in the middle of a section of a song. It is also interesting to EQ a sound so that it seems to be coming out of a telephone.

Equalizing the Entire Mix During Mastering

There are two main types of EQ done during mastering. First, minor repairs can be done if the overall EQ doesn't sound quite right, but if the problem is very bad the entire song must be remixed. It is quite common to adjust the amount of overall bass or treble slightly. Second, the overall EQ can be adjusted to make the overall bass, midrange, and treble more similar from song to song. Again, if the difference is too great, it might require remixing the songs. There is only so much that can be done in mastering with EQ since all the sounds are no longer separate on their own tracks.

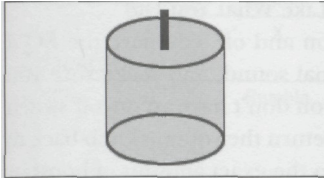
USING AN EQUALIZER: STEP-BY-STEP INSTRUCTIONS

When you approach a mixing board equalizer for the first time, it is a good idea to play with it to get to know how it works and what it does. However, when working on a project with other people, you must be quick at getting things to sound great. The following procedure will help you become more efficient whenever you use an equalizer.

A COMMON, STEP-BY-STEP PROCESS FOR EQ'ING A SOUND

1. Reset to "0"

Reset the volume controls on the equalizer to "0." This usually means setting the volume knob straight up (not all the way counterclockwise). At this position you are neither boosting nor cutting the volume of any frequency.



Visual 80. EQ Knob With Volume Set to "0"

Even if the EQ has an on/off switch, the volume knob should still be set to "0," so when the EQ is turned on, it makes no changes and you are starting from "0," not some unknown preset. In many professional studios, if you don't reset, or normal, the EQ at the end of your session, you will hear from the management later.

2. Listen

The most common mistake made by an inexperienced engineer is to begin turning the EQ knobs before listening. Don't touch the knobs until you know what you want to do. Listen to see if anything is wrong with the sound first, and if it ain't broke, don't fix it.

There are many fine details you should listen for when EQ'ing. The three main things to check are if the sound is muddy, has irritating or "honky" frequencies in the midrange, or is bright enough. If you do nothing else while recording to the multi-track, you should at least take care of each of these aspects, which make up over 75% of all EQ'ing to be done.

a) **Cut Muddiness (100-800Hz):** Check each instrument for muddiness. Kick drums almost always need to have the muddiness cut (unless it is a rap or hip hop kick). Other potentially muddy instruments include toms, bass guitar, piano, acoustic guitar, and harp. Muddiness is normally around 300Hz. If you cut the muddiness too much, the instrument will sound thin because this mud also contributes to the body of most sounds. When cutting muddy frequencies, always make sure that you haven't lost your bottom: the low lows. You might compensate by boosting the lows around 40-60Hz. Using a parametric to zone in on the specific muddy frequency will help to preserve the bottom of the overall sound.

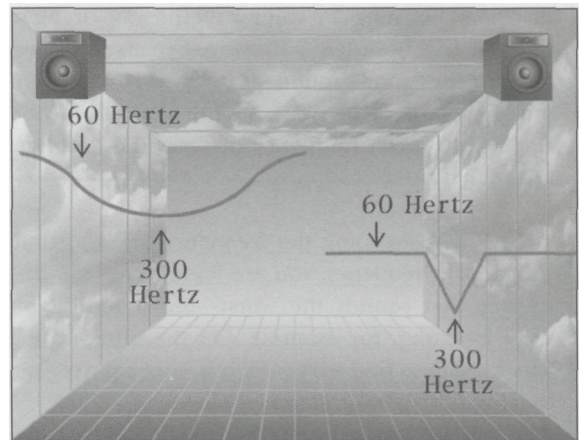
b) **Cut Irritation (1000-5000Hz):** Cut any exces-

sively irritating or honky frequencies occurring in the midrange from 1000-5000Hz. Vocals, electric guitars, and cymbals (including hi-hat) often need frequencies cut in the midrange. Depending on the type of music (and the particular snare drum used), snares sometimes need this edge cut also. The best way to detect an irritating frequency is to turn the entire sound up very loud. If you and the people in the room are cringing on the floor, then it's irritating. Never boost or cut the midrange too much and make sure you haven't made the sound too dull. At that point, you might compensate by boosting the highs around 5000-8000Hz. Using a parametric to zone in on the specific irritating frequency will help to preserve the brightness of the overall sound.

c) **Boost Highs (5000-8000Hz):** Boosting highs on instruments that sound dull, like the snare, is largely dependent on the style of music. R&B, dance, and certain types of rock 'n' roll require more crispness than other styles. Country, middle-of-the-road, and folk music do not need as much boost in this range, so they sound more natural.

3. Set the Bandwidth

a) When getting rid of muddy frequencies, set the bandwidth as thin as possible, because if you use a wide bandwidth, you might also drop the nice "bottom."



Visual 81. Wide and Thin Bandwidths on 300Hz Cut

b) When getting rid of irritating frequencies, set the bandwidth as thin as possible for very much the same reason as above. If you use a wide bandwidth on a vocal, guitar, or cymbal, you might lose the entire body of the sound in the midrange. Then the sound would be dull and not present.

c) When boosting highs, set the bandwidth to medium wide. This sounds more natural. If ever in doubt as to how to set the bandwidth, start with the

thinnest one possible. Then you can try widening it out a bit to see if it does what you want and sounds better. By doing this, you end up with the center frequency where it should be.

4. Find the Frequency to be Boosted or Cut

Now that you have decided that a frequency needs to be boosted or cut, you must first find the frequency.

a) Boost the volume on the band of EQ where you think the problem is. When first starting out, it is a good idea to boost the volume all the way. Be careful, though. Boosting the volume all the way in the bass area can blow up your speakers. And boosting the volume all the way in the midrange can make you deaf. It's a good idea to keep your other hand on the channel fader or master volume control so as not to hurt anybody.

Boosting the volume all the way will help you locate the frequency you want to turn up or down. A good analogy is when you cook with new spices. Though tasting red hot chili peppers by themselves can be a bit extreme, you need to taste them before cooking with them to get an idea of what they taste like. Similarly, when you boost the EQ volume all the way, though it won't be that strong in the mix, it gives you an idea of what it might be like when added in moderation.

NOTE: You can also cut the volume all the way instead of boosting the volume all the way. Doing it this way is a little less annoying, because you are looking for "good" sounds instead of irritating or muddy sounds. However, you run the risk of not finding the exact frequency that was the problem in the first place.

b) When sweeping the frequency knob to find the culprit frequency, you are looking for the frequency that sounds the worst—the muddiest or most irritating, for example. On the other hand, when trying to find a frequency to turn up, you are looking for where it sounds the best.

If you are trying to get rid of a frequency and you have cut the volume knob all the way (instead of having boosted the volume knob all the way), sweep the frequency knob to find the spot where the sound seems to be the best.

5. Return the Volume Knob to "0"

With the volume boosted all the way, you are now in outer space. You have lost all touch with the reality of what the sound was like in the first place. Regain your perspective on the tone of the sound before it was EQ'd by returning the volume knob

to "0" (on the EQ band you are working on).

6. Boost or Cut the Volume to Taste

If you are getting rid of a frequency, slowly turn the volume down as much as you think it needs. If you are boosting a frequency, same thing. Play with the volume knob until you figure out how much it needs to be boosted.

7. Check to See If You Like What You Did

Turn the EQ switch on and off, compare the EQ'd sound with the original sound, and make sure you like what you did. If you don't have an on/off switch on your EQ quickly return the volume knob back to "0," then zip it back to the exact amount of boost or cut. This is also helpful when doing more than one EQ change on a sound. For example, say you have cut the muddiness on one band and you have brightened the highs on another band. If you turn off the EQ you turn off both bands. Instead, simply return the volume control to "0" on the one EQ band you are working on, so you can see what that one change is doing and whether you like it or not.

So far I have provided you with an extensive overview of how to use EQ. However, it requires practical experience to get know its intricacies. For those of you who are just beginning, here is a listing of common EQ techniques for well-known instruments—although, in reality, every sound is different.

Frequency	40-100	100-200	200-800	800-1000	1000-5000	5000-8000	8000-12,000
SOUNDS							
BASS	Bottom	Roundness	Muddiness	Body on Small Speakers	Presence	High End	Hiss
KICK	Bottom	Roundness	Muddiness			High End	Hiss
SNARE	X	Fullness	Muddiness			Presence	X
TOMS		Fullness	Muddiness		Presence Irritation	High End	X
FLOOR TOMS	Bottom	Fullness	Muddiness		Presence		X
HI-HAT	X		Muddiness		Irritation	Clarity/ Crispness	Shimmer/ Sizzle
CYMBALS			Bleed				
VOICE	Rumble	Fullness	Muddiness		Presence Irritation Telephone	Clarity/ Crispness Sibilance-6K	Sparkle/ Hiss
PIANO	Bottom	Fullness	Muddiness	Muddiness	Presence	Clarity/	Harmonics
HARP		Pedal Noise			Twanginess	Crispness	
ELECTRIC GUITAR	X	Fullness Crunch	Muddiness Roundness		Cut/Shred Irritation	Crispness Thinness	Hiss
ACOUSTIC GUITAR	X	Fullness	Muddiness			Clarity/ Crispness	Sparkle
ORGAN	Bottom	Fullness	Muddiness			Clarity/ Crispness	
STRINGS	Bottom	Fullness	Muddiness		Irritation Digital Sound	Clarity/ Crispness	Sparkle
HORNS	X	Fullness	Muddiness	Roundness		Clarity/ Crispness	
CONGA	Boominess	Fullness				Clarity/ Crispness	
HARMONICA	X	Fullness			Irritation	Clarity/ Crispness	X

Chart 4. Equalization Chart

Freq.	HH	Kick	Snare	Overheads	Toms	
High Highs (10-12k)	+3			+3		
Highs (5-8k)		+5	+7		+6	
Low Mids (200-400)	-9	-10		-6	-6	
Lows (40-60)		+2				
Freq.	Bass	Dist Guitar	Clean Guitar	Acoustic Guitar	Piano	Vocals
High Highs (10-12k)				+4		
Highs (5-8k)			+3	+3	+3	+2
Mids (1-3k)	+5	+3				
Lo Mids (200-400)	-3			-5	-5	
Lows (40-60)	+2					

Chart 5. Common Quick General EQ

Hi-Hat		
<u>Lows</u>	<u>Mids</u>	<u>Highs</u>
Roll-off muddiness around 300Hz.	If irritating, find & roll-off irritating frequency	Around 12k, boost 3-6dB for sizzle.
Kick Drum		
<u>Lows</u>	<u>Mids</u>	<u>Highs</u>
Roll-off muddiness around 300Hz.		Boost highs around 5-6k. Boosting up around 10-12k will only bring out hiss and cymbals.
Snare Drum		
<u>Lows</u>	<u>Mids</u>	<u>Highs</u>
Add a little bit around 60-100Hz if snare sounds thin and wimpy.	Take out irritating frequency if apparent or going for sweet, smooth sounding mix	Add 3-10dB around 6k.
Toms		
<u>Lows</u>	<u>Mids</u>	<u>Highs</u>
Cut boominess around 300Hz.		3-8dB boost around 5k. Less boost on floor tom.
Overheads		
<u>Lows</u>	<u>Mids</u>	<u>Highs</u>
Cut any muddiness around 300Hz.	Be especially aware of any irritating freq's in midrange. Cut them if apparent.	Possibly boost a little around 6k and/or 12k but be wary of making them too edgy.
Bass Guitar		
<u>Lows</u>	<u>Mids</u>	<u>Highs</u>
Possibly boost 40-60Hz if song calls for it. Possibly cut 300Hz if bass is too muddy for song.	Boost around 1-2k if more presence is needed and if string noise is not too much.	Boost around 5k for presence if mix is sparse enough to even hear it.
Electric Guitar		
<u>Lows</u>	<u>Mids</u>	<u>Highs</u>
Boost or cut around 300Hz depending on need.	Boost around 3k for edge. Cut 3k for transparency.	Boost around 6k for presence and clarity. Boost 10k for sparkle.
Acoustic Guitar		
<u>Lows</u>	<u>Mids</u>	<u>Hi's</u>
Cut 100-300Hz where muddiness and boominess is.	Cut 1-3k to make image higher and more transparent.	Boost around 6k for presence and clarity. Boost 10k for sparkle.
Piano		
<u>Lows</u>	<u>Mids</u>	<u>Highs</u>
Cut muddiness around 300Hz.	Cut any honkiness around 1k.	Boost around 6k for presence and clarity.
Vocals		
<u>Lows</u>	<u>Mids</u>	<u>Highs</u>
Cut or boost 300Hz depending on mic, voice, and use in mix.	Listen closely for any irritating or midrange honk (telephone-like sound). Cut either.	Boost around 6k for presence and clarity.
Horns		
<u>Lows</u>	<u>Mids</u>	<u>Highs</u>
	Beware of irritating or honky midrange. Cut if necessary.	

Chart 6. Typical EQ for Typical Instruments

Common Terminology for EQ Frequencies

Even if you learn all of the frequencies, understand how boosting or cutting each frequency affects various instruments differently, and master how to EQ an instrument for different types of music and songs, the people you are working with might still be using street terminology to describe what they want. Therefore, Chart 7 is a list of slang and what it means.

SECTION C

Panpots and Stereo

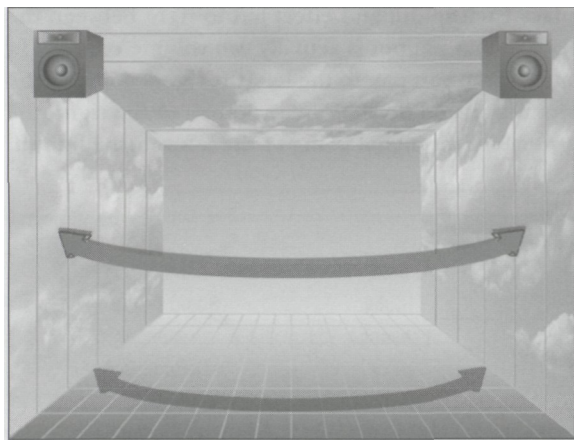
Placement

When mixing, you use panpots (balance knobs) to place each sound and effect left to right between the speakers. A panpot is actually two volume controls in one. When you pan to the left, the signal going to the right is turned down. When you pan to the right, the volume of the signal going to the left is turned down.

40-200 <u>Bass</u>	200-800 <u>Low Mids</u>	800-5K <u>Mids</u>	5-8K <u>Highs</u>	8-12K <u>Super Highs</u>
Fullness	Body	Presence	Presence	Presence
Boomin'	Robustness	Projected	Airy	Crispness
Ballsy	Warmth	Forward	Bright	Sparkling
Punchy	Crunchy	Intelligible	Brilliant	Screamin'
Powerful	Fat	Articulate	Live	Sharp
Thumpin'			Clear	
Solid			Smooth	
Thick			Crisp	
Round				
Beefy				
Bad!!				
<u>Too Much</u>	<u>Too Much</u>	<u>Too Much</u>	<u>Too Much</u>	<u>Too Much</u>
Heavy	Muddy	Hornlike	Tinny	Crisp
Boomy	Tubby	Phonelike	Steely	Sizzly
Rumbly	Barrelly	Honky	Metallic	Searing
		Bathroomy	Strident	Glare
		Boxy	Cutting	Glassy
		Woody	Piercing	
		Nasal	Shrill	
		Chunky	Screamin'	
		Woofy		
		Edgy		
<u>Not Enough</u>	<u>Not Enough</u>	<u>Not Enough</u>	<u>Not Enough</u>	<u>Not Enough</u>
Thin	Distant	Veiled	Dull	Flat
Anemic	Hollow	Covered	Dead	Cheap
Wimpy	Disembodied	Muffled	Dark	

Chart 7. Common Terminology and Slang

As previously discussed, panning in a mix is mapped out visually as a function of left to right. Panning a sound to one side or the other also seems to make the instrument a bit more distant in the mix. If the sound is panned to the center, it will seem to be a bit closer, a little more out front.



Visual 82. Left and Right Placement

If we think of the space between the speakers as a pallet on which to place instruments left to right, we are free to pan as we please. However, certain styles of music have developed their own traditions for the particular placement of each instrument left to right in the stereo field. Normally, the placement of a sound is static; it stays in the same place throughout the mix. However, the movement of a panpot during a mix creates an especially effective dynamic. We will discuss the common ways panning is used to create musical dynamics in the next chapter.

SECTION D

Time-Based Effects

DELAYS

After many failed attempts to use outdoor racquetball courts to create delays, engineers realized they could get a delay from a tape player. You could hear a delay by recording a signal on the record head, then listening to the playback head two inches later. The delay time could be set by changing the tape speed. Engineers used this technique for years with the Echoplex, which fed a piece of tape through a maze of tape heads at different distances, each giving different delay times. Not bad, but the problem with tape is that every time you record over it, you get more tape hiss.

Then came analog delays, which would put a signal through a piece of electronics to delay the signal

a bit. The more you put the signal through the electronics, the longer the delay. It was a bucket brigade type of system. The only problem was that when you put a signal through a piece of electronics over and over, it gets extremely noisy after a while.

Then came digital delays, which record the signal digitally onto a chip, then use a clock to tell the unit when to play the sound back. The delayed signal can also be fed back into the input to get the well-known sound of feedback or regeneration when the signal continues to repeat.

You must learn the details of the frequency spectrum, as well as how each delay time feels and what feelings or emotions each delay time evokes. Then, when you hear a song that has a similar feeling or emotion, you will know what delay time might work. There are, of course, a wide number of other reasons for using different delay times that I will cover later.

Delay Times vs. Distance

In order to assist you in remembering what different delay times sound and feel like, it is helpful to understand the relationship between delay time and distance. Sound travels at approximately 1130 feet per second. That's around 770 miles per hour, which is extremely slow compared to the speed of sound in wires—186,000 miles per second, the speed of light. Therefore, it is easy to hear a delay between the time a sound occurs and the time it takes for a sound to travel even a few feet to a wall and back. We can also easily hear a delay when we put two microphones at two different distances from one sound. In fact, changing the distance between two microphones is exactly like changing the delay time on a digital delay.

The following chart illustrates how different distances relate to delay time. Of course, if you are calculating a delay time based on the distance between a sound source and a wall, the distance must be doubled (to and from the wall).

Feet	=	Delay (ms)
1130		1000
560		500
280		250
140		125
70		62.5
35		32.25
17.5		16.13
8.75		8.01
4.28		4
2.14		2
1.07		1

Chart 8. Distance vs. Delay Time

As distances become smaller and smaller, the distance in feet almost equals the milliseconds of delay. This correlation comes into play when using more than one mic on a sound (e.g., piano, guitar amps, acoustic guitars, horns, or background vocals) and is especially helpful when miking drums. For example, the distance you place overhead mics above the drum set will create a corresponding delay time between the overhead mics and the snare mic (or any of the rest of the mics for that matter). It is also important to note the distance between instruments when miking an entire band live (or recording everyone in the same room at once) since mics may be more than ten feet away from another instrument and still pick it up.

Besides delay time, you must also consider phase cancelation, a problem that happens with extremely short delay times. We'll discuss more about this later.

If you pay attention to the way that something sounds when miked at different distances, you will eventually become aware of what different delay times sound like. Once you become familiar with the way that different delays affect different sounds, you can control their use in a way you deem most appropriate; that is, you can do whatever you want.

There might not be any rules in this industry except one: Gain a perspective so that you know what you are doing. Then, if anyone disagrees, it doesn't matter.

Different Delay Times

Let's define specific delay time ranges, so that you can get to know them and incorporate them into your memory time banks.

More than 100ms

Professional engineers refer to this length of delay as "echo." However, the real world (and my mom) use the term echo to refer to reverb. For our purposes, we will use echo to refer to a delay time greater than 100ms, not reverb.

When setting a delay time greater than 100ms, it is important that the delay time fits the tempo of the song, otherwise it will throw off the timing of the song. The delay time should be in time, a multiple of, or an exact fraction of the tempo. The following chart gives the relationship between tempos and delay times.

Beats Per Minute	Time Between Beats
60bpm	1000 ms
90bpm	750 ms
120bpm	500 ms
150bpm	437.5 ms
180bpm	375 ms
210bpm	312.5 ms
240bpm	250 ms

Chart 9. Tempo vs. Delay Time

A simple way to set delay times to the tempo without the chart is to put the delay on the snare drum (or some other instrument playing a continuous pattern). You can then hear when the delay is in time with the tempo of the song. Once you have found a delay time that works, any multiple or fraction of that time might also work.

A delay time over 100ms creates a dreamy effect and is most commonly placed in songs with slower tempos where there is room for the additional sound. Therefore, the more instruments and the more notes in a mix, the less often delays are used. This is especially true when there is feedback on a long delay time. The delays take up so much space in a mix that they are often only turned up at the end of a line, where there is enough space to hear the echoes by themselves.

60 to 100ms

You can hear this delay time, commonly referred to as "slap," on the vocals of Elvis Presley and in rockabilly music. In fact, there is about an 80ms delay between the syllables "rock" and "a" in the word "rockabilly."

This effect can be quite helpful in making a thin or irritating sound (especially a voice) sound fuller. It can help to obscure bad vocal technique or pitch problems. In fact, a slap can be used to bury any bad sound. However, you never want to bury anything too deep. Add too much delay on a bad vocal and not only do you have a bad vocal, but you also have a bad mix. On the other hand, a slap can make a vocal seem

less personal. If you have an incredible singer, you might forego using any delays. Just put it out there with a little reverb and let it shine.

30 to 60 ms

Put your lips together and blow a raspberry (this is the interactive portion of the book), technically called a "motorboat." The time between each flap of your lips is approximately 50ms. Delay time in this range is referred to as "doubling" because it makes a sound seem like it was played twice, or double tracked. When a part is sung or played twice there will naturally be a time delay ranging from 30 to 60ms (no one can ever sing or play a part twice exactly in time). Therefore, adding a delay of this length makes it sound like the part has been played twice. The Beatles used this effect extensively to simulate more vocals and instruments.

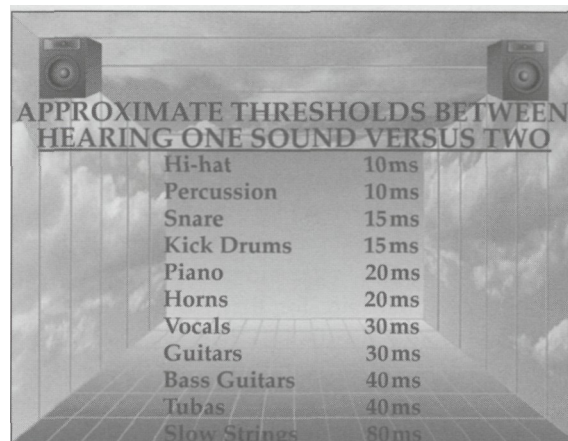
Just like a slap, doubling helps to obscure a bad sound or a bad performance. So it can be used to help bury things in the mix. Likewise, since it does obscure the purity and clarity of a sound, you should use it selectively, depending on the sound, song, and style of music.

NOTE: Although doubling makes a sound seem like it has been played twice, it is a different sound than if you actually doubletrack a sound. In fact, doubling often sounds so precise that it sounds somewhat electronic. This is especially true on vocals and simple sounds. However, if a sound is complex, especially if the sound is a combination of sounds (like a bunch of background vocals or a guitar sound with multiple mics), then you don't notice the precision of the delay. Therefore, when you put doubling on 20 vocals, it sounds like 40 vocals, and it sounds incredibly natural.

1 to 30ms

An unusual thing happens with this type of delay, commonly known as fattening. At this delay time, our brain and ears are not quick enough to hear two sounds; we only hear one fatter sound.

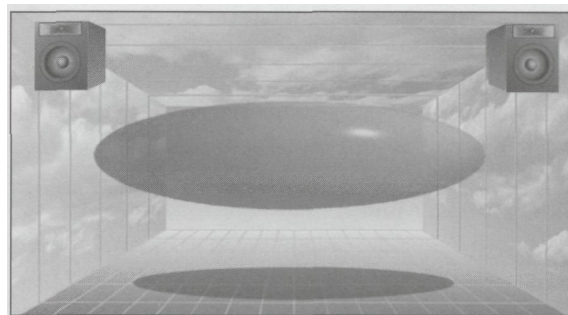
The threshold between hearing one sound or two sounds actually varies depending on the duration of the sound being delayed. Also, the delay times are even shorter when the original sound and the delay are panned separately, left and right. The following chart gives approximate thresholds for some instruments with different durations (actual thresholds will depend on the particular timbre and playing style of the instrument):



APPROXIMATE THRESHOLDS BETWEEN HEARING ONE SOUND VERSUS TWO	
Hi-hat	10ms
Percussion	10ms
Snare	15ms
Kick Drums	15ms
Piano	20ms
Horns	20ms
Vocals	30ms
Guitars	30ms
Bass Guitars	40ms
Tubas	40ms
Slow Strings	80ms

Chart 10. Quickness of Our Brain

Besides reverb, fattening is the most-used effect in the studio, mostly because it doesn't sound much like an effect. Fattening is the primary effect used to make a sound stereo, which has a certain magic to it. When you put the original "dry" instrument sound in one speaker and put a delay less than 30ms in the other speaker, it "stretches" the sound in stereo between the speakers.



Visual 83. Fattening: Delay <30ms

Fattening can make an already beautiful acoustic guitar or piano sound incredible. Fattening is the most effective of all delay times in making a thin or irritating sound fatter and fuller. It also seems to make a sound more present simply because when a sound is in stereo, it takes up more space between the speakers. This is especially effective when you want to turn a sound down in the mix but still have it discernible. On the other hand, because fattening will make a mix fuller and denser, you must make sure there is enough room between the speakers. Therefore, fattening is used most often when there are fewer notes and sounds in the mix.

When you want to create a wall of sound, though, even if the mix is already busy, you can add fattening to make it more busy. (This blows people's minds.) This is commonly done in heavy metal, alternative rock, and some new age music.

0 to 1ms

This sort of a delay time causes phase cancellation. I will address only the critical aspects of phase cancellation here. But keep in mind that phase cancellation is a very serious problem in recording and I highly recommend that you do further research to gain a complete and clear explanation of the problems and detriments of it.

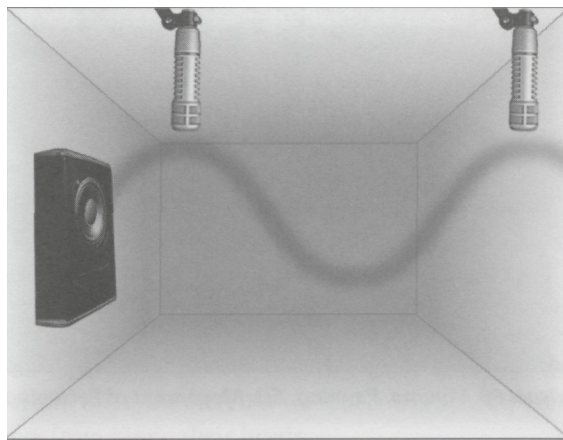
Phase cancellation happens when two of the exact same sound, like those created with two mics or two speakers, are a little bit out of time. A perfect example is when you switch the positive and negative wires on one of two speakers. Now, one speaker is pushing out while the other is pulling in. When a speaker pushes out, it creates denser air than normal. When a speaker pulls in, it creates more spaced out air than normal (rarefied air). When the denser air from one speaker meets the spaced out air from the other speaker, you end up with normal air; normal air equals silence. This means you could have two speakers blasting away and theoretically you could hear nothing.

There are many companies now using phase cancellation to quiet the world. This technology is used in automobiles, on freeways (instead of cement walls on the sides of the freeways), in factories, and even in headphones to cancel out sounds around you. Marriage counselors are selling them by the dozens.

If you have two mics on one sound at two different distances, one mic might be picking up denser air while the other mic is picking up spaced out air. Put the two mics together in the mix and they will tend to cancel each other out, though not completely. The following are common problems when using more than one mic on drums, piano, and guitar.

1. You lose volume when both mics are on, especially when you're in mono (which, by the way, is one of the best ways to detect phase cancellation).
2. You lose bass frequencies, making the sounds thin.
3. Most importantly, you lose the clarity and precision of the perceived image of the sound between the speakers. The sound seems to be more "spacey." Though some people like this effect, most people are addicted to clarity these days. If the mix is ever played back in mono (as on TV or AM radio), the sound will disappear completely.

There are many ways to curb phase cancellation. The primary way is to simply move one of the mics. If both mics are picking up the sound in the same excursion of the wave, there will be no phase cancellation.



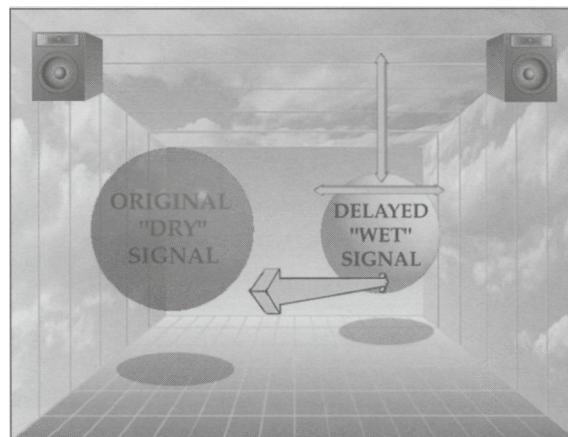
Visual 84. Two Mics Picking Up Sound in Phase

It takes 1ms for a complete wave of 1000Hz to pass by us. If we were to set a delay time of .5ms on a sound, it would put it out of phase. Therefore, we can use a digital delay to put the sound back in time.

Finally, we can remove a large amount of phase cancellation through isolation. Often, the bleed of a sound into a second mic will cause phase cancellation with the first mic. By using baffles or noise gates, we can reduce the bleed in the second mic, voiding the phase cancellation.

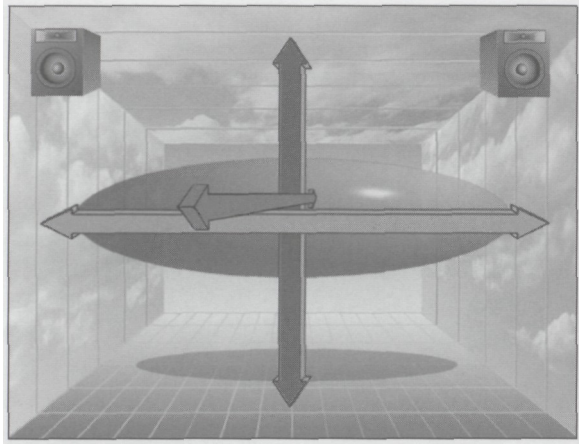
Panning of Delays

When the delay time is long enough to hear two sounds, then the delayed signal can be treated just like another sound and can be placed anywhere in the mix using volume, panning, and EQ.



Visual 85. Volume, Panning, EQ, Movement of Delay >30ms

When the delay time is less than 30ms or so, fattening occurs. We can also place this line of sound anywhere with volume, panning, and EQ.

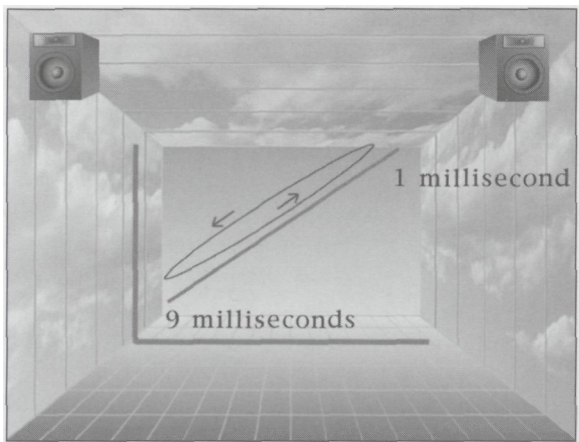


Visual 86. Volume, Panning, EQ, Movement of Fattening

FLANGERS, CHORUSES, AND PHASE SHIFTERS

In 1957, Toni Fisher was doing an album and someone accidentally sat on one of the reels on the tape player, slowing down the tape. When they stood up, it sped back up to normal speed. The band went, "Cool, let's put it on the record." They did put it on the record, and thus, flanging was born. The song, "The Big Hurt," went to No. 3 on the charts in 1957.

If you set a digital delay for less than 30ms of delay time and crank up the feedback, you get an effect called tubing (check it out on a digital delay). The interesting thing is that the shorter you set the delay time, the higher the pitch of the tube. The longer the delay time, the lower the pitch of the tube. Now, if you set a clock to sweep the delay time back and forth between, say, 9 and 1ms, then you get the effect called flanging.



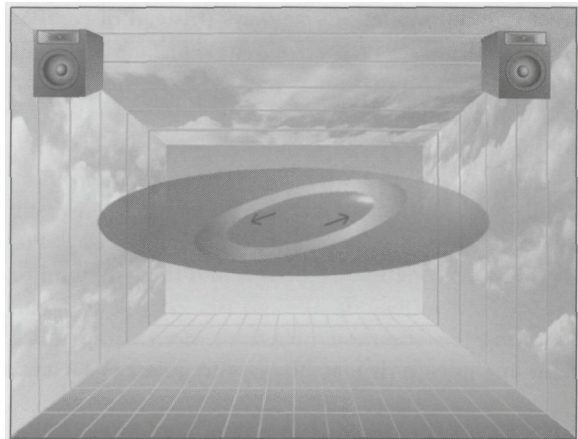
Visual 87, Pitch vs. Delay Time of Flanging

A flange is shown visually like this:



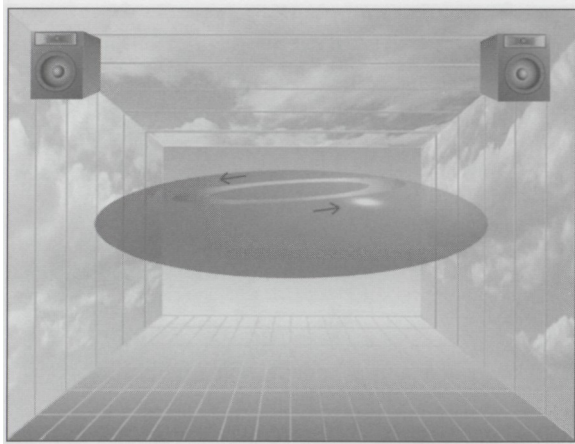
Visual 88. Virtual Mixer Flanging (see color Visual 88C)

If you set the width (depth or intensity on different units) so that the sweep of the delay time is not so wide, you then have the effect called chorusing. (Chorus effects have a delay like doubling or fattening also added.)



Visual 89. Virtual Mixer Chorusing

If you set the delay time so that you are only sweeping between 0 and 1ms, you hear the effect called phasing.



Visual 90. Virtual Mixer Phasing

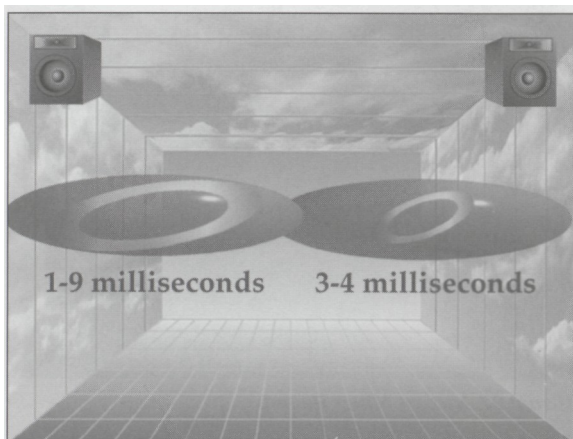
There are various parameters or settings found on flange, chorusing, and phasing units:

Rate, Speed, Frequency

The setting is the time it takes for the delay to sweep back and forth between two delay times. For example, it can be set to take one second to smoothly change from 1 to 9ms and back. The rate of the sweep can be set to the tempo of the song—you might have it rise on one beat and fall on the next beat—or to rise on one chord and fall on the next chord. You could even set it to rise on the first half of the verse and fall on the second half. The rate is often set so slow that it doesn't correspond to any part in the music.

Width, Depth, Intensity

This setting is the range of the delay sweep. For example, a narrow width setting might sweep between 3 and 4ms, while a wide width setting might sweep between 1 and 9ms. Because pitch corresponds to the delay time, this means that the wider (or deeper) the setting, the wider the frequency sweep.



Visual 91, Narrow and Wide Sweep on Flange, Chorus, or Phaser

Feedback

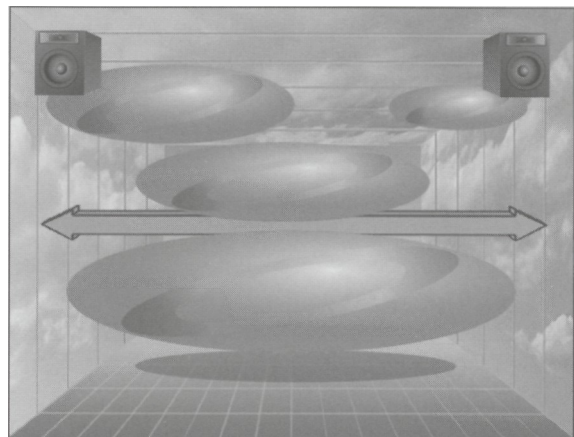
Feedback takes the output of the delay and "feeds it back" into the input. Some feedback is required to get the flange effect in the first place. The more feedback you add, the more intense or dynamic the frequency sweep.

Negative Feedback

Negative feedback puts the signal being fed back into the input out of phase. This generally causes a more hollow tubular type of flange sound.

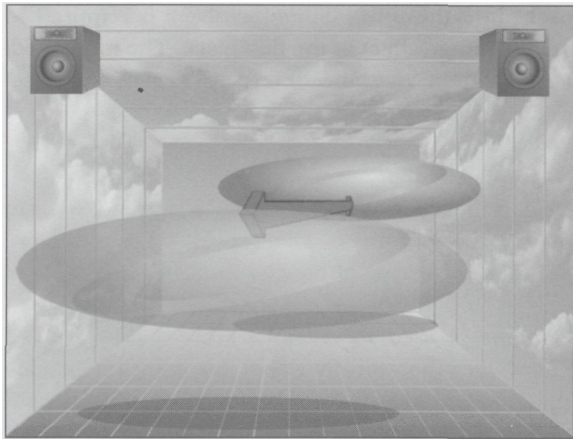
Flanging is used to create a more spacey type of mood, an other-worldly effect. It's great for making things sound like they are under water. Chorusing is often used to simulate a chorus of people or chorus of instruments. Phasing is a very subtle effect—so subtle that when used at Grateful Dead concerts, the crowd often wondered if the effect was actually coming from inside their heads.

Each of these effects can be panned in various ways:



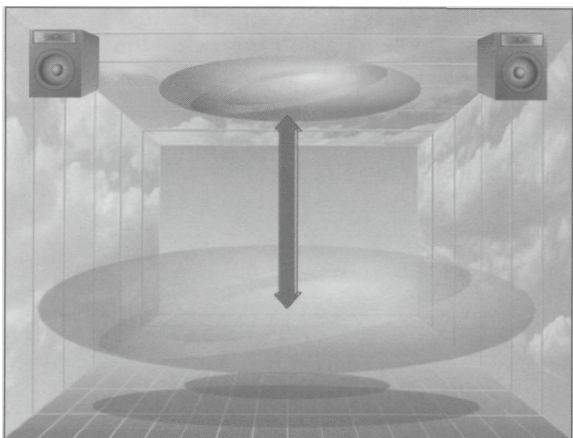
Visual 92. Flanging Panned Various Ways

Each can also be brought out front with volume .



Visual 93. Flanging at Different Volumes

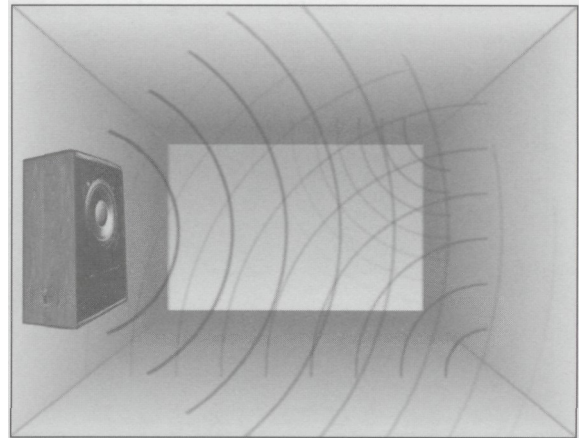
. . . and raised or lowered a little bit with EQ.



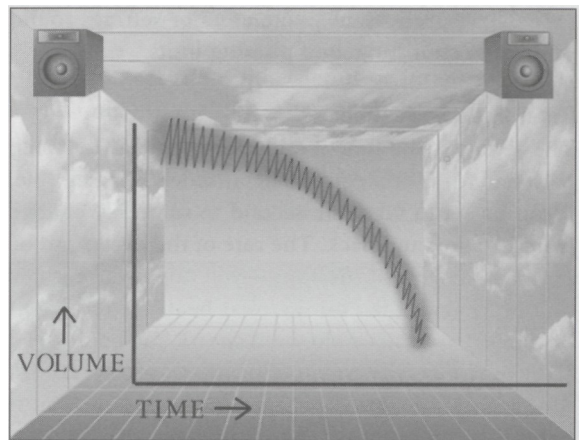
Visual 94. Flanging EQ'd Differently

REVERB

Reverb is hundreds and hundreds of delays. When a sound first occurs, it travels throughout the room at the snail's pace of around 770 miles per hour. It bounces off the walls, ceiling, and floor and comes back to us as hundreds of different delay times. All of these delay times wash together to make the sound we know as reverb.

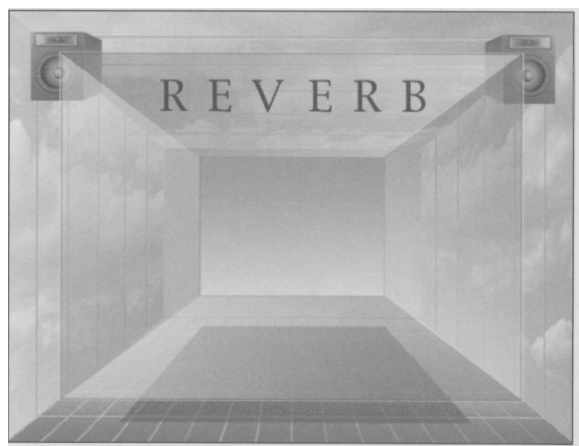


Visual 95. Waves Bouncing Around Room



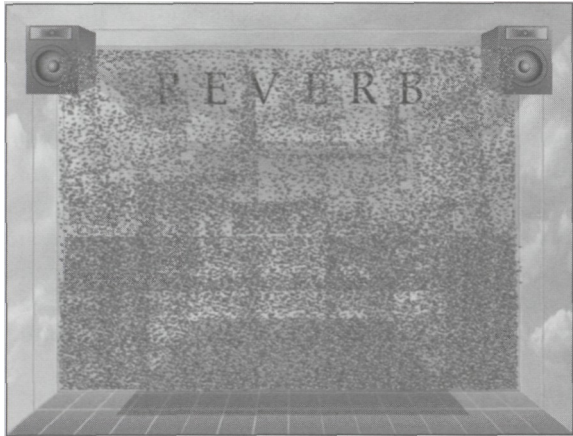
Visual 96. Wash of Reverb

When we place reverb in a mix, it is like we are placing the sound of a room between the speakers. Therefore, I will show reverb visually as a room or cube between the speakers.



Visual 97. Virtual Mixer Reverb

Reverb takes up a tremendous amount of room in this limited space between the speakers. In a digital reverb, all of these delays are panned to virtually hundreds of different places between the speakers. This is why reverb masks other sounds so much in the mix.



Visual 98. Reverb: Hundreds of Delays Panned Between Speakers

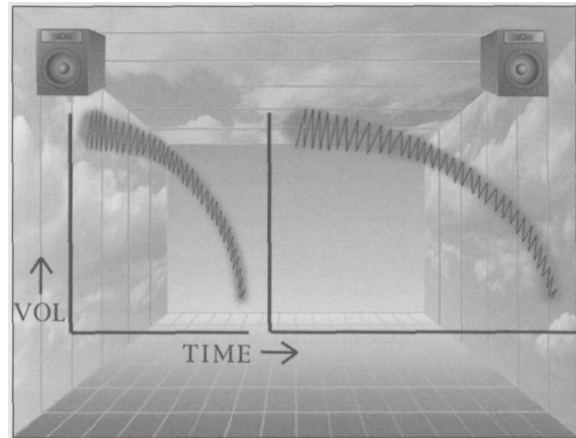
There are certain parameters of control found in units that create reverb. I will explain each setting and show it visually.

Room Types

Modern digital reverbs allow the user to change the "type of room." Imagine different types of rooms between the speakers. There are no strict rules as to the type of room that is used in a mix. Some engineers prefer a plate reverb sound on the snare drum. Some use hall reverbs on saxophones. However, it is important to check the type of reverb while in the mix (with all the sounds on) to make sure it cuts through the mix like you want it to because different types of sounds mask the reverb in different ways.

Reverb Time

You can also change reverb time: the duration or length of time it lasts.

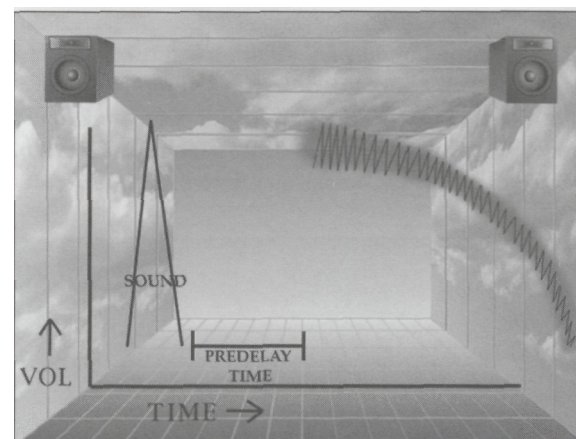


Visual 99. Long and Short Reverb Times

NOTE: A common rule is to set the reverb time on a snare drum so that it ends before the next kick lick; this way, the snare reverb does not obscure the attack of the next kick note, which will keep the kick drum sounding clean, punchy, and tight. The faster the tempo of a piece, the shorter the reverb time. Again though, rules are made to be broken.

Predelay Time

When a sound occurs, it takes awhile for the sound to reach the walls and come back. The time of silence before the reverb begins is called the predelay time.



Visual 100. Predelay Time

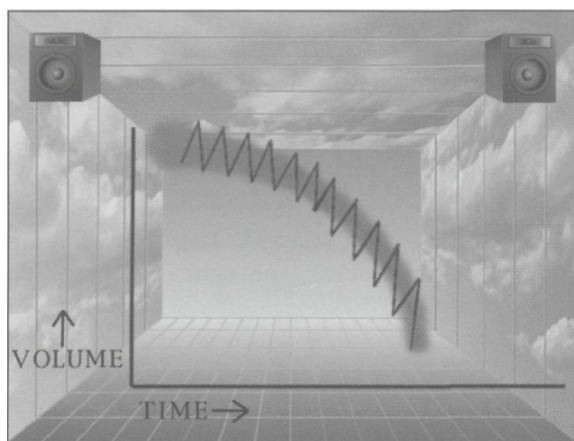
Different sized rooms will naturally have different predelay times. A medium-sized auditorium has around 30ms of predelay time, while a coliseum might have as much as 100ms of predelay time. Therefore, it is important to have a bit of predelay time if you are looking for a truly natural reverb

sound. Most times, when you call up a preset in a reverb unit, someone has already programmed a pre-delay time. You can adjust this as desired.

The cool thing about longer pre-delay times (over 60ms or so) is that they help to separate the reverb from the dry sound. With shorter pre-delay times, reverb will very quickly "mush up" the original dry sound, making it unclear. With longer pre-delay times, a vocal, for example, will remain clean and clear even with a good amount of reverb.

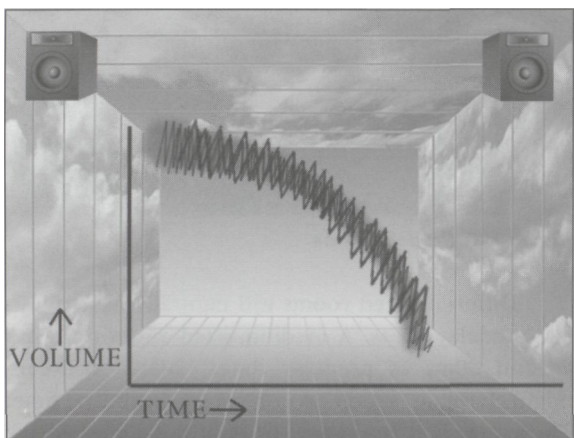
Diffusion

In most effect units, diffusion is the density of the echoes that makes up the reverb. Low diffusion has less echoes.



Visual 101. Low-Diffusion Reverb

You can actually hear the individual echoes in a low-diffusion setting. It sounds kind of like "wil, il, il, il, il, bur, bur, bur, bur, bur, bur." A hall reverb setting is preset with a very low-diffusion setting. High diffusion has more echoes—so many that they meld together into an extremely smooth wash of reverb. Plate reverbs often have a very high-diffusion preset.



Visual 102. High-Diffusion Reverb

There are no strict rules for the use of high- or low-diffusion settings. Some engineers prefer a low-diffusion setting on a snare drum to make it sound more raucous for rock 'n' roll. High diffusion is often used to make vocals sound smoother.

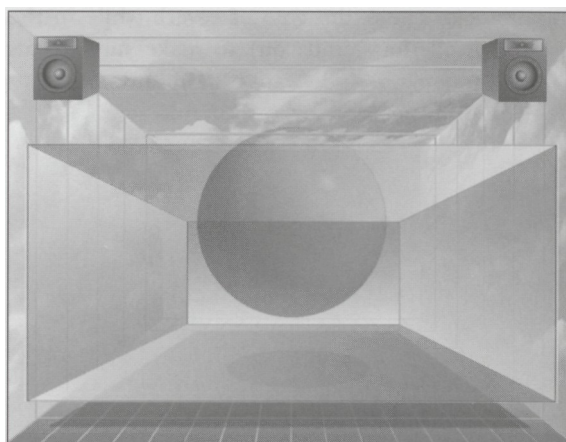
EQ of Reverb

You can equalize reverb at various points in the signal path. First, you can EQ the reverb after the signal comes back into the board (if you are using channels for your reverb returns that have EQ on them). It is usually better to use the EQ in the reverb unit itself. Not because it is necessarily a better EQ but because in some units you can place the EQ before or after the reverb. Ideally, it is best to EQ the signal going to the reverb. If your reverb unit does not have this capability, you can actually patch in an EQ after the master auxiliary send, on the way to the reverb unit.

High- and Low-Frequency Reverb Time

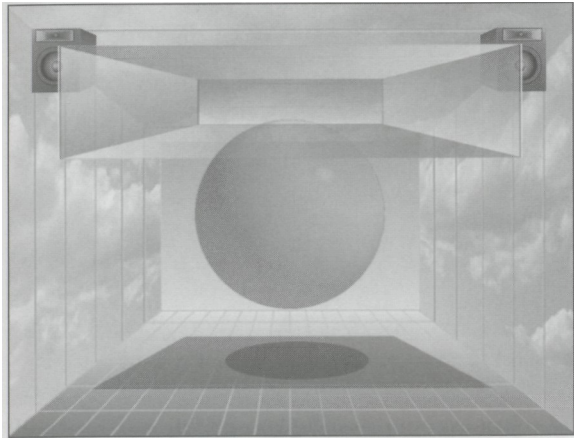
Even better than using EQ on your reverb is setting the duration of the highs and lows. Many reverb units have this setting these days. This is a bit different than EQ which changes the volume of the frequencies. High- and low-frequency reverb time changes the duration of the frequencies. Using these settings will make the reverb sound more natural than any type of EQ

Regardless of whether you EQ your reverb or set the duration, there is a huge difference as to how much space it takes up in the mix—and the resulting masking it creates. Reverb with a low-frequency EQ boost takes up an enormous amount of space in a mix .



Visual 103. Reverb With Low-Frequency EQ Boost

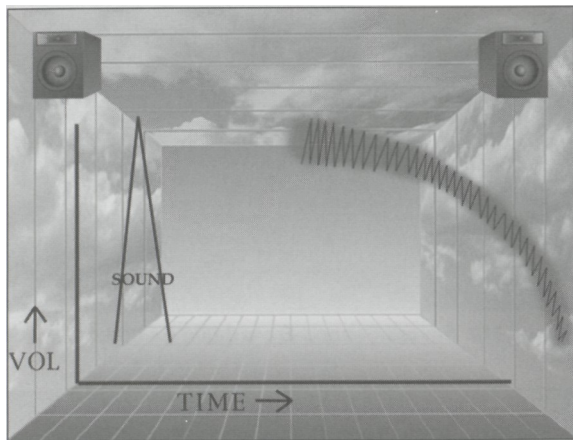
. . . compared to reverb with a high-frequency EQ boost.



Visual 104. Reverb With High-frequency EQ Boost

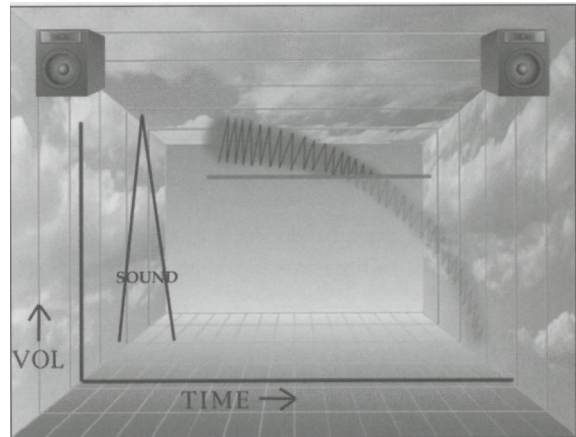
Reverb Envelope

Another setting of reverb is the "envelope"; that is, how the reverb changes its volume over time. Normal reverb has an envelope where the volume fades out smoothly over time.



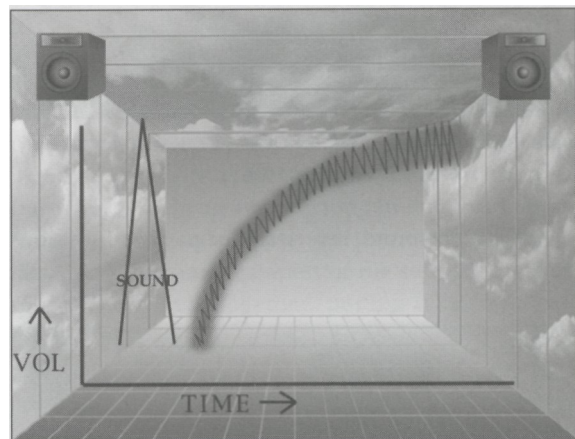
Visual 105. Envelope (Change in Volume Over Time) of Normal Reverb

Engineers thought to put a noise gate on this natural reverb, which chops it off before the volume has a chance to fade out. Therefore, volume stays even then stops abruptly.



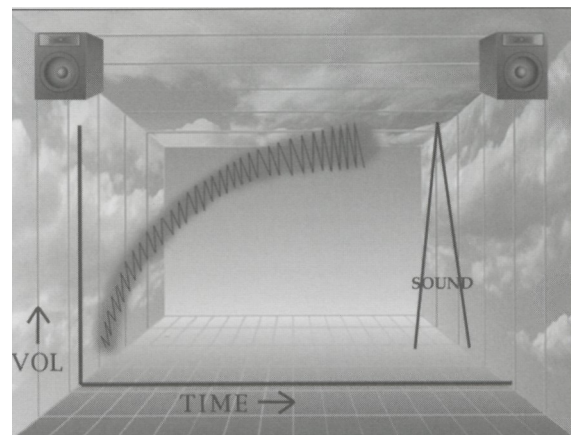
Visual 106. Envelope of Gated Reverb

But it's simpler to use the gated reverb setting on your effects unit. If we turn the envelope of normal reverb backward, reverb volume rises then stops abruptly.



Visual 107. Envelope of Reverse Gate Reverb

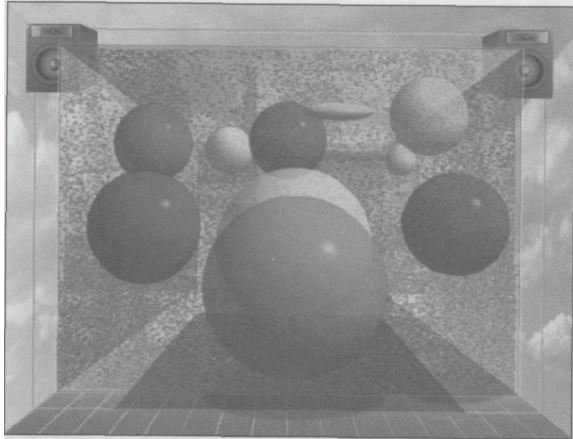
If you take the tape, play it backward, add normal reverb, record it on open tracks on the multitrack, and turn the tape around to run forward, you'd get preverb.



Visual 108. Preverb

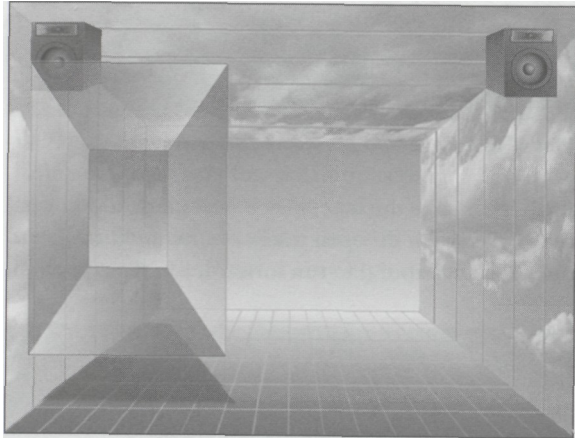
This effect is the most evil one that can be created in the studio; only the devil could put an effect on something before it happens. Furthermore, it has been used in every scary movie made, including *The Exorcist* and *Poltergeist*. And, of course, it is Ozzy Osbourne's favorite effect.

One of reverb's main functions is to connect sounds in a mix and fill in the space between the speakers:

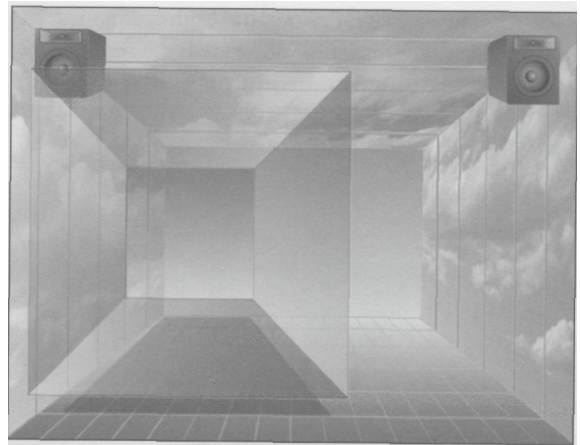


Visual 109. Reverb Filling in Space Between Speakers
(see color Visual 109C)

Like any sound, reverb can be panned in various ways:

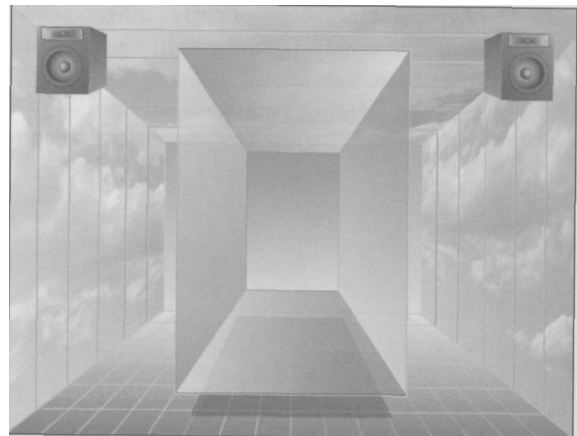


Visual 110. Reverb Panned to Left

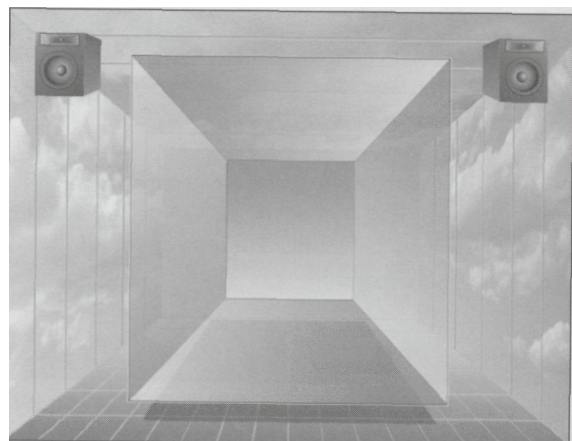


Visual 111. Reverb Panned From Left to 1:00

Just as sounds can be moved left and right with panpots, reverb can be placed left and right between the speakers. Similarly, reverb can be spread to any width.

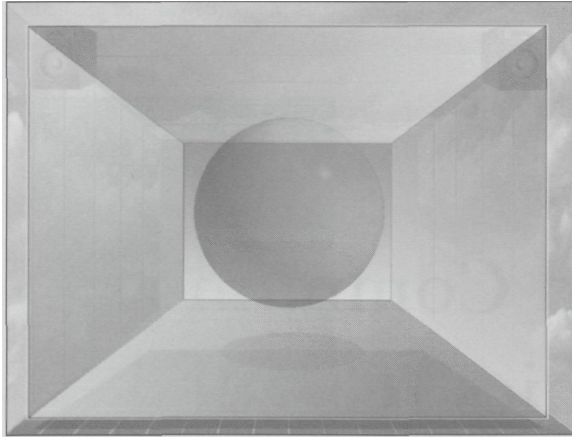


Visual 112. Reverb Panned From 11:00 to 1:00



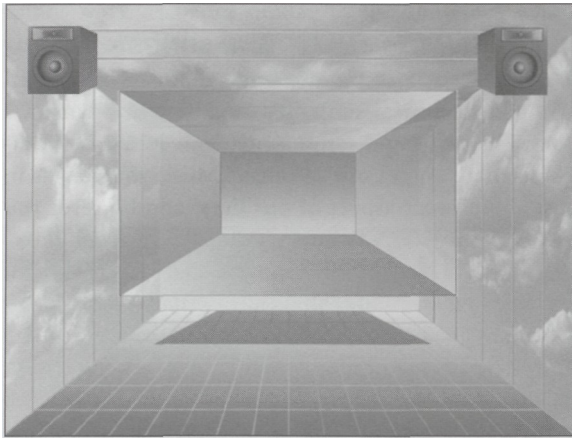
Visual 113. Reverb Panned From 10:00 to 2:00

Reverb can also be brought out front with volume . . .



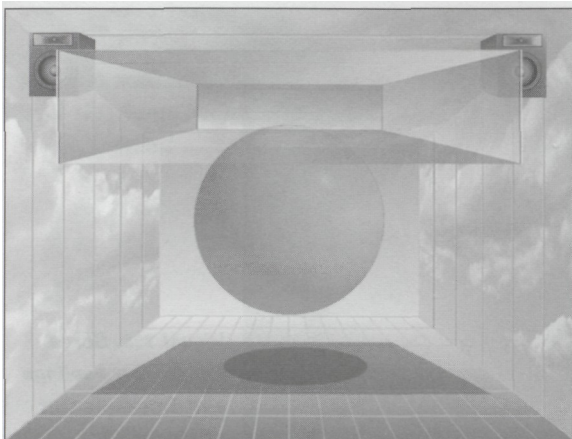
Visual 114. Reverb Turned Up in Mix

. . . placed in the background by turning down the volume . . .

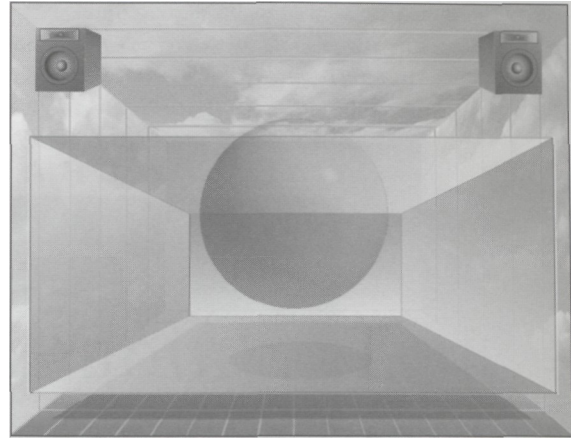


Visual 115. Reverb Turned Down in Mix

. . . or raised or lowered a bit with EQ.



Visual 116. Reverb With High-Frequency EQ Boost



Visual 117. Reverb With Low-Frequency EQ Boost

HARMONY PROCESSORS , PITCH TRANSPOSERS , OCTAVERS

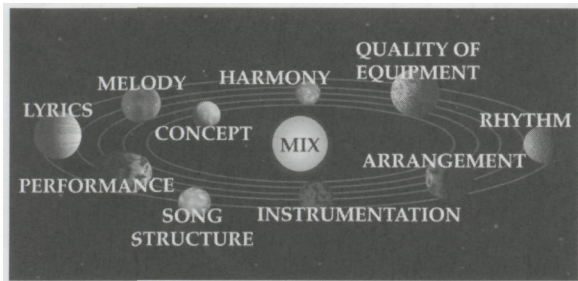
A harmony processor (harmonizer, pitch transposer, octaver) raises or lowers the pitch and then puts it back in time. Usually, when you raise or lower the pitch of a sound, the duration of the sound is either shortened or lengthened. A harmonizer takes a longer, lowered pitch; deletes tiny slivers of sound (individual samples); and then splices it back together to keep it in time. (This means you can have Darth Vader singing a happy song in time.) A harmonizing unit also takes a shorter sound that has been raised in pitch, makes copies of the sound, and then splices them back together, putting it back in real time. Therefore, you can have the Chipmunks singing the blues in time with the rest of the band. Often, on cheaper harmony processors, you can even hear the "glitches" where the sounds have been spliced back together to put them in time.

When you raise or lower the pitch of a sound, it directly affects the amount of space it takes up. The higher the pitch, the less space the sound takes up.

Each and every effect has its own world of feelings that it brings to a mix. The trick is to get to know the feeling it gives you.

Traditions and Common "Musical Dynamics" Created with Studio Equipment

To make a great mix, we must determine what you can do in a mix as opposed to what you can do during the recording.



Visual 118. Mix as Center of 11 Aspects (see color Visual 3C)

When mixing, the four types of tools that you can use to create all the different styles of mixes in the world are *volume faders, panpots, equalization, and effects*.

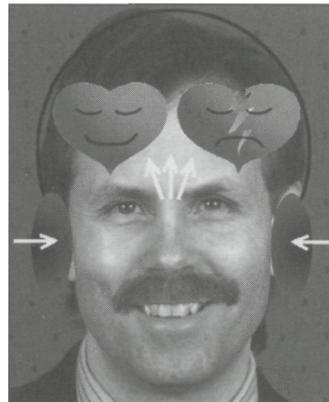
The art of mixing is the way in which the dynamics we create with the equipment in the studio interface with the dynamics apparent in music and songs.

When we speak about dynamics, we are not talking about the common terminology used for volume dynamics; we are not talking about changes in loudness. We are talking about changes in intensity.

THE DYNAMICS IN MUSIC AND SONGS

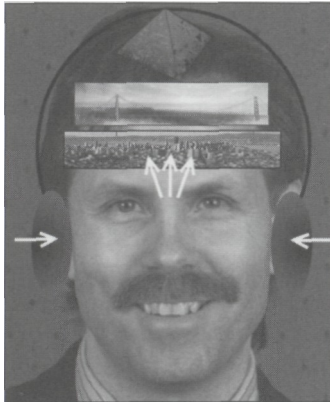
Before we explore the dynamics that can be created with the technical tools, let's explore the dynamics found in music and songs. A dynamic in music is anything that you get out of music. Music touches us in just about every aspect of our lives, and however you relate to music is, of course, valid. There are millions of dynamics discernible in music that affect us theoretically, emotionally, physically, visually, psychologically, physiologically, and spiritually.

The most common dynamic that people feel in music is "up" and "down," whether it be on a physical, abstract, emotional, or psychic level. Some people feel very strong emotions when they hear certain types of music. It can make them happy or sad. It can crack them up with laughter or bring tears to their hearts.



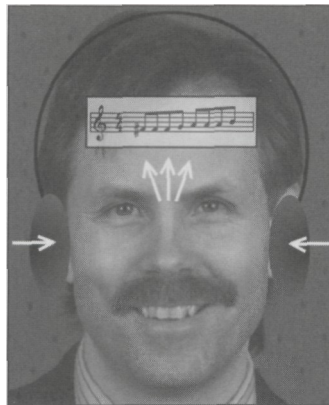
Visual 119. Some People Get Feelings and Emotions Out of Music

Some people see structure in music. And often they relate these structures to common structures found in the world, such as buildings, bridges, and pyramids.



Visual 120. Some People See Structure and Form in Music

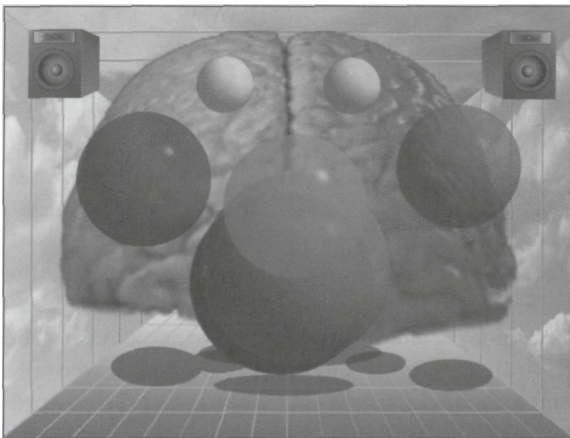
Some people relate to music through music theory. They see notes on a scale, the intervals between notes, and chord structures. There are thousands of schools that teach the incredibly complex detail found in the study of music itself.



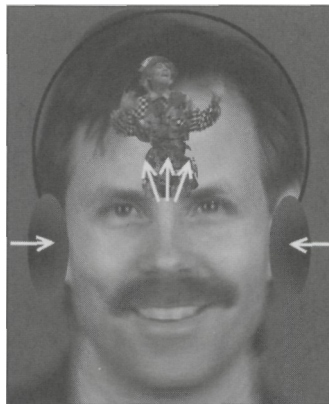
Visual 122. Some People See Music Theory

There are those who actually see the workings of the brain in a song. They see the way in which our minds work as being similar to the flow of a song. Other people even think of songs as thought forms. In fact, there are bands that write their music to represent the way the brain works. This explains the common theory that music is just an extension of our personalities.

Most of us also have physical reactions, like toe tapping, finger snapping, head bopping (or banging), and dancing. Much of the study of dance is how movement is related to music. Shake, rattle, and roll. Physically, music can make us feel good from head to toe.

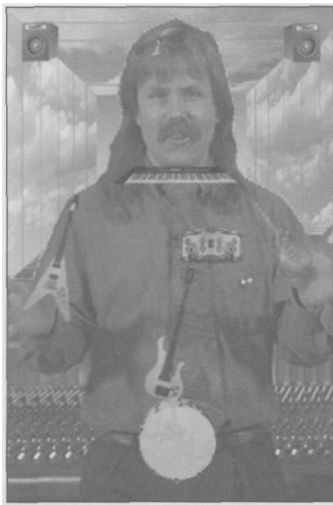


Visual 121. Some People See Thought Forms and the Mind



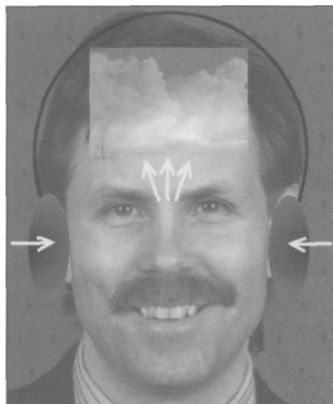
Visual 123. Some People Move When They Hear Music

Not only does music move us physically, there is also a whole world of music therapy based on the healing vibrations of sound. Just imagine—if you could place instruments in a mix at different places in your body—where would you put the kick drum? How about the guitar or string section? Try a tuba in your tummy or sitar in your chest. Or how about reverb in your brain? Quite possibly, certain songs played inside of different organs in our bodies might even cure diseases.



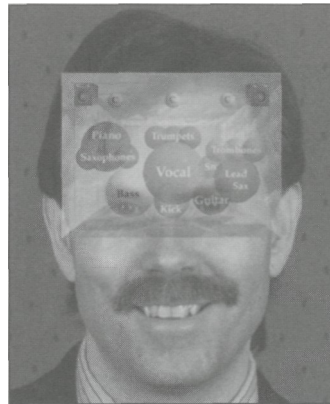
Visual 124. Where in Body Would You Put Sounds in Mix?

Some people see visual imagery or abstract colors and images. Walt Disney saw flying elephants.



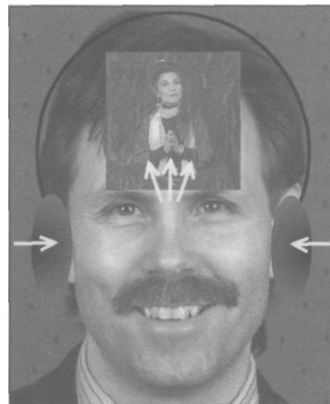
Visual 125. Some Get Imagination Out of Music

Just check out MTV to see a whole other world of visual imagery. There are also those who see bubbles.



Visual 126. Some See Bubbles

Then there are those who see spiritual connotations. The whole world of religious music is a good example. Music is often seen as a direct connection to God. Others go elsewhere.



Visual 127. Some See Spirituality in Music

So now you see that music can evoke a wide range of possible dynamics in people. They are as varied as people and life itself, and they are all valid. The recording engineer should look for and be sensitive to the dynamics that people see in music. The recording engineer's job is to create musical dynamics with the equipment that reveals or enhances the magic people find in music.

THE DYNAMICS CREATED BY THE EQUIPMENT

So, what are the dynamics that we can create with the equipment in the studio? There are four types of tools to create all dynamics in the world: volume faders, panpots, equalization, and effects. To make the complexities of dynamics created with these four tools easier to understand, I will break each down into three levels. These levels increase in intensity, with Level 3 being the most intense.

Level 1—Individual Placement and Relative Settings

This is the difference between the individual levels or settings of each piece of equipment. Setting volumes, EQ, panning, and effects at specific levels creates a relatively minor emotional effect. For example, placing a vocal louder or softer or left or right of center, EQ'ing it to sound natural or unusual, or adding effects or not will all affect the way that the vocal comes across in the song.

Level 2—Patterns of Placement

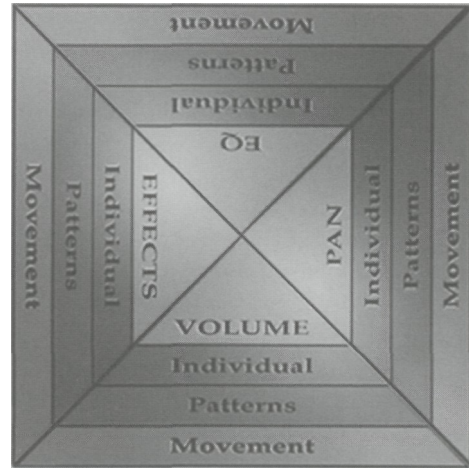
This is the combination of the settings for all the sounds in the mix. These dynamics make more of a difference than those in Level 1. For example, if you set all the volumes "even," little variation between the loudest and softest sounds in the mix, the mix will sound quite different than if you set the levels so that the dynamic range between softest and loudest sounds is wide. Also, lopsided panning, an overall bright EQ for the entire mix, and effects that collectively tend towards a certain style of mix will all create an effective dynamic.

Level 3—Changing Settings

This is the movement created when you change settings during the mix, when you change the volume, panning, EQ, or effects during the actual recording of the mix to a stereo deck. It is the most intense of the three levels and can overwhelm the song, becoming the sole focus of attention at that moment. Therefore, this level of dynamic is only used when it is appropriate for the style of music or song (and when the band will let you).

In certain styles of music, the mix should be invisible, or transparent. For example, if you can hear the mix with big band music, acoustic jazz, or bluegrass, it only gets in the way. The mix should let the music show through.

However, in other styles of music, the dynamics created with the mix actually act as a musical component of the song. The mix itself becomes part of the song. Pink Floyd has, of course, taken this to the extreme with quadraphonic concerts. Rap, hip hop, and techno music also commonly utilize the mix as if it is another instrument in the song. Let's look at the four control room tools—volume, EQ, panning, and effects—and the three levels of dynamics for each.

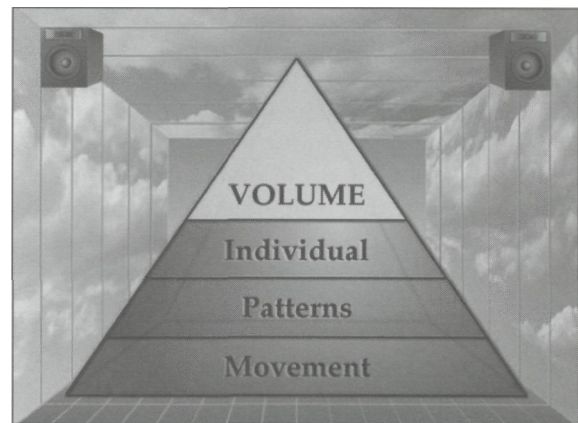


Visual 128. Pyramid of Tools and Dynamics (and Outline of This Chapter)
(see color Visual 128C)

I'll begin with volume.

SECTION A

Volume Control Dynamics



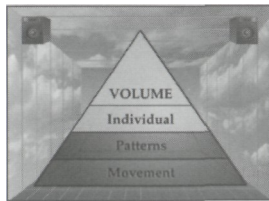
You can create musical and emotional dynamics by placing each instrument at different volume levels in a mix. Simply making a sound louder or softer affects how it is perceived. However, you create a much more intense dynamic when all of the volume controls create a pattern based on their collective placement. For example, if all of the volumes are set evenly, so that there is very little variation between the loudest and softest sounds, the mix will be quite different from one with a wide variation in volume levels. When you

change the volume levels during a mix, it creates a level of dynamic that is often so strong it draws the listener's attention away from the song, which could be cool if it's appropriate for the style of music and song.

Now, I'll go into more detail about each of the three levels of dynamics that can be created with volume settings.

FADER VOLUME LEVELS

Level 1 Dynamics: Individual Volume Placement and Relative Settings



You can create a wide range of emotional and musical dynamics depending on how you set the faders on the console. The first and most basic level of dynamics is based on where you place the volume of each sound in relation to the other sounds in the mix. For example, if you place a vocal loud and out front in the mix, it will sound completely different than if it is placed back in the mix and softer.

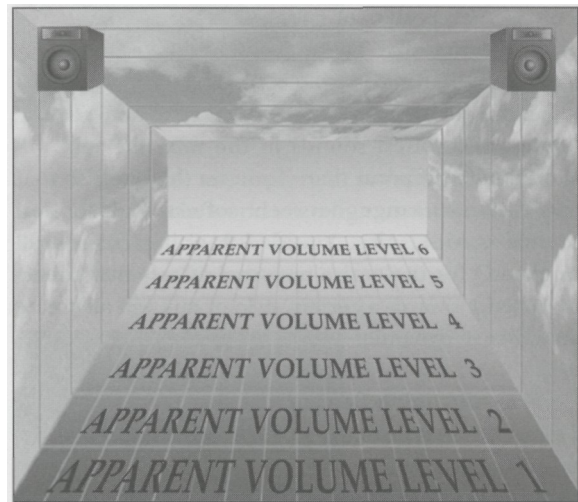
The musical dynamics that can be created with volume placement are much more complex than most people imagine. Many people think of balancing the volume of sounds as making them even in volume. However, normally, we don't want all of the instruments to be the same volume. We usually want one instrument to be a bit louder than another, some in the foreground, some in the background, some in between.

Every instrument has its own traditional volume level based on the style of music and the details of the song. In many types of music, these levels have become strictly set. For example, the volume levels for

where each level should be).

Let's explore these traditional levels in volume placement for each instrument. We'll begin by setting up a scale for the volume levels that different instruments are placed at in a mix.

If we think of volume in decibels, based on sound pressure level, then a sound could be set at over 140 different volume levels in a mix. But in order to make this wide range of levels more manageable, I'll divide them into six different levels, where 1 is the loudest and 6 is the softest.



Visual 129. 6 Apparent Volume Levels (see color Visual 129C)

Remember that we are discussing relative apparent volumes. The apparent volume of a sound is also dependent on the waveform of a sound. For example, a chainsaw sounds louder to our ear than a flute, even if they are both at the exact same volume. The apparent volume is the level that sounds seem to be to our ear.

1	2	3	4	5	6
Alarm Clocks	Lead Vocals	Main Rhythm	Rhythm Beds	Effects	Whispers
Explosions	Lead Inst's	Lead Vocal	Chordal Pads	Kick (Jazz)	Talking
Primal Screams	Boom	Toms	Drums (Jazz)	Hums	Noises
	Horn Blasts	Snare (Dance)	Bckgrd Vocals	Bckgrd Vocals	Doubling
	Symph Blasts	Kick (Metal)	Strings		
		Hi-Hat (Jazz)	Reverb		
		Loud Effects			

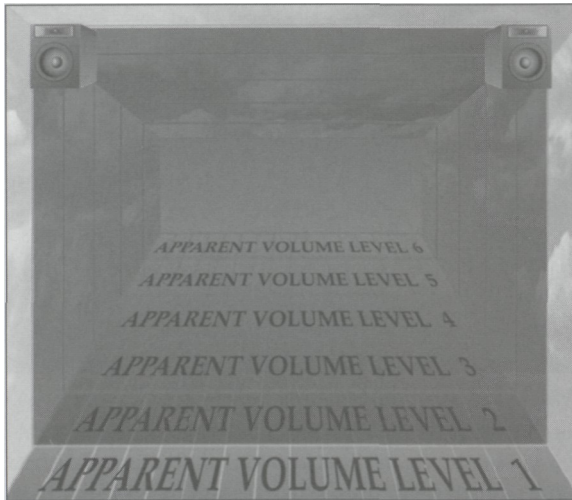
Chart 11. 6 Ranges of Apparent Volume Levels With Typical Instruments in Each Level

big band, jazz, and even country have very little leeway. On the other hand, the set levels in rap and hip hop are much looser (although certainly some rap and hip hop artists have their own strict ideas as to

RANGES OF APPARENT VOLUME LEVELS

Apparent Volume Level 1

Sounds at this volume are shockingly loud. In fact, it is quite rare and unusual to place sounds at this level. Commonly, only sounds that are very short in duration are this loud. If a normal instrument is placed at this level, it is usually thought of as either being wrong or extremely creative. The alarm clocks in "Time" from *Dark Side of the Moon* by Pink Floyd are an example of interesting Level 1 sounds. Explosions, primal screams, and other special effects might also be this loud.

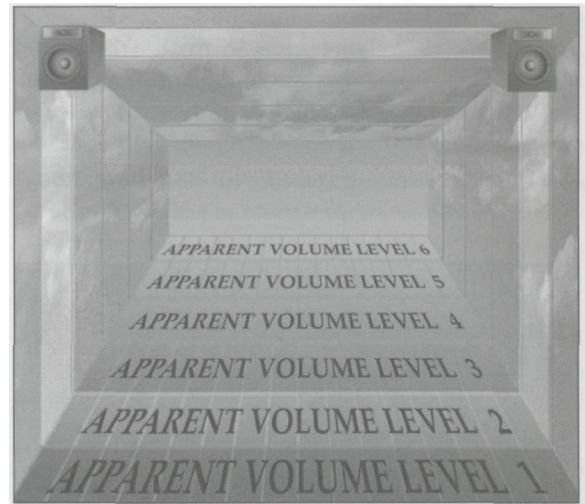


Visual 130. Apparent Volume Level 1 Highlighted

Apparent Volume Level 2

The primary sounds at this volume are vocals and lead instruments used for music in which the vocals or lyrics are the main focus of attention, such as big band, middle-of-the-road, or for vocals, like those of Bob Dylan, Janis Joplin, Mariah Carey, etc. In many types of rock 'n' roll, the vocals are placed much lower in the mix.

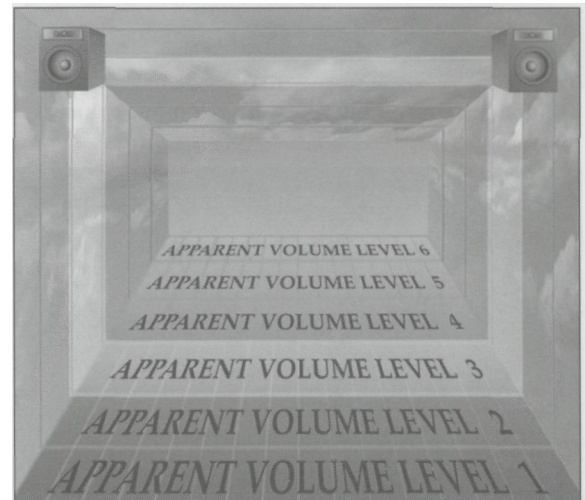
If a song has a great lead instrument player, that instrument is often placed at this level in the mix. You might also find the boom in rap music or the kick drums or toms in heavy metal at this level. Horn blasts in big band music and symphony blasts in classical music are often set at this level.



Visual 131. Apparent Volume Level 2 Highlighted

Apparent Volume Level 3

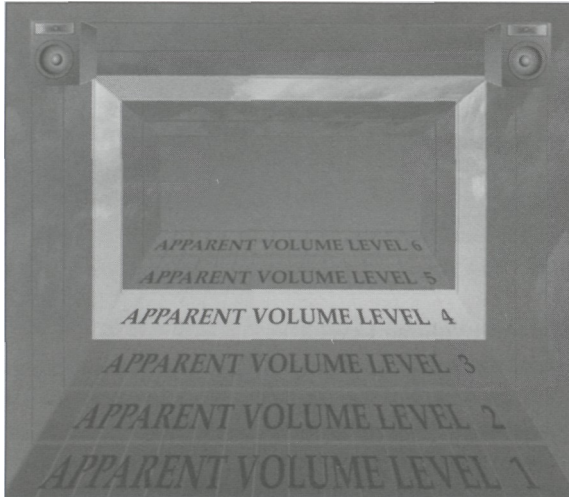
Sounds at this level consist of primary rhythm parts, such as drums, bass, guitar, and keyboards. Lead vocals in a lot of rock 'n' roll are also at this level when set back in the music. Other examples include kick drums in most heavy metal, snare drums in most dance music, and toms and cymbals in almost all styles of music. Hi-hat is only occasionally at this level, although jazz and dance music often place it here. Phil Collins was probably the first person to place reverb on the drums this loud.



Visual 132. Apparent Volume Level 3 Highlighted

Apparent Volume Level 4

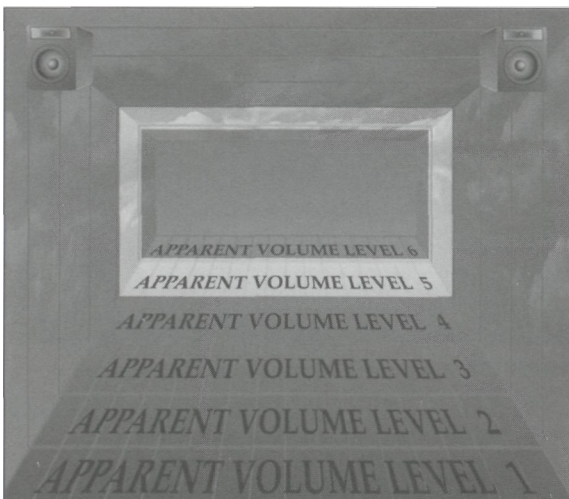
Sounds at this volume include rhythm beds and chordal pads, such as background piano, keys, or guitar. Drums in lots of jazz, middle-of-the-road, and easy rock are often at this level. When reverb is noticeable as a separate sound, it is normally here. Background vocals and strings are also often placed here.



Visual 133. Apparent Volume Level 4 Highlighted

Apparent Volume Level 5

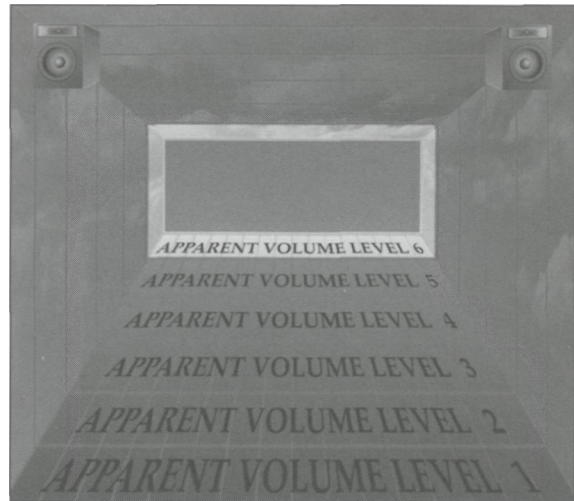
Sounds at this level include the kick drum in jazz and big band music. Lots of effects and reverb are often placed here, so that they can only be heard if you listen closely. Background vocals are sometimes relegated to this level. Other instruments placed here function only to fill in the mix because their images will not be clear and defined at such a low volume.



Visual 134. Apparent Volume Level 5 Highlighted

Apparent Volume Level 6

Sounds placed this far back in the mix are so soft that they are hard to detect. Pink Floyd is well known for adding little whispers or almost subliminal sounds to draw you into the mix. Sounds at this level can be very effective, but it is important that they serve to add to the overall mix in some way. If these sounds do not fit just right, they might be perceived as noise.



Visual 135. Apparent Volume Level 6 Highlighted

These are the instruments that we most often find at each level. However, I have placed them here only to outline and explain the scale of six volume ranges. Actual instrument levels vary depending on the style of music, song, and the musicians.

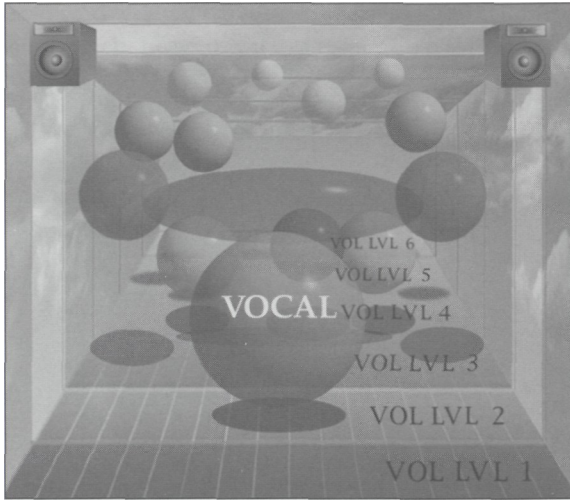
VOCALS

Let's take a look at various examples of vocals placed at different levels in the mix. Depending on the style of music, the song, and how much the singer likes his or her own voice, lead vocals normally vary between levels 2 and 4 (although a capella music puts them at level 1).

Apparent Volume Level 2

We commonly find vocals at level 2 in opera and middle-of-the-road music, like Barry Manilow and Frank Sinatra. Some folk, big band, and country music also put the vocals right out front. Besides the style of music, the details of the song also affect the level placement. If the lyrics are the main focus in the music (Bob Dylan) or the singer is phenomenal (Janis Joplin, Steve Winwood, Al Jarreau, Bobby McFerrin), then the vocals might be brought out

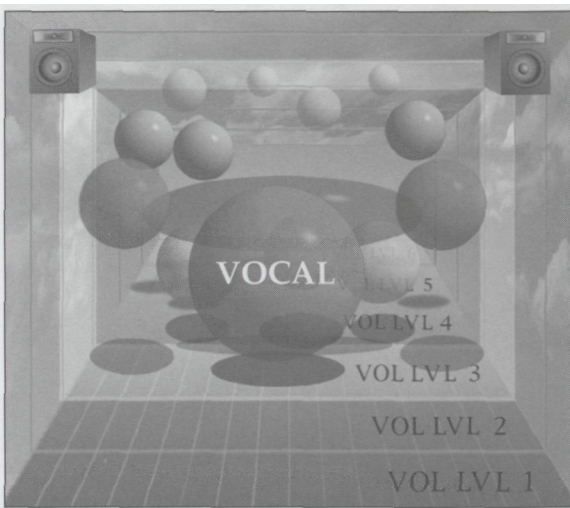
front. Also, the denser the arrangement, the lower the vocals are placed in the mix, so that the details within the arrangement won't be dwarfed by the vocals. Loud vocals can make the rest of the mix sound wimpy.



Visual 136. Apparent Volume Level 2 Vocals (see color Visual 136C)

Apparent Volume Level 3

Most vocals are mixed at level 3: laid back in the mix but still loud enough to understand what they are saying. Vocals at this level are also not so loud that they dwarf the rest of the mix.



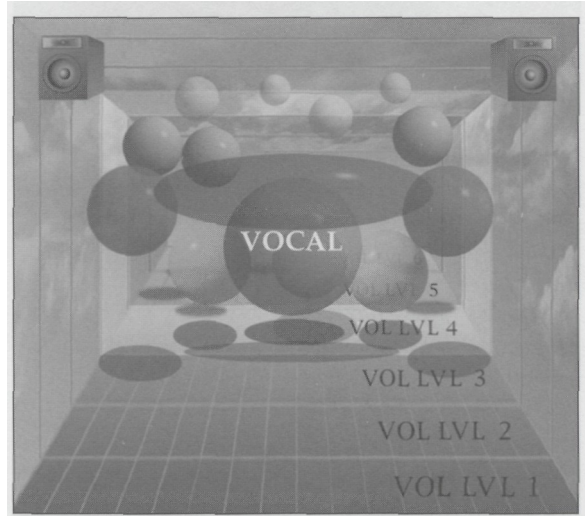
Visual 137. Apparent Volume Level 3 Vocals

Apparent Volume Level 4

Vocals at this level are so low that you normally can't understand the lyrics. As Mom would say, "How can you understand what they're saying?" "You read the lyrics in the liner notes, Mom." A good amount of rock 'n' roll, especially certain types of alternative

rock, like Smashing Pumpkins and Pearl Jam, have vocals this low in the mix. Pink Floyd also often has vocals at level 4. The lyrics (or vocal sounds) of Enya might be considered to be at level 5.

Besides the style of music, probably the most common reason for placing vocals at this level is so that they blend better with the music, therefore, not obscuring the overall rhythm and melody of the song. I have also heard clients say that if the listener has to work harder to hear what the lyrics are saying, then they will have more meaning. Possibly true, if you can understand the lyrics at all. Finally, if the lyrics are really bad or they just don't turn you on, you normally don't put them right out front. But, you never know when it comes to lyrics—it takes all types for the world to go 'round.



Visual 138. Apparent Volume Level 4 Vocals (see color Visual 138C)

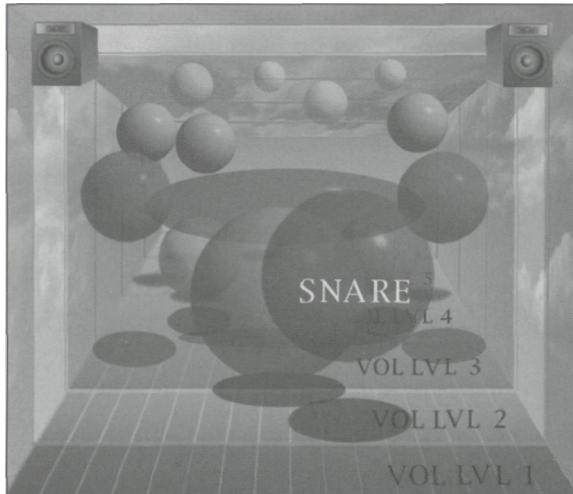
SNARE

The volume that a snare is placed in a mix is dependent on the style of music, the song, and the minds of the band members just as with vocals. The volume level of the snare, which seems to vary between levels 2 and 5, has progressed up the scale over the years. Rock 'n' roll was probably responsible for raising the level of the snare an entire level, then, in the 1960s, dance music and disco helped to raise the level of the snare another level.

Apparent Volume Level 2

Various forms of rock (some Led Zeppelin and Bruce Springsteen) have the snare this far out front in a mix. But don't confuse a large amount of reverb on a snare with being a loud snare. Often a snare that was played loudly with lots of reverb is actually placed very low in volume. Normally, a snare is only this loud if it sounds very good and is complex. A loud snare

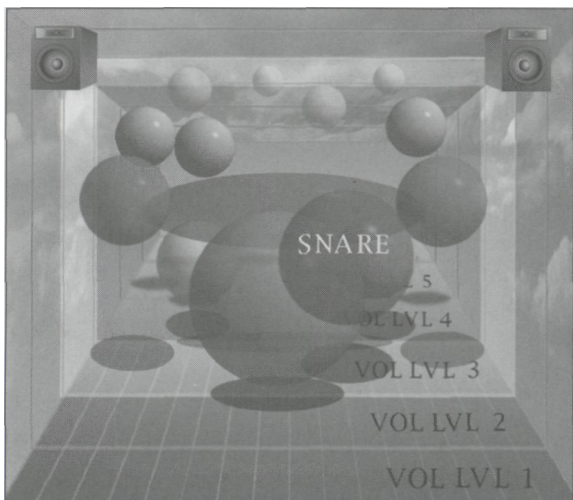
that has a simple sound and is also irritating would probably get on your nerves. Of course, there are those who might like this! Also, a snare is usually only placed at this level when the tempo is slower, leaving more room in the mix. This is probably because when it is this loud, it takes up a lot of space in the mix.



Visual 139. Apparent Volume Level 2 Snare (see color Visual 139C)

Apparent Volume Level 3

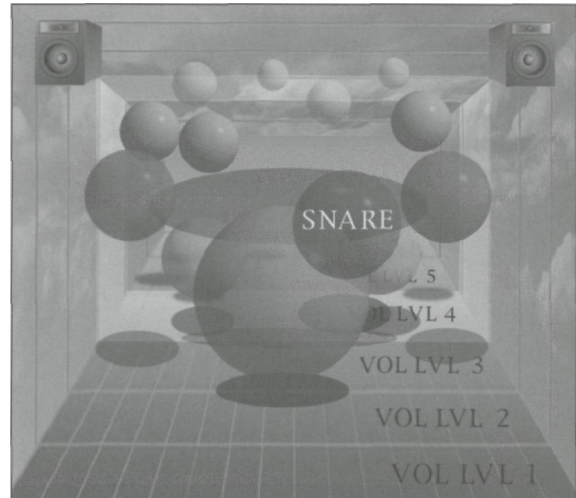
This level is most common for rock 'n' roll. The snare is at this level for many styles of music, including heavy metal, blues, and now, even country.



Visual 140. Apparent Volume Level 3 Snare

Apparent Volume Level 4

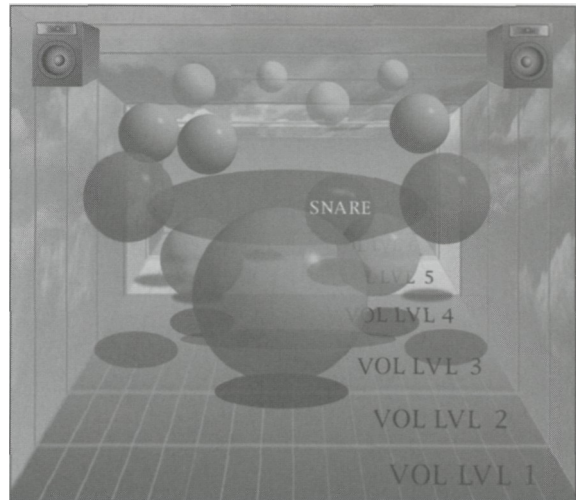
Big band, easy rock, new age, and '50s and '60s rock music often have the snare mixed this low. Most ballads will place the snare at this level, though there are some ballads that have a massive snare as loud as level 2. Hip hop will often have the snare this low because of its fast tempo and busy arrangements.



Visual 141. Apparent Volume Level 4 Snare (see color Visual 141C)

Apparent Volume Level 5

Big band music sometimes has the snare this low.



Visual 142. Apparent Volume Level 5 Snare

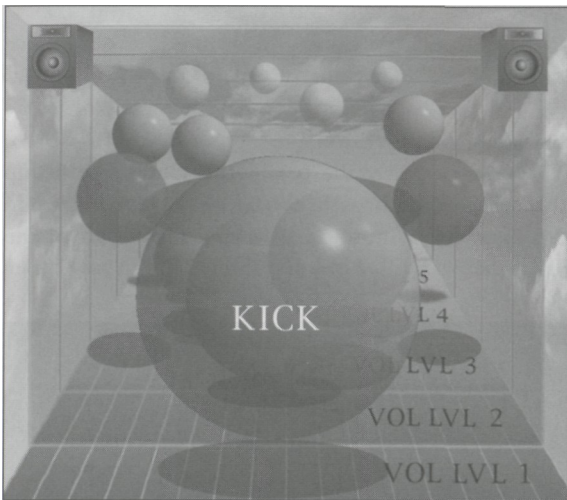
Some general rules (to be broken) include: The better the snare sound, the louder it is placed in the mix; the slower the tempo, the louder the snare; and the busier the arrangement, the lower the snare.

KICK DRUM

Again, the style of music will be the biggest influence in the volume in the mix. Kick drums tend to span levels 2 to 5. It has also been making its way up the volume scale throughout history, probably suppressed for years because it was considered to be the beat of the devil. Of course, rock brought it up one level. Then, heavy metal was responsible for raising it another level. Then, rap and hip hop came along and put it off the scale. Now, we find the kick drum at extremely loud levels in all kinds of modern music. Even Peter Gabriel has a rap boom on the album *Us*.

Apparent Volume Level 1

Rarely is a kick drum ever this loud; however, if we think of the 808 rap boom as a kick drum, then we do sometimes see it here.

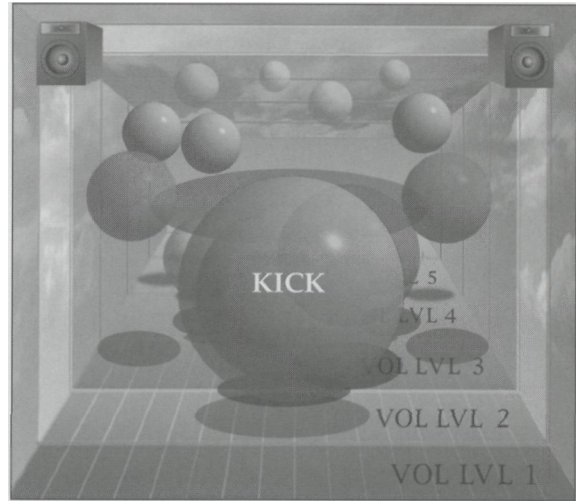


Visual 143. Apparent Volume Level 1 Kick (see color Visual 143C)

Apparent Volume Level 2

Rap booms are at this level, as is the primary kick in hip hop and house music. The kick drum in heavy metal is sometimes at this level, though it is usually raised to this level for only a short period of time in certain sections of the song. Occasionally a ballad will even have the kick at this level, and engineers have been known to make the kick this loud in blues and reggae.

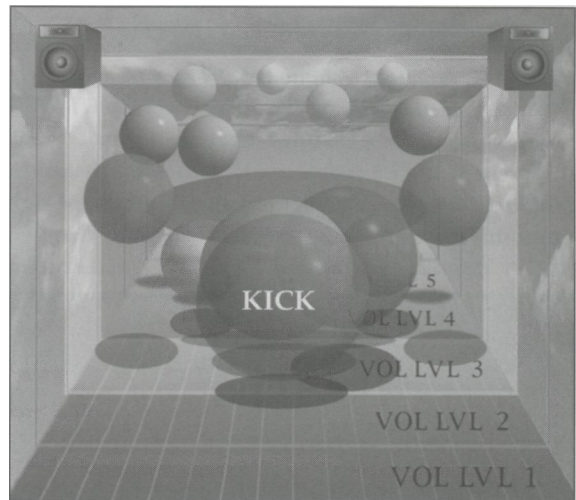
When at this level, you should always take into consideration that such a loud, low-frequency sound takes up a huge amount of space in the mix. Therefore, you need to calculate just how much room there is for it and decide whether it should be so prominent.



Visual 144. Apparent Volume Level 2 Kick

Apparent Volume Level 3

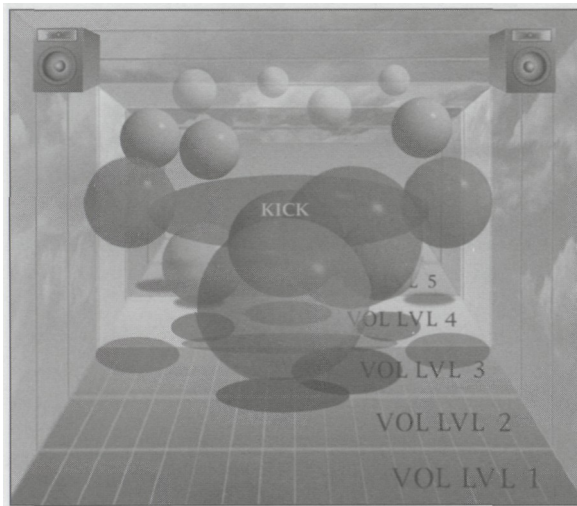
This is the most common level for the kick in most styles of music, especially rock, blues, jazz, and country.



Visual 145. Apparent Volume Level 3 Kick

Apparent Volume Level 4

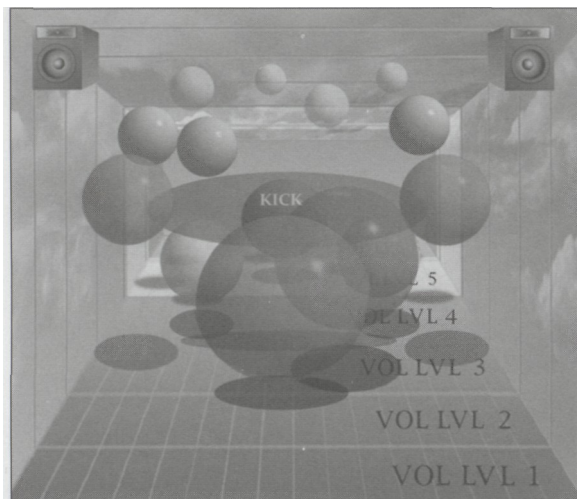
Jazz and new age, as well as a lot of ballads, commonly have the kick at this level. It is interesting that much of Jimi Hendrix's music was mixed with the kick drum down around level 4, so that you could hardly hear it. Of course, this was common in many songs and styles of music in the '60s.



Visual 146. Apparent Volume Level 4 Kick (see color Visual 146C)

Apparent Volume Level 5

Big band music commonly has the level of the kick down this low in the mix.



Visual 147. Apparent Volume Level 5 Kick

Just like the snare drum, the kick drum volume is primarily based on the style of music. However, both the song and the particular instrument sounds also contribute to this decision. The more interesting and complex the kick sound, the louder it usually is in the mix. The slower the tempo, the louder the kick. The busier the arrangement, the lower the kick.

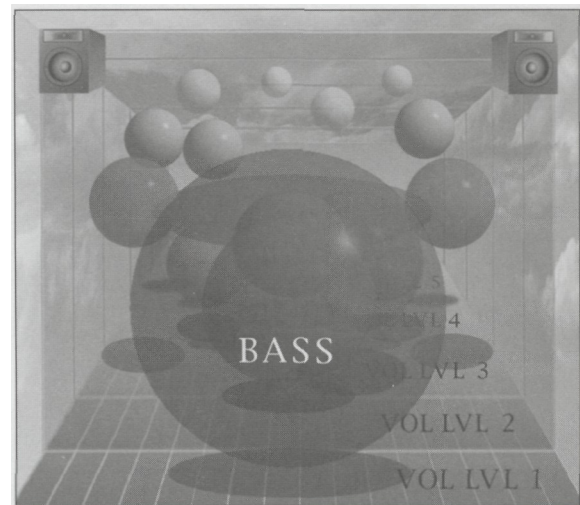
BASS GUITAR

The bass guitar normally spans levels 1 to 4. Because it takes up so much space in a mix, it is often placed lower in the mix, so it doesn't mask the other instruments too much.

With the evolution of rock and then disco, the bass has crept up the volume scale. Then rap began a revolution that not only helped raise the level of bass guitars in mixes, but resulted in a change in the hardware we use. When you go to a stereo store, you see things like Mega Bass and boom boxes. And normal home stereos are now capable of handling a lot more bass than before.

Apparent Volume Level 1

It is quite rare that the bass is this loud, even in rap and hip hop. Ordinarily, the bass is only turned up to this level for a moment in a special section of the song.

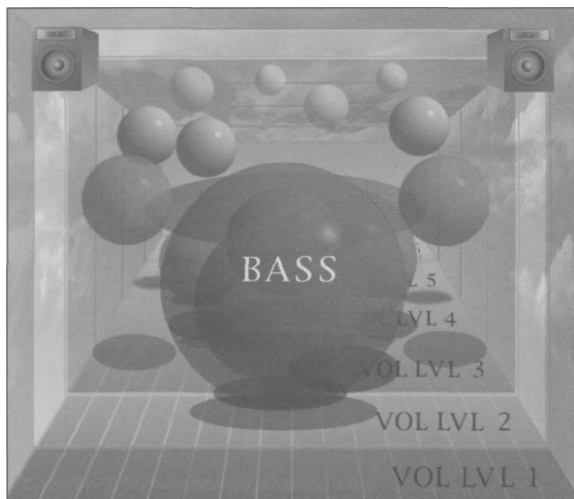


Visual 148. Apparent Volume Level 1 Bass (see color Visual 148C)

Apparent Volume Level 2

Reggae and the blues often have the bass this loud. Because the bass is carrying the song in blues, it is often needed to help fill out the sparse arrangements commonly found in these mixes. When the bass is a lead part in the song or music, it is often right out

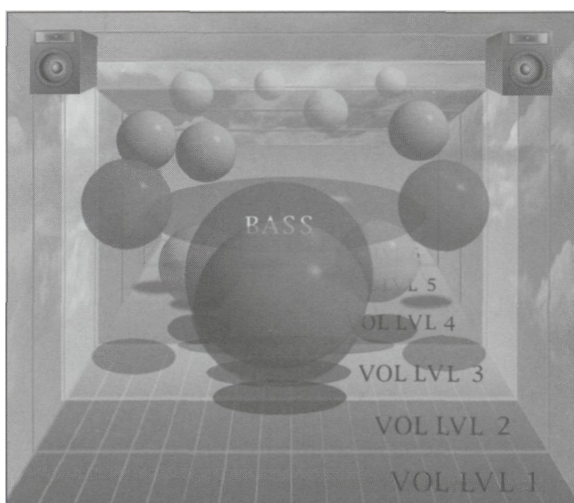
front at this level. This is often the case in jazz, especially if the bass guitar is a fretless. Primus and Stanley Clarke are good examples of the bass played at this level.



Visual 149. Apparent Volume Level 2 Bass

Apparent Volume Level 3

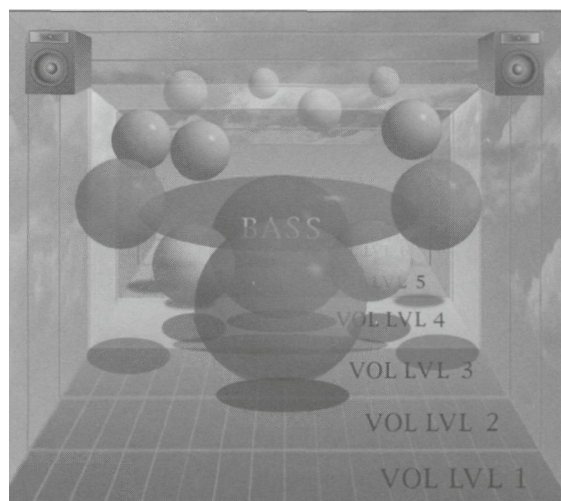
This is the most common level for the bass guitar for most styles of music: not so loud that it takes up too much space, but loud enough to still be heard well.



Visual 150. Apparent Volume Level 3 Bass (see color Visual 150C)

Apparent Volume Level 4

The bass guitar in a good amount of rock 'n' roll is down at this level, so it doesn't get in the way. In big band music, you often find the bass here. In fact, when you have a standup or acoustic bass, it often ends up here.



Visual 151. Apparent Volume Level 4 Bass

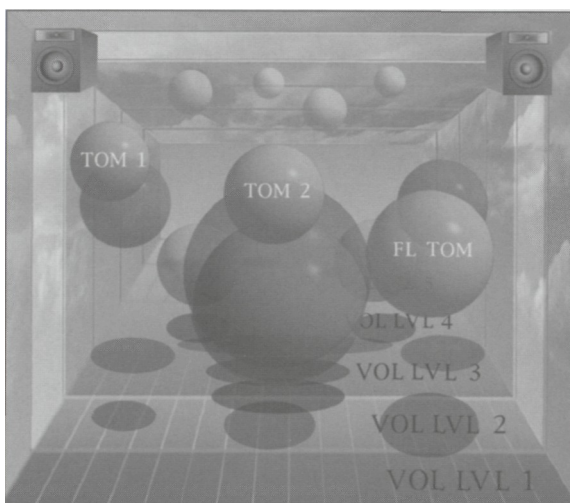
Commonly, the fewer instruments in a mix, the louder the bass because you need something to fill out the space between the speakers. Also, if you have a lot of instruments, there just isn't enough room for the bass guitar, and it will mask the other sounds if too loud.

TOM TOMS

Toms span the entire volume scale from 1 to 6. Although somewhat dependent on the style of music, the details of the song and the preferences of the engineer and band seem to be the most common determinants of tom levels. The brightness of the toms in the mix makes a huge difference as to how much they are masked by the rest of the mix.

Apparent Volume Level 2

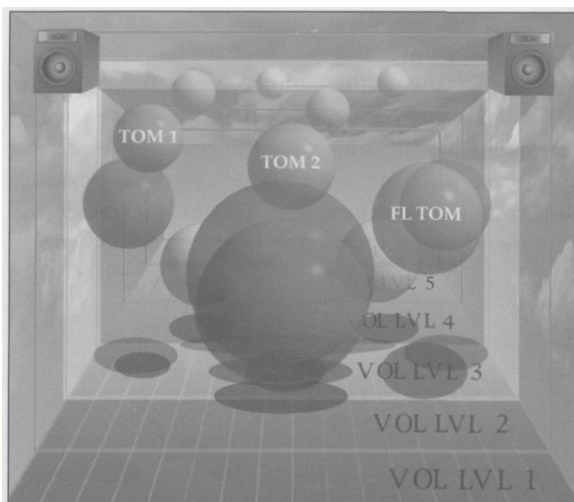
Toms are sometimes placed this loud because their duration is so short and they are played so sparsely. When sounds don't last very long, they can be turned up louder: They're gone before you know it. Also, because toms are not so edgy, they are often boosted more than you would think. Generally, the more they are played in the song, the lower toms tend to be placed in the mix.



Visual 152. Apparent Volume Level 2 Toms (see color Visual 152C)

Apparent Volume Level 3

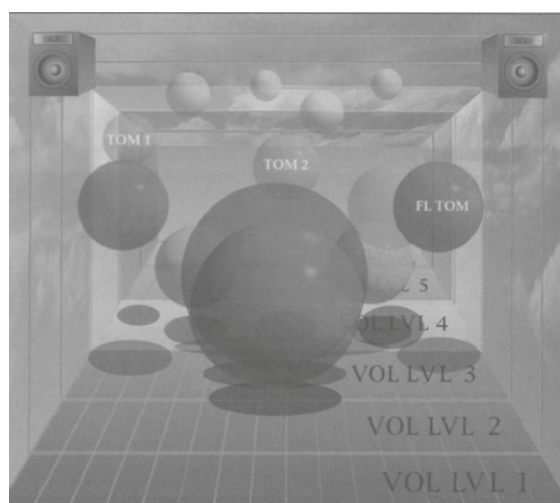
This is the most common level for toms in most styles of music: present, but not so loud that they break up the beat or rhythm of the song too much.



Visual 153. Apparent Volume Level 3 Toms

Apparent Volume Level 4

Toms are normally not very loud in most types of music, somewhere around level 4. This might have to do with the problem of cymbals bleeding into the tom mics. When this happens, the sound of the cymbals in the tom mics is irritating because the sound is reflecting off the tom heads. I think engineers won't usually turn the toms up very loud because it makes the cymbals sound so horrendous, especially if the toms need to be brightened a lot with EQ, and so they don't interrupt the flow of the song rhythm too much.



Visual 154. Apparent Volume Level 4 Toms (see color Visual 154C)

Apparent Volume Levels 5 and 6

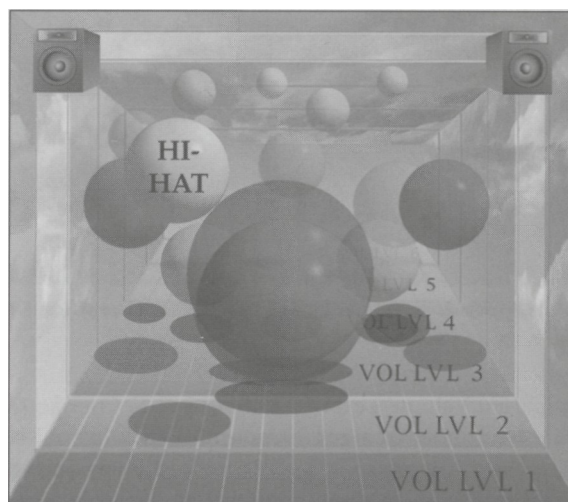
I wouldn't doubt that engineers who mix toms at levels 5 or 6 either don't like the tom parts, don't like toms in the first place, or forgot about them.

HI-HAT

The level of the hi-hat depends mostly on the style of music, although the details of the song often make a big difference, too. They normally fluctuate between levels 2 and 5.

Apparent Volume Level 2

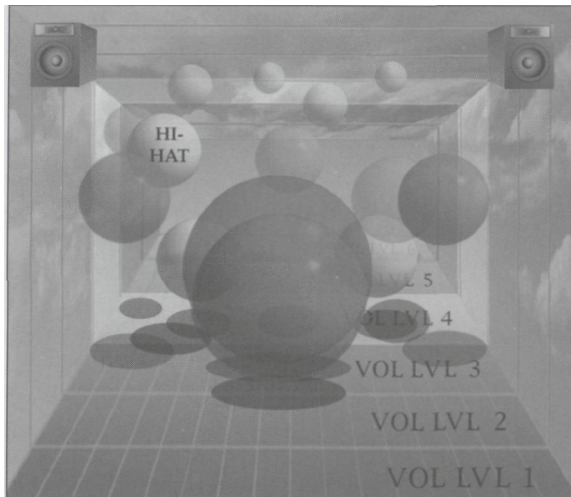
Hi-hats are normally the loudest in heavy metal and R&B music. Hip hop and jazz often place it at this level as well.



Visual 155. Apparent Volume Level 2 Hi-Hat (see color Visual 155C)

Apparent Volume Level 3 and 4

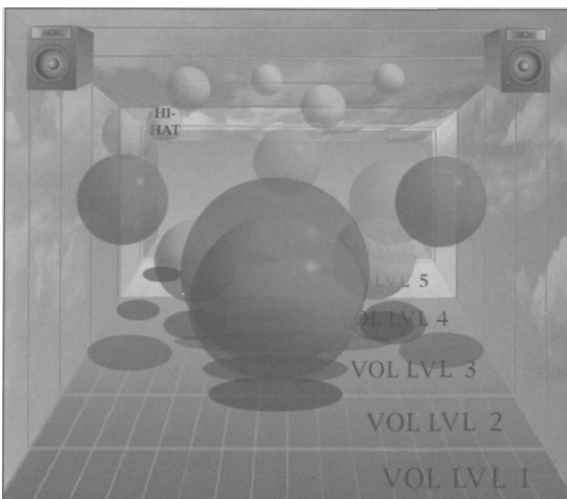
Hi-hats commonly fluctuate between these two levels for most styles of music, especially rock 'n' roll.



Visual 156. Apparent Volume Level 4 Hi-Hat

Apparent Volume Level 5

Although the hi-hat doesn't take up much space in a mix, it does cut through well. Not only is it an edgy type of sound, but it also resides in a frequency range with very few other instruments. Therefore, even when placed low in the mix, it can still be heard just fine.



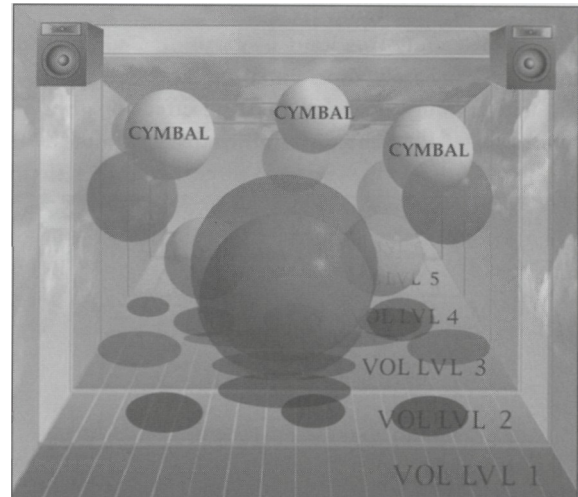
Visual 157. Apparent Volume Level 5 Hi-Hat (see color Visual 157C)

CYMBALS

Cymbals range the entire gamut, from 1-6. The style of music makes a difference, but even more importantly, the particular sound of the cymbals and the parts being played in the song tend to affect the level the most. However, it is the preferences of the engineer and the band that often determine final levels.

Apparent Volume Level 2

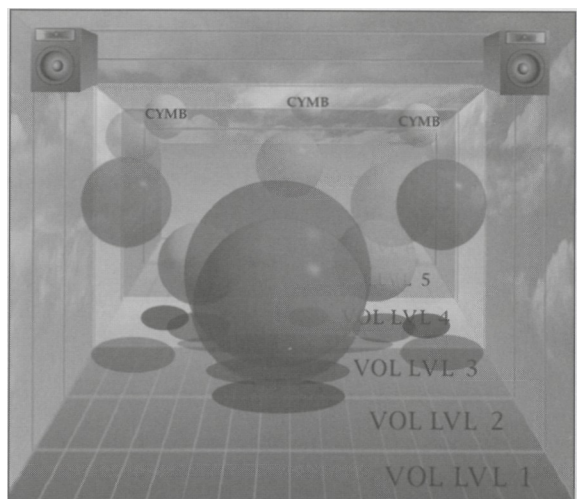
It isn't too often that cymbals are at this level, although Led Zeppelin and Creedence Clearwater Revival placed them this loud occasionally.



Visual 158. Apparent Volume Level 2 Cymbals (see color Visual 158C)

Apparent Volume Level 3 and 4

Most cymbals are set at these levels, so that they are evident but still blend in with the rest of the instruments in the song.



Visual 159. Apparent Volume Level 4 Cymbals (see color Visual 159C)

Cymbals at levels 5 or 6 are often there because of their sound or masking from other sounds in the mix.

EFFECTS

The volume of different effects varies widely over the level spectrum. Reverb, for example, has progressed up the scale over the years.

Apparent Volume Level 1

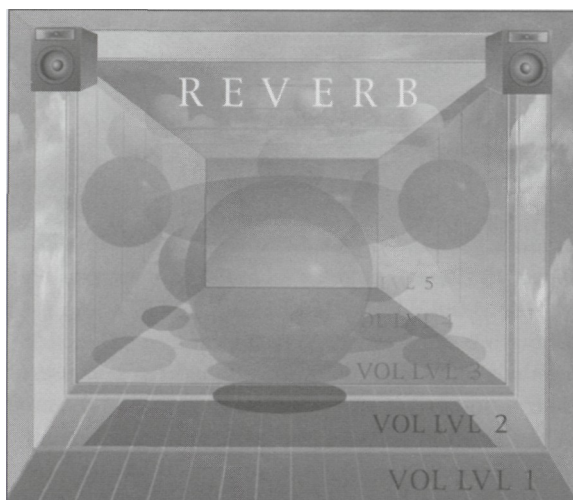
Effects are rarely this loud in a mix, usually only if they are extremely short in duration. They can be shocking enough to have a lasting effect on the listener, longer than the duration of the sound itself.



Visual 160. Apparent Volume Level 1 Effects (see color Visual 160C)

Apparent Volume Level 2

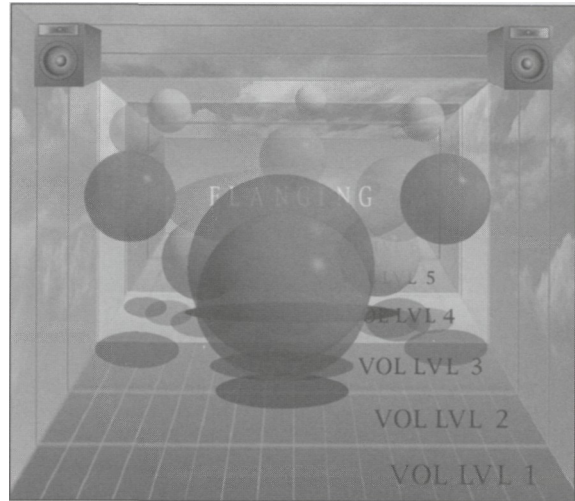
Reverb is occasionally this loud on a snare drum, depending on the song and style of music. Delays are often the same level as the sound it's on. For example, a lead guitar or vocal might easily have a delay this loud. Flange-type effects are also sometimes at this level.



Visual 161. Apparent Volume Level 2 Effects (see color Visual 161C)

Apparent Volume Levels 3 and 4

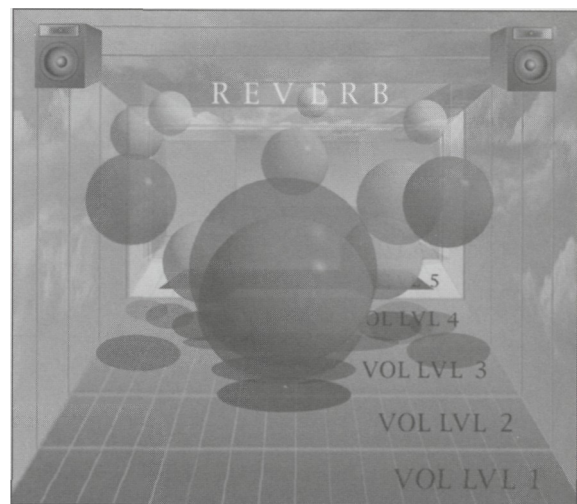
Most effects are placed at this level: loud enough to hear the detail within the effect, but not so loud that it overwhelms other sounds in the mix.



Visual 162. Apparent Volume Level 4 Effects (see color Visual 162C)

Apparent Volume Level 5

Reverb is often at this level and is quite unnoticeable to most listeners.



Visual 163. Apparent Volume Level 5 Effects (see color Visual 163C)

OTHER INSTRUMENTS

We have covered only the most common instruments found in recordings. There are, of course, a huge number of other instruments. You should note the level of each and every instrument in the music you listen to.

SUMMARY

As you can see, there is an incredible variety of musical dynamics based on the level that you set each sound in the mix. This is important because so many bands want their mixes to sound like they traditionally do for their style of music.

When bands complain that the mix doesn't sound quite right, but they don't know why, it is often as simple as an instrument being placed at the wrong volume. It seems that most engineers will start changing EQs and effects to try to please the band, but it might actually be that the rhythm guitar is too loud compared to the vocals, or the kick drum is the wrong volume compared to the bass guitar.

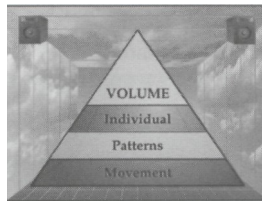
I have only provided examples of common styles of music and songs. The details of each instrument level for each style of music and song are as detailed as people themselves. And after you throw in the values of the band, the engineer, and everyone else involved, every project has further variations. It is this level of uniqueness that makes being a recording engineer such a joy. You are never bored.

Now that you know this scale (1-6), start checking out the relative level of every sound in every song. Most importantly, for each sound, ask yourself these three questions: Why might the engineer have put it at the level it's at? Do I like it there? Would I have put it there?

As you now know, there are a number of reasons for the placement of volume levels based on the type of music, the song, and the people involved. See if you can guess why the engineer might have placed it where he or she did. At first, you may not have any preferences. But if you simply pay attention to the level of each sound, after awhile you will develop your own values and you will know exactly where you like the levels of different instrument sounds for various styles of music and songs. Then, when you go into the studio, you'll no longer be unsure about exact levels; you'll know exactly where you want the volume of each sound.

The next step is to begin differentiating between finer and finer levels of volume, so that you can see more than just six levels: Twelve levels is cool, but twenty-four is incredible.

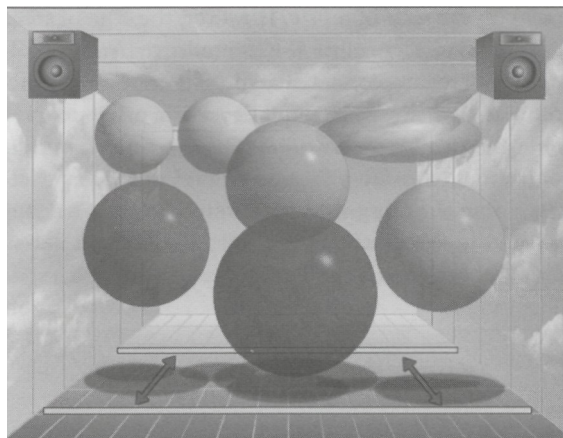
Level 2 Dynamics: Patterns in Volume Placement



Compared to the individual volume levels of an instrument, combined levels created by the overall relationships of the volume levels are more emotionally and musically dynamic. I call these volume patterns.

Certain styles of music have developed their own traditional levels of how even or uneven the overall volumes are set. And again, certain styles of music have stricter rules than others. It is important to get to know these traditional levels, so you can push the limits of creativity and change the world.

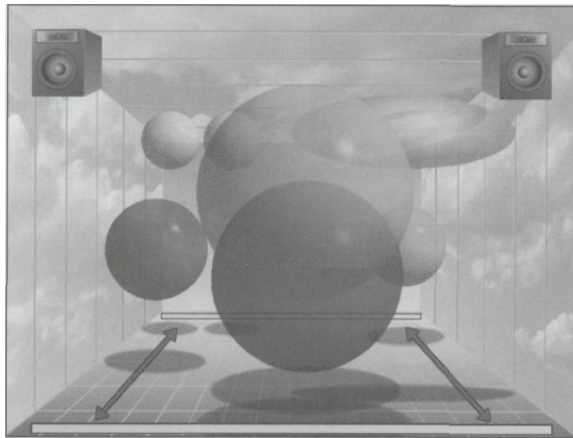
In some styles of mixes, the volumes are set evenly so that there is very little variation between the loudest and softest sounds. New age music, alternative rock (Tears for Fears, REM, Smashing Pumpkins, Nine Inch Nails, etc.), middle-of-the-road music, country music, and easy rock are often mixed with very little variation in volumes. You could say that Muzak is the extreme example. Even volumes might also be appropriate for a love song.



Visual 164. Song With Even Volumes (see color Visual 42C)

Sometimes, it is necessary to compress sounds a bit more to help make the volumes more even. However, you can only compress things so much before they sound squashed. Often it becomes necessary to "ride" (move) the faders up and down in volume to keep things even. However, because this actually means moving the faders, I will deal with this more in the next section on "Changing Volumes."

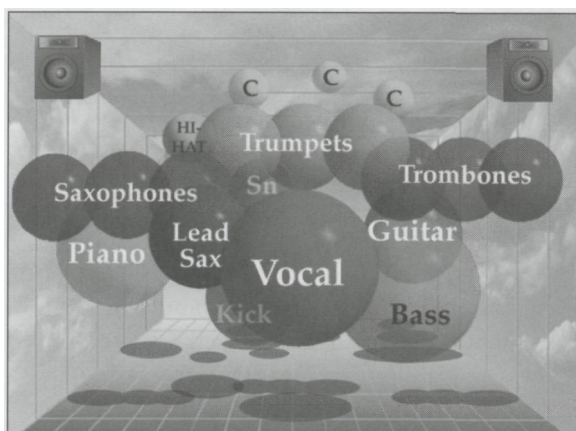
Alternatively, some styles of music are mixed with extreme variations between the softest and loudest sounds, like this:



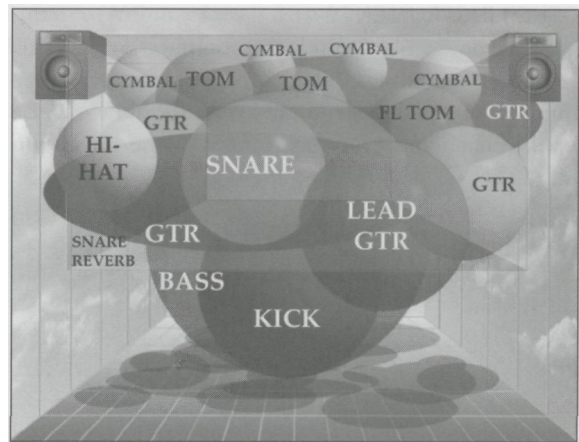
Visual 165. Song With Uneven Volumes (see color Visual 43C)

Lots of rock 'n' roll, dance music, and rap are mixed this way. Big band music is also a perfect example of this type of mix. You might have extremely soft sounds followed by huge horn blasts. Even some classical music is this dynamic. Pink Floyd is well known for trying to shock you to death with alarm clocks and explosions. It can be quite fun and exhilarating.

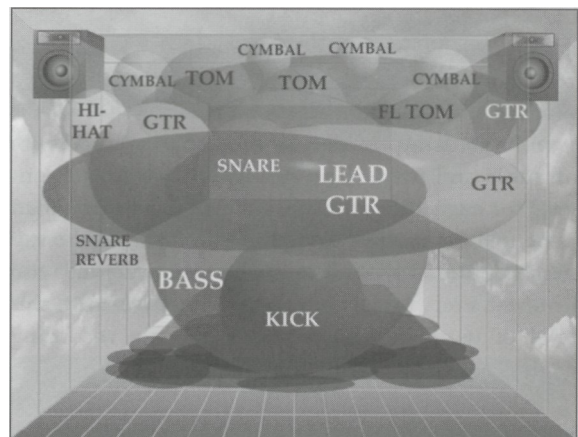
Whether the mix is even or uneven is mostly based on the style of music. However, the type of song also helps to determine the overall evenness of volumes. For example, a ballad might be mixed with volumes that are more equal to each other to preserve the overall mellow feel. On the other hand, a song about "shocking changes in life" might very well have some shocking volume differences. It is helpful to listen to the details of the song to help you determine whether levels should be even or uneven.



Visual 166. Uneven Volumes: Big Band Mix (see color Visual 166C)

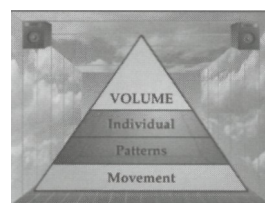


Visual 167. Even Volumes: Heavy Metal Mix (see color Visual 167C)



Visual 168. Even Volumes: Alternative Rock Mix (see color Visual 168C)

Level 3 Dynamics: Changing Volume Levels



Volume can range from soft to loud, and individual sounds can also be raised or lowered within the song. When faders are moved while a sound is playing, the dynamic created tends to be intense. If the level of a sound is changed at a good transition point, such as the beginning of a chorus or lead break, the dynamic created is not nearly as intense as when changed in the middle of a section. Such a strong dynamic often causes the listener to focus on the change you are making. Therefore, it should be done as musically as possible—that is, in time with the tempo or other changes that are occurring in the song.

The volume of the entire mix can also be raised or lowered. The master stereo fader volumes are not commonly changed except at the beginning or end of the song. Fading in the entire mix at the beginning of a song creates a very nice and smooth dynamic; The Beatles used this on "Eight Days a Week." I've also heard songs where the entire mix is faded out, faded back in, faded out again, and faded in one more time. A very cool effect is to cut, boost, or gradually fade the overall volume in the middle of a song. Such dynamics can be quite effective. Fading out a particular section of instruments (such as drums) and then fading it back in can also serve to wake people up.

In addition to moving a fader to create volume dynamics, you will usually need to adjust levels to keep the volumes even. Compressor/limiters can only do so much before they make a sound unnatural. Therefore, you can create another dynamic—to actually even out volumes more—by riding the faders throughout the mix.

If you bring a sound out front by turning the volume up at the beginning of the song, it will now be clear in our brain for the rest of the song, even if it is set back in volume in the mix. Because of this, you can create a special psychoacoustic effect by bringing up and highlighting a different sound in the mix, then turning it down. If you keep doing this, you create the illusion that all sounds in the mix are loud and clear. However, if someone were to walk into the room in the middle of the song, they probably would not agree.

Although changing levels in a mix can create a major dynamic, you can create much more subtle (and often more effective) dynamics by making minor volume changes in various sections of a song. For example, you might boost the volume of the guitars (ever so slightly) in the chorus, raise the snare and snare reverb ever so slightly in the lead break, then bring up the bass guitar and kick drum (again, just a touch) in the vamp at the end of the song. These subtle volume changes can add serious magic to your mix.

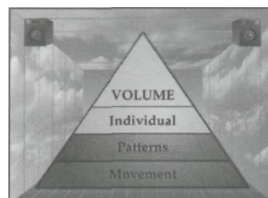
These three levels of dynamics—volume placement, volume patterns, and volume movement—make up all that can be done with volume faders in a mix.

COMPRESSOR/LIMITERS

Just as volume faders can create a wide range of dynamics, compressor/limiters can also be used to create musical dynamics to fit the music or song. Compressor/limiters are often used for technical reasons, such as to get a better signal-to-noise ratio (less hiss). However, this section covers how they are used

to create a musical or emotional component like another instrument in the mix.

Level 1 Dynamics: Individual Compressor/Limiter Placement and Relative Settings



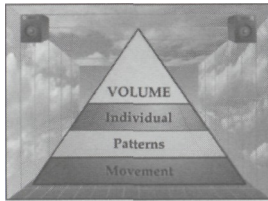
Sounds are compressed based on the dynamic range of the sound itself. For example, a "screamer"-type vocal (Aretha Franklin, Axl Rose, Janis Joplin, Pavarotti) will normally be compressed more to account for the huge difference in volume from soft to loud. However, there are certain sounds that are compressed more out of traditions that have developed over years of recording and mixing.

First, most acoustic instrument sounds are compressed. Vocals and bass guitar are almost always compressed. Many engineers will compress the kick drum for presence, although there are some who do not believe in compressing the kick. If the drummer is good and has control of the volume of each kick lick, then compression may not be necessary. However, compression does make the attack of the kick drum sharper.

Many instruments are only compressed when they are placed in a mix (as opposed to being solo). For example, it is rare for anyone to compress a solo piano; however, pianos are commonly compressed when placed in a mix, especially a busy one. Acoustic guitars are also commonly compressed in a mix. In fact, as mentioned before, the busier the mix, the more the individual sounds are compressed. This is done in order to minimize the huge amount of movement by the natural fluctuations in volume of each sound. We can only handle so much stimuli before we start to flip out.

It is also common to compress the loudest and softest sounds in a mix more than other sounds. This is because there are certain limits as to how loud a sound can be in a mix before it sounds "wrong." Likewise, if a sound is too low in a mix, it simply will not be heard. Lead guitars are often compressed more, simply because some people like the intensity and power of an electric guitar right in their face. Remember, one of the primary functions of a compressor/limiter is to make a sound more present.

Level 2 Dynamics: Patterns of Compressor/Limiter Placement



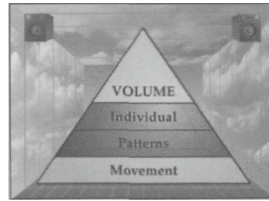
The overall amount of compression on a mix is obviously more noticeable than any individual setting. There are two ways that it can be applied. The first is based on the combined overall amount of compression added to each sound individually because some sounds may have no compression at all. The second is based on the amount of compression added to the overall mix once it has been mixed. This process, commonly done in mastering for CD pressing, only compresses the loudest sounds in the entire mix. When sounds are compressed individually during the recording and mixing of the song, all volumes could be compressed, not just the loudest ones.

Regardless of the way overall compression is applied, or calculated, certain styles of music have developed quite strong traditions as to how much they are compressed. For example, most pop music has more overall compression than most country music or punk. This can be perceived as "polish," which some people complain is part of being over-produced. You can see the amount of overall compression on cassette deck VU meters. The meters barely move on highly compressed material.

Rhythm and blues and middle-of-the-road music are often compressed more than other styles. Acoustic music, such as bluegrass and acoustic jazz, are commonly not compressed as much. Again, these rules are made to be broken. Much of the electronic type of music (anything that uses a lot of synthesizers and drum machines) will often sound more compressed because many synthesized sounds have been compressed previous to being placed in the synth. Therefore, much of the hip hop and techno music mixes sound highly compressed.

The trick is to now pay attention to the overall amount of compression that seems to be going on in each song you hear, and develop your own values for how much compression you like.

Level 3 Dynamics: Changing Compressor/Limiter Settings (Levels and Parameters)

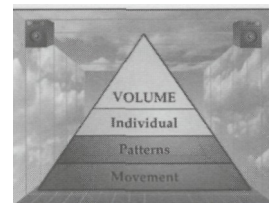


Changing the amount of compression, ratio setting, attack, or release time is rare in the midst of a mix. It is commonly done when mixing voices in a movie, video, or commercial. Narration is often compressed more than dialogue, for example. Because compression has the effect of making something sound more present, it can actually be used to create a dynamic that seems to move from more distant to more present or vice versa. One of the most dynamic effects is to change from no compression to limiting. This makes the sound seem to jump right out at you.

Normally, changes in settings are done at musical transitions in the song—such as at the beginning of a verse, chorus, bridge, or lead break—so that the change is not so abrupt or shocking. However, it just might be an interesting effect (if appropriate) to change the settings of compression while in the middle of a vocal or lead solo. When doing this, you are creating a dynamic effect so strong that it will show through the mix—therefore, it should be musically performed so that it fits the song.

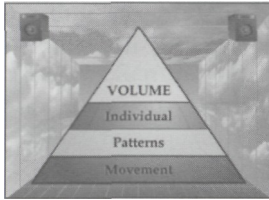
NOISE GATES

Level 1 Dynamics: Individual Noise Gate Placement and Relative Settings



The use of noise gates is primarily based on technical considerations: That is, getting rid of low volume noises and bleed from other instruments in the room. The only consideration for using a noise gate that might have developed any sort of tradition would be using a noise gate to shorten the duration of a sound by chopping off the attack or release. Otherwise, they are not used very often to shorten the duration. This is not to say that it isn't a cool effect and should not be utilized; it just isn't very common.

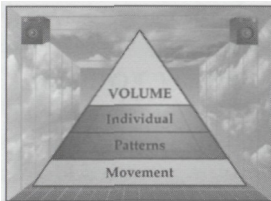
Level 2 Dynamics: Patterns of Noise Gate Placement



Extensive use of noise gates in a mix primarily results in more precise imaging between the speakers because of the way that noise gates help to isolate a sound and get rid of phase cancellation. It seems that most pop music is mixed using gates. Styles of music that are more focused on clarity, such as Steely Dan, will often use more noise gates overall.

On the other hand, some engineers prefer not to use noise gates much, especially on the drums. Using less noise gates will help make the mix sound more "live" in some engineer's eyes (or ears).

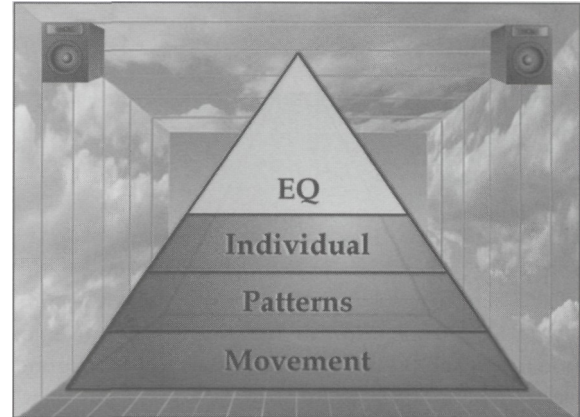
Level 3 Dynamics: Changing Noise Gate Settings (Levels and Parameters)



Settings on noise gates are rarely changed during a mix. However, to do so may give the illusion of a mix that is becoming more and more clean, with more precise imaging. You could also use noise gates to shorten the duration of a sound bit by bit, which might be totally appropriate for a song about losing weight or a shrinking reality.

SECTION B

Equalization Dynamics



If you have been doing much recording, you know that the limits of creativity are tight with EQ. There is very little room for creativity. With volume, you have more freedom. With EQ, if you can just get things to sound "right," you are lucky (or good).

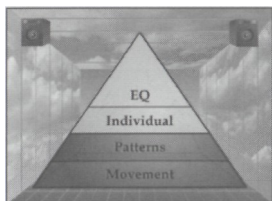
What we consider to be natural EQ for each instrument within each style of music has become entrenched in our audio consciousness. The brightness, midrange, and fullness of each instrument are now strictly defined. In fact, if we don't EQ the instruments based on these traditions, it is either considered to be wrong or exceedingly creative.

Because creativity is so limited, it is important to look closer—refine your focus, so to speak. It's like looking at the frequencies with a magnifying glass. Once you "zoom in" on the exact limitations of good and bad EQ you can push the limits. You can be creative without going off the deep end. Often this means minuscule changes—it doesn't take much to screw up EQ. Of course, you might only be creative with EQ when it is appropriate for the style of music, the song, and if the band will let you.

As with volume, there are three levels of dynamics that can be created with equalization. First, the relative brightness, midrange, and bassiness of each instrument (relative to the rest) create small but definite differences. In fact, each instrument has developed its own traditions for what we consider to be normal EQ. If we set the EQ different from these traditions, we are creating a unique dynamic that affects the overall perception of the music or song. There is a much stronger dynamic created by the combination of all of the EQ settings together in the song. But the most powerful dynamic you can create with an equalizer is to change the EQ during the song. This tends to be even more intense than changing volume levels during a song.

EQUALIZATION DYNAMICS

Level 1 Dynamics: Individual Equalization Placement and Relative Settings



As with volume faders, there is a large and complex world of EQ relationships between instruments in the mix. There are two primary ways in which the individual EQ of a sound can create musical and emotional dynamics. First, the individual EQ of a sound can either be made to be "natural" or "interesting." Second, the way a sound is EQ'd relative to the rest of the sounds in the mix also creates a dynamic that can be utilized for the song.

NATURAL EQ

In the beginning, the basic goal of using EQ was to make the sound natural—just like it sounded in the room where the instrument was. You can't get any more natural than that, right? The only problem is that natural ain't natural any more. These days natural is defined by what is currently on CDs and the radio. We have become addicted to crisper, brighter, and cleaner, as well as fatter, fuller, and bigger. Therefore, to make a sound natural can be boring and unnaturally dull by today's standards. What we hear on the radio and on CDs these days is much brighter and crisper than the real thing. If it isn't bright enough, it won't be considered right.

A common mistake is to use the EQ to make a sound clearer or more separate from the other sounds in the mix, while losing track of whether the sound is still natural. This problem often happens when the engineer tries to use EQ to fix an arrangement problem when too many instruments are located in the same frequency range. For example, you might turn up the midrange to make the sound a little more present and discernible. You can now hear the details of the sound in the mix. The problem is that when you listen to the mix the next day, it sounds midrangey and honky. Therefore, whenever you EQ a sound to work well, it is always a good idea to doublecheck that the sound is still natural when in solo. You might find that you should compromise if the sound is unnatural. This will help you end up with an overall EQ that sounds natural and has some separation.

The following is a list of a few of the most common instruments and their typical EQs, to give you an idea of what we have come to expect based on the

style of music and song. Of course, these EQ settings depend entirely on the particular instrument utilized and the type of microphones used. Ideally, with the right mics, you should only have to do minimal EQ'ing, if any.

KICK

There are three general types of drum sounds that engineers seem to go for: (1) the dead thud you get with one head on the drum and some type of weight (sandbag, mic stand bottom, or brick) on top of the pillows or padding in the drum, (2) the resonant ring you get with two heads on the drum and a small hole in the front head of the drum, and (3) the dull boom you get with both heads on the drum and no hole (commonly used for rap, hip hop, or techno).

The first and second type of sounds normally have a huge amount of the muddy range taken out, as much as 10dB, in the EQ range around 300Hz. They also sometimes have a high-frequency boost of a few dB around 5000 to 6000Hz.

The third type of rap or hip hop type kick often has a bit of a boost in the muddy range around 300Hz and a boost around 40 to 100Hz for the low end. The high end, around 6000Hz, might actually be rolled off to get rid of the attack of the sound.

There are many other types of EQ for kick drums, but these are some of the most common settings.

SNARE

The snare drum is commonly only boosted in the highs around 5000 to 6000Hz. Sometimes a bit of low end is added around 60 to 100Hz to make a thin drum sound fatter. And occasionally, it is necessary to take out some of the muddiness around 300Hz. Some snare drum sounds have a midrange "flap" or edginess around 800 to 1000Hz that needs to be taken out to smooth out the sound.

HI-HAT

It is often necessary to take out just about all of the low end to get rid of the bleed from the kick drum. If you have a highpass filter, you can roll off the entire low end up to around 300 to 700Hz. It is also quite common to roll off the muddiness in the bleed from the rest of the drum kit. Occasionally, it is nice to add a bit of super high frequencies around 10,000Hz for a nice, bright sizzle up top. Also, every so often, it is necessary to take out any irritating frequencies in the midrange between 1000 to 4000Hz. However, if taken out too much, the hi-hat will sound too dull—a thin bandwidth is helpful in this situation.

BASS

On some bass guitars, it is necessary to take out some of the muddiness around 300Hz. However, if taken out too much, the bass will sound too thin and wimpy. It is also often necessary to boost the highs (much more than you would think when in solo) around 2000Hz. Occasionally, it is fun to boost the low end of the bass around 40Hz to add a solid bottom.

GUITAR

Most commonly, guitars only need to be brightened up around 3000 to 6000Hz. Occasionally, it is necessary to take out some of the muddiness around 300Hz.

VOCALS

Vocals vary tremendously depending on the sound of the person's voice. It is quite common to not EQ vocals while recording because it can be difficult to find the exact same EQ in future vocal overdub sessions. This is fine because vocals are normally EQ'd so little anyway. Not only are we hypersensitive to midrange frequencies (where vocals hang out), but we are also extremely hypersensitive to the natural sound of vocals. We know what a voice should sound like better than any other sound in the world. Therefore, it is critical to be sparing with any vocal EQ.

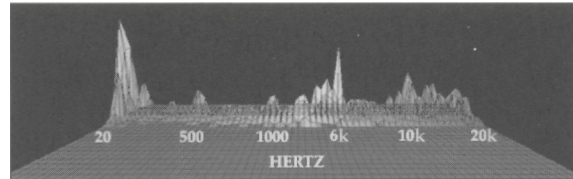
Vocals are often boosted just a couple of decibels around 5000 to 6000Hz. Occasionally, it is necessary to take out a bit of muddiness around 300Hz and a bit of irritation around 3000 or 4000Hz. The irritation sometimes comes from the harmonic structure inherent in the sound, but it can also come from a cheap or bad microphone. It is often helpful to use a highpass filter to roll off all low frequencies below 60Hz in order to get rid of any rumbly noises or bleed from any bassy instruments.

INTERESTING EQ

Certainly there are those who don't use the traditions or history of EQ to set their EQ. Some people are very intuitive about their frequencies. I mean, how did the first engineers know how to EQ sounds? One way was to make it sound natural. But what is natural when it comes to the sound of a piece of sheet metal? What is a natural EQ for a lot of the unnatural sounds we find in synthesizers?

The EQ of a sound is sometimes based on sounding interesting rather than sounding natural. Therefore, the question becomes what makes a sound interesting?

Interesting comes in various flavors. One way is to simply not make the EQ natural. Another is to EQ it so that the maximum complexity of the sound shows through. This means to use the EQ to even out any excessive peaks in a sound. Check out this spectrum analysis of a sound.



Visual 169. Spectrum Analysis of Sound With Excessive Frequency Peaks

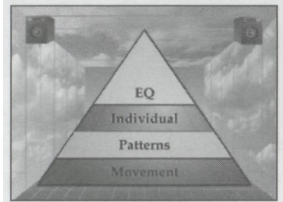
Notice the peaks around 20Hz, 6000Hz, and 10,000Hz. If you were to listen to this sound, you would primarily hear these three loudest frequencies. With EQ you can turn down the peaks, to hear more of the entire frequency spectrum. The sound appears to be more complex, more interesting. When a sound is more complex, it sustains repeated listening better, because the closer you listen to it, the more you hear. This is a common production value for many major producers: to make a sound appear as complex as possible by getting rid of the peaks.

On the other hand, there is always the counter-culture (thank goodness). Instead of complexity, some have now reverted back to using simple sounds. For example, Phil Collins has recorded a song with an 808 snare, the tinniest and cheapest-sounding electronic snare in the world; it sounds like "dooh." This proves that "interesting" is subjective.

But regardless of whether you EQ a sound to be interesting or natural, it is important to make sure that the EQ of the sound also works with the other sounds in the mix. As previously described, the sound should have appropriate highs, midranges, and lows relative to all of the other sounds. As with "balancing volume relationships," it is commonly most desirable to have the EQ of all of the instruments as even as possible, so that they blend well. However, it is often desirable for certain instruments in a mix to be unusually bright, dark, or midrangey. In fact, sounds can be made to sound more similar to each other or more dissimilar. A lead instrument might be made more cutting and abrasive so as to really grab attention. An instrument might be given extra bass to make the song more danceable or just to excite the listener.

The particular EQ of a sound and its relationship to the rest of the sounds in the mix creates another musical and emotional dynamic for the engineer to wield in his or her quest for the perfect mix—even though perfection has no limits.

Level 2 Dynamics: Patterns of Equalization Placement

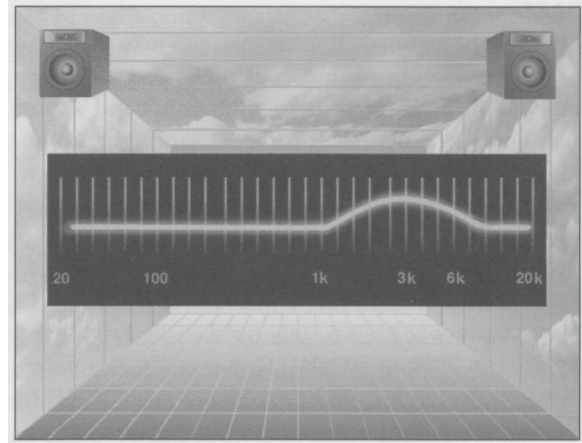


The combination of all EQ settings together in the song creates a much stronger dynamic in a mix than any single individual EQ setting. In fact, the overall EQ is one of the most important dynamics because it is critical for a mix to sound correct for all the styles of music that we know so well. When anyone listens to a mix, the first thing they hear is the overall EQ.

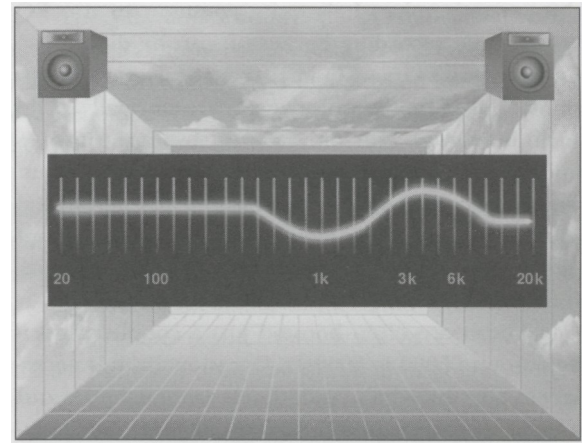
The engineer EQs each instrument so that the overall EQ of the song will sound like a particular type of music usually sounds. For example, country has an overall natural EQ. Heavy metal has more of a boost in the cutting midrange frequencies. Rap and hip hop have the low end boost.

The type of song also can determine the general EQ of the mix. For example, you just might make the overall EQ a bit more edgy and cutting for a song about chainsaw murders, whereas a song about sweet and sensitive love might have an overall EQ that is very pleasing and conducive to mush.

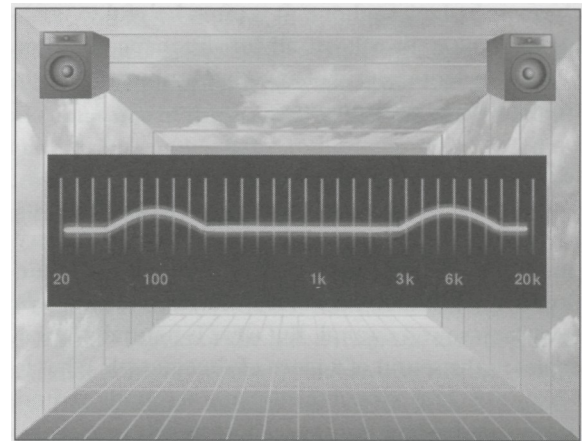
Aside from the style of music and the song, often certain engineers have their own style that they prefer. These engineers tend to create mixes with overall EQs they happen to be partial to. Here are some typical—in fact, stereotypical—overall EQs for different styles of music. These EQ curves are sometimes very specific for certain styles of music.



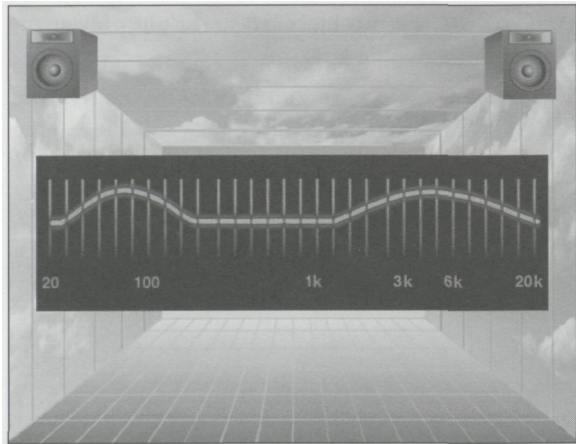
Visual 170. General Overall EQ for Heavy Metal



Visual 171. General Overall EQ for Jazz

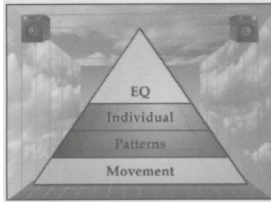


Visual 172. General Overall EQ for Country



Visual 173. General Overall EQ for Rap and Hip Hop

Level 3 Dynamics: Changing Equalization



Because we are so limited as to how creative we can be with EQ, making EQ changes in a sound while it is playing creates an extremely noticeable dynamic. If not appropriate for the song, this could be quite distracting. If appropriate, it could be quite effective.

Making an EQ change at a break in the song is the most natural way to create a dynamic. Jethro Tull did it in the song "Aqualung" when the voice changes to a telephone EQ. Pink Floyd also did it in the album *Wish You Were Here* when the acoustic guitar sounds like it is in a little box.

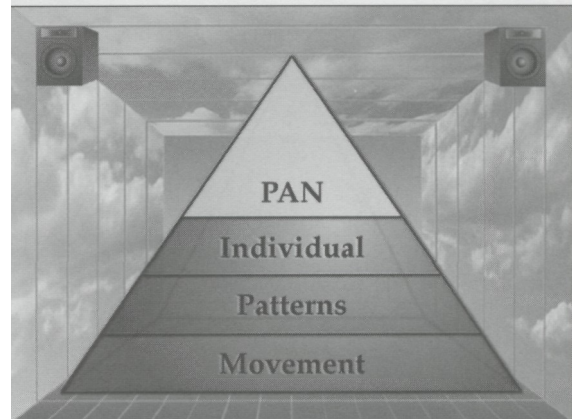
If you change EQ at the beginning or end of a section in a song, it is not nearly as noticeable as when you make a change in the middle of a part. Probably the most bizarre effect is to actually sweep the frequency knob of an EQ in the middle of an important part, such as a lead solo. Doing this totally takes the focus away from the music itself; however, if done in a way that works with the music and song, it can be extremely cool.

Currently, it is considered very unusual to actually change EQ settings during a mix. However, it just might be the next creative frontier, especially for those mixing hip hop and similar styles of music.

The musical and emotional dynamics that can be created with EQ—EQ placement, overall EQ and changing EQ—all depend on the style of music, the song and all of its details, and the people involved.

SECTION C

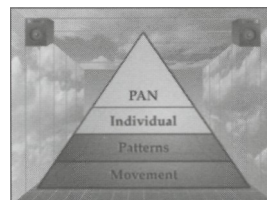
Panning Dynamics



As with volume and equalization, there are three levels of dynamics that can be created with the placement of panpots on a mixer. First, a sound will be perceived differently depending on where it is placed in the mix, left to right. For some instruments, the traditions for the specific placement of left to right have become very strictly enforced. Panning is also based on the relationship of a particular instrument to the panning of the rest of the instruments in the mix. But when you create patterns of panning, you establish a much more powerful musical and emotional dynamic. For example, a lopsided mix left to right will come across quite differently than a mix that is balanced from left to right. Finally, when you move a panpot during a song, you are creating a dynamic almost as strong as an earthquake. Now let's explore the three levels of dynamics.

PANNING DYNAMICS

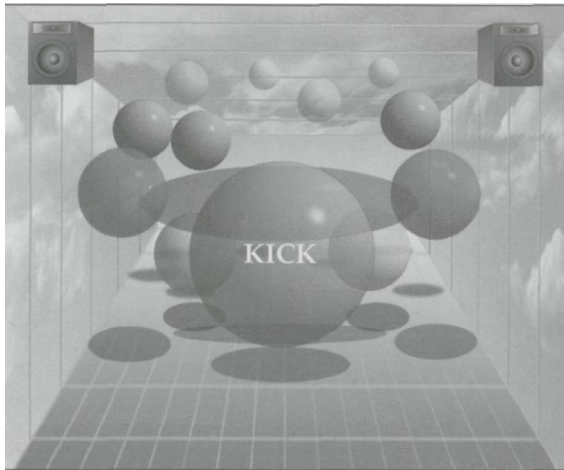
Level 1 Dynamics: Individual Panning Placement and Relative Settings



If you follow the traditions, you create a dynamic that is transparent and lets the music show through more. Whereas, if you don't follow tradition, you are then considered to be "creative." Unusual panning can actually create tension; this can be cool if appropriate. Let's go through typical panning placement for some well-known instruments and sounds.

KICK DRUM

It is rare that the kick drum is ever placed anywhere except in the middle, exactly between the speakers.



Visual 174. Kick Drum Panned to Center

It isn't necessarily wrong to place it somewhere else, but it has become commonly accepted there. It is interesting to speculate why the kick has been relegated to the center. First, the kick often takes up a large amount of space in the world of imaging. There is simply more room in the middle. Also, the kick drum has so much energy it commands our attention. We are often compelled to turn and face the music, especially loud and powerful sounds. Therefore, if you are facing the kick in the middle, your peripheral vision (or hearing) can see the other sounds better. If you were facing a kick on one side, then you would be off balance.

Aside from the imaging, there is another reason, based on physical reality, for the kick to be placed center: When a sound is in the middle, you have two speakers carrying the sound instead of one. The speakers don't have to work as hard, especially with big sounds like kick drums and bass guitars. Therefore, technically it sounds better when in the middle. Also, the kick drum is normally in the center of most drum kits.

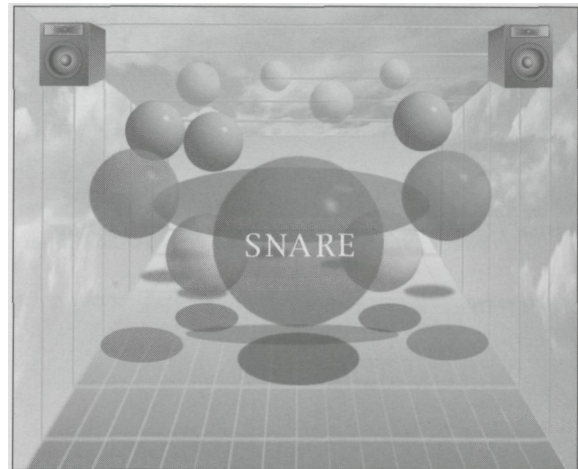
Regardless of the reasons for placing the kick drum in the center, it has become a pretty strict tradition. If you place it anywhere else, watch out. . . you could be admonished for being too creative.

Two kick drums, or a double kick, presents an interesting dilemma when it comes to panning. The main deciding factor depends on how often the second kick drum is played. Some people will pan them slightly left and right, others will place the main kick in the center and only pan the second kick slightly. To pan the two kick drums completely left and right is highly unusual, or creative, but has been done. I've

even panned the two kicks left and right only at the moment of a double kick roll.

SNARE DRUM

The snare drum is also most commonly placed in the middle.

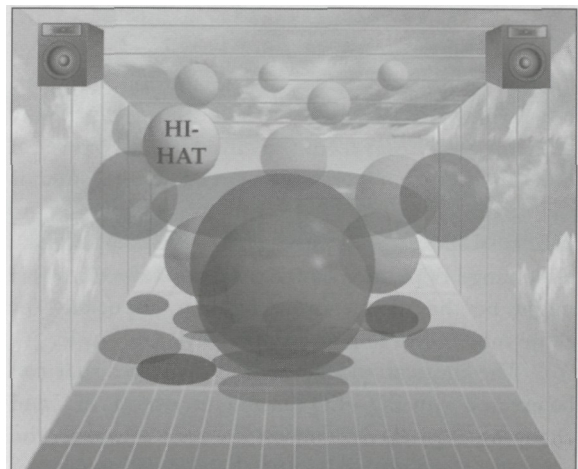


Visual 175. Snare Drum Panned to Center

Although some engineers do place it a bit off to the side—especially in jazz—because the snare drum is off to one side in a real drum set. If the snare drum sound is huge (bigger sound and/or more reverb), it is more commonly placed in the center. This is probably because it is taking up so much more space (similar to the kick drum). It is interesting that the snare has come to be so commonly placed in the center when it is actually so far to one side on most drum sets.

HI-HAT

The hi-hat is often placed about halfway between one side and the middle (we'll discuss which side later).

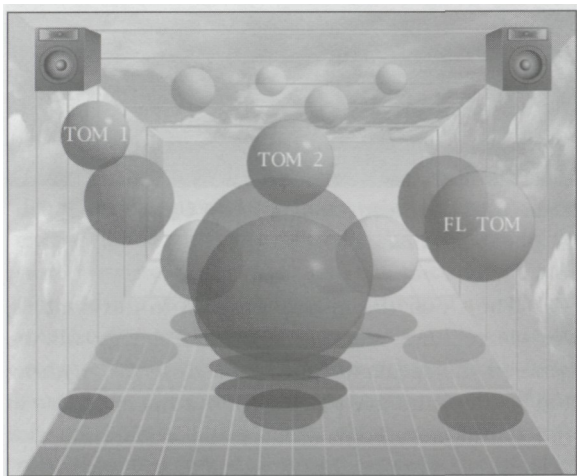


Visual 176. Hi-Hat Panned Halfway Between Left Side and Middle (see color Visual 176C)

This is also interesting because the hi-hat is normally as far left on a real drum kit as any sound. However, often when the mix is busier, the hi-hat is panned all the way to one side. This is also the case when the mix being created is meant to be "spatial." Meanwhile, in house music and hip hop, not only can the hi-hat be panned anywhere, it is commonly moved during the mix and is sometimes panned far left with a delay panned to the far right.

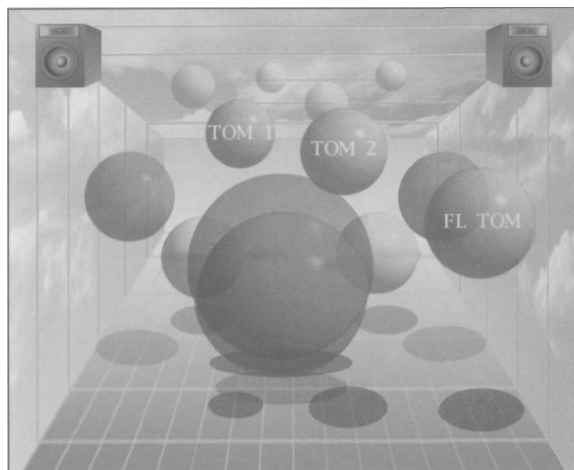
TOM TOMS

In order to provide maximum fun, tom toms are commonly spread completely left to right or right to left.



Visual 177. Toms Panned Completely Left to Right (see color Visual 177C)

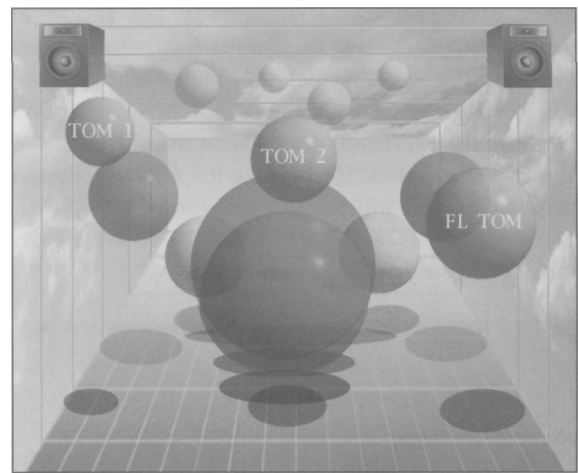
However, for natural panning, the toms are sometimes placed between the speakers exactly as they are on the actual drum set.



Visual 178. Toms Panned Same As on Drum Kit (see color Visual 178C)

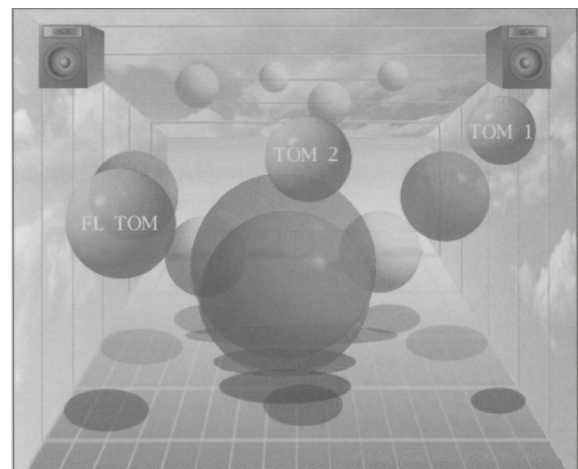
A floor tom is normally placed on the far side. However, occasionally the floor tom will be placed in the center for the same reason we normally put a kick drum and a bass guitar in the middle—because it is so powerful, commands so much attention, and will sound better when both speakers are carrying the sound.

The discussion of tom placement brings up an interesting question: Should the toms be panned from left to right, as if from the drummer's perspective . . .



Visual 179. Toms Panned Left to Right

. . . or from right to left, as if from the audience's perspective?



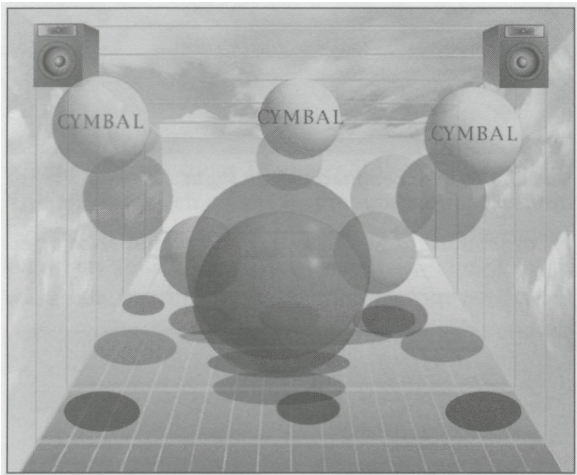
Visual 180. Toms Panned Right to Left (see color Visual 180C)

Those who do live sound wouldn't be caught dead with the toms panned left to right because they always see it this way in a live show, but it seems that just as many engineers pan from left to right (just like we read). If the band is being recorded live, or if the band is being recorded as if they were live, then the

toms should probably be panned right to left, from the audience's perspective, because there is an audience. Even though it really doesn't matter which way you pan the drums in a mix, most people seem to have very strong feelings about the matter, so it's good to be aware of the preferences of the people you are working with. Besides, it would be boring if all toms were panned the same way.

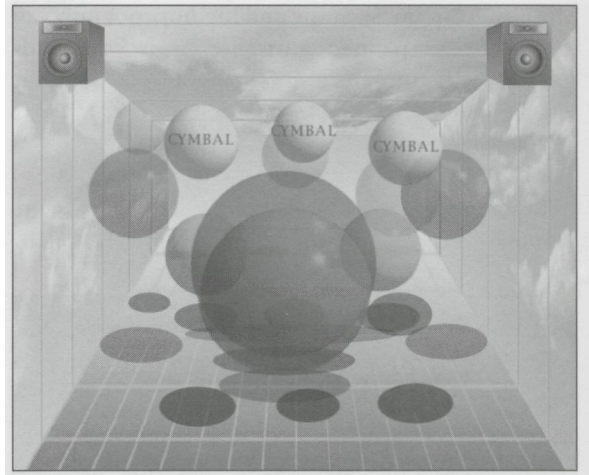
OVERHEADS

Overheads are normally recorded in stereo on two tracks and then spread completely left and right between the speakers. This allows for the maximum separation between cymbals and the widest spread of stereo imaging. Of course, the type of imaging you get from the overheads depends on the placement of the mics themselves. If you place the mics as far apart as possible, you will get a wider spread of cymbals between the speakers; however, you also have a greater chance of getting phase cancellation.



Visual 181. *Overheads Panned Completely Left to Right*

If you place the mics next to each other in the middle using the "X" technique, there is less spread between the speakers; however, the imaging is often a little clearer because there is no phase cancellation.

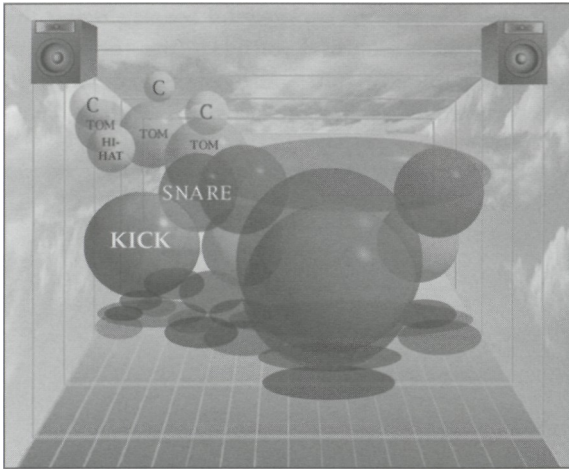


Visual 182. *Overhead Panning When Using "X" Technique*

The closer the mics are placed to the cymbals, the clearer and more up front the image will be between the speakers (put a mic closer to anything and it will sound more present), but the cymbals will also sound more edgy, which could be fine for rock 'n' roll.

DRUMS AS A WHOLE

It is interesting to note the way that drums have been panned throughout the history of recording. The Beatles placed the vocals in one speaker and the rest of the band in another. Though this was, in reality, a mistake. They meant for the two tracks to be mixed down to mono when the record was made, but the mastering engineer decided to be creative. Many jazz groups have placed the entire drum set in one speaker. The obvious advantage of doing this is that it leaves a huge amount of space between the speakers for the rest of the band. The big disadvantage is that the separation between individual pieces of the drum set becomes obscured.

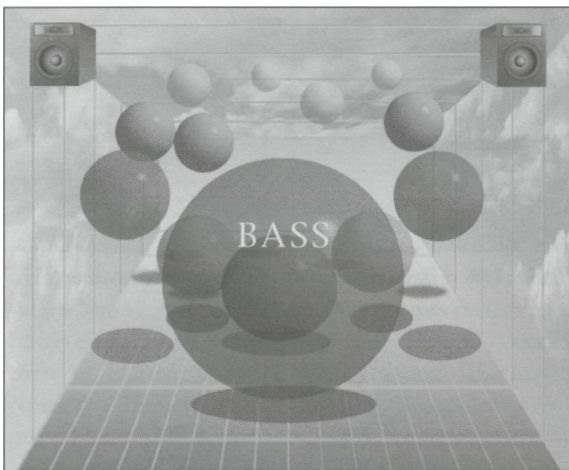


Visual 183. Mix With Drums Panned to One Side (see color Visual 183C)

NOTE: In order to obtain the most natural panning of a drum set, try this: Pan the overhead mics on the drum kit completely left and right, listen to where each drum seems to be between the speakers in the stereo overhead mix, then pan the mic of each individual drum exactly where you hear it. This will give you the clearest imaging you can obtain because the image of the instrument in the overhead mix is in the exact same place as the image in its own mic. If they are not panned the same, then you are actually spreading the sound in stereo between the speakers—making the image less precise.

BASS GUITAR

Bass guitar is most commonly placed in the middle because it is so large and commands so much attention, like the kick drum.



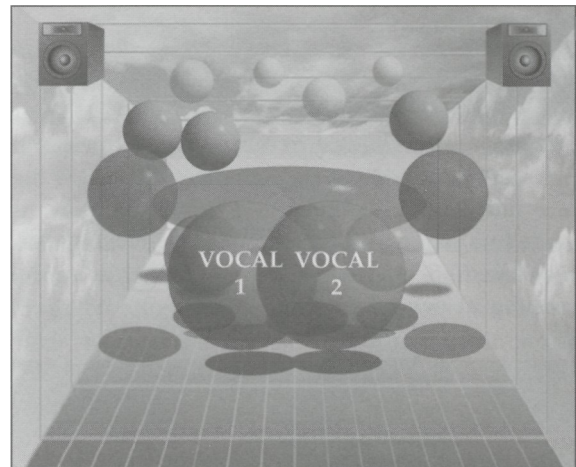
Visual 184. Mix With Bass Guitar Panned to Center

Jazz and similar types of music often place the bass off to one side. Aside from the style of music dictating the panning, a bass is normally only panned off to one side if the part being played is a lead part. When this is the case, the bass is often a much brighter and cutting type of sound. When the bass sound is thinner, there tends to be more room for the bass to be placed off to one side.

LEAD VOCALS

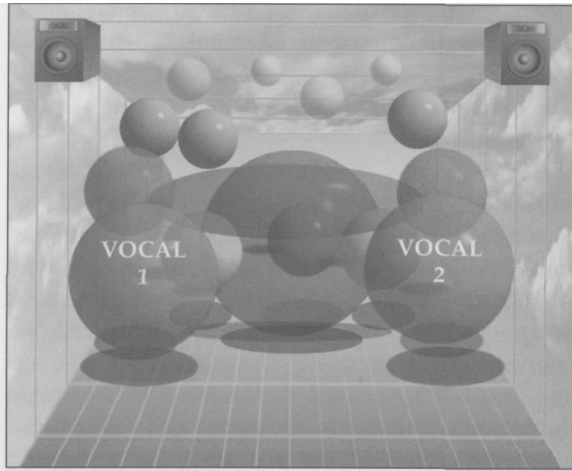
It is almost against the law to place a lead vocal anywhere except smack dab in the middle. Pan a lead vocal to one side and go to jail. By most standards, you are simply being too creative. However, it might be appropriate if the song is about unbalanced psychotic behavior.

If a vocal is recorded in stereo with two mics, doubletracked, or made into stereo with a time-based effect, the two sounds are normally spread evenly left to right. Sometimes they are placed at 11:00 and 1:00.



Visual 185. Lead Vocals Panned at 11:00 and 1:00 (see color Visual 185C)

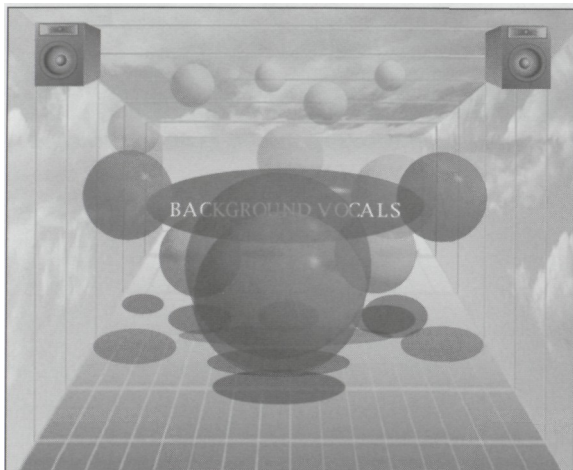
Sometimes they are placed at 10:00 and 2:00. But occasionally, they are placed completely left and right.



Visual 186. Vocals Panned Completely Left and Right

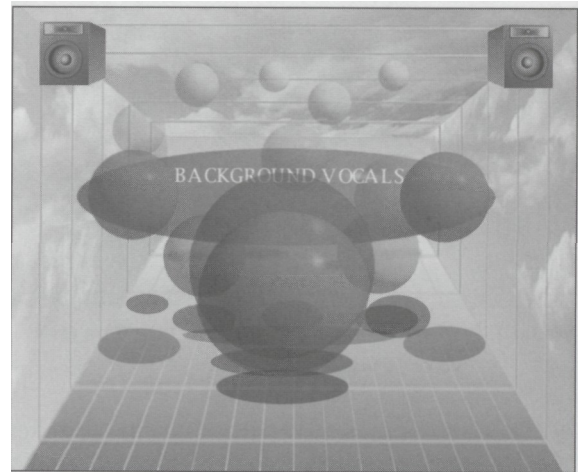
BACKGROUND VOCALS

The panning of background vocals often depends on the vocal arrangement. When there is only one background vocal, it can't be panned in the center because it gets in the way of the lead vocal. You could put it off to one side or the other, but this makes the mix unbalanced. Commonly, a single harmony is made into stereo with two mics, doubletracking, or a time-based effect. Then it can be panned in stereo, creating a balanced mix from left to right.



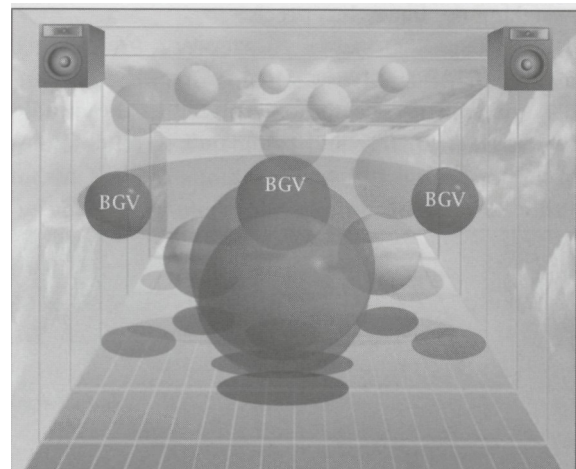
Visual 187. 1 Stereo Background Vocal Panned From 11:00 to 1:00 With Fattening

If there are two background vocals singing the same part in unison and you place the background vocals completely left and right, they will pull together, creating a line of vocals.



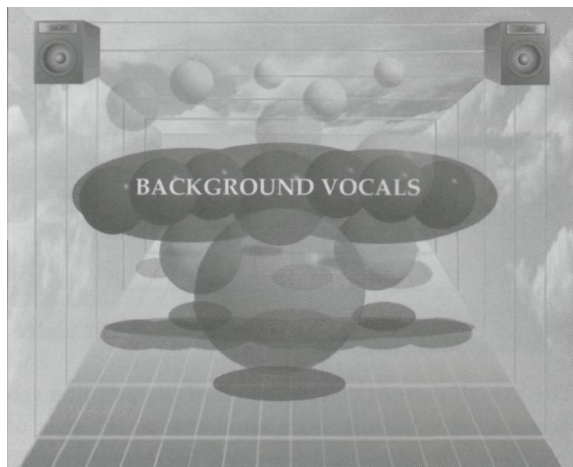
Visual 188. 2 Background Vocals "Pulling Together"

If the background vocals consist of different harmony parts, they won't pull together as much. The more different the sound of the voices that are doing the harmonies, the less they will blend together, the more they will stay separate. If the same person does all of the parts, they will blend more.



Visual 189. 3 Background Vocals Panned Separately (see color Visual 189C)

Background vocals are commonly recorded in stereo, doubletracked, or made into stereo with a time-based effect and then spread left to right. As you can see, there is a wide range of possibilities.



Visual 190. 7 Background Vocals Panned to 7 Different Places Combined With Variety of Fattening (see color Visual 190C)

The style of music can also make a difference in panning. For example, in country music, many engineers will only pan the background vocals from 11:00 to 1:00 or from 10:00 to 2:00, in order to give the impression of a tight-knit harmony group.

PIANO

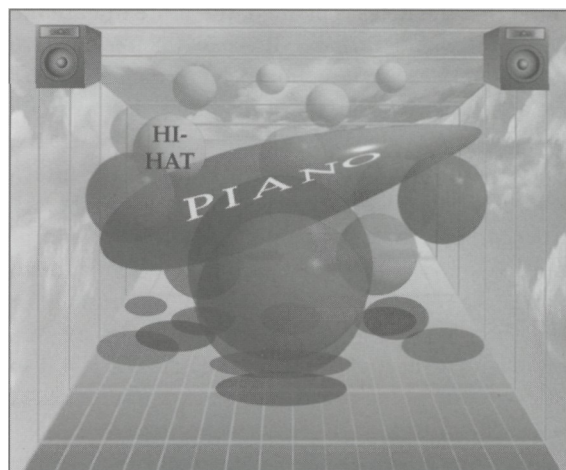
A solo piano is almost always panned completely left and right in stereo. The bass strings are panned to the left and the high strings are panned to the right, because this is the way a keyboard is laid out. It is funny that this is probably the strictest rule of all when it comes to panning. You better shoot the piano player before you pan the high end to the left. You might think this is odd because when standing in front of a piano, the high strings are on the left. Even in a live show with a stereo PA, the piano is still panned with the lows on the left.

When in a mix, a piano is still commonly panned in complete stereo, just because it sounds so nice that way. That is, if there is room in the mix. A stereo sound takes up a lot more space in the mix; however in certain styles of music, such as country, even in a busy mix, the piano is still commonly panned completely left to right. Sometimes it is pulled in a little bit or panned more to one side to leave room for other sounds. In some busy songs, the piano is panned in one spot to leave room for the rest of the mix.

The panning also depends on the type of musical part being played. If the part is full of rich sus-

taining chords, it will tend to be panned in full stereo. On the other hand, if it is very staccato and rhythmical with many single notes, it might be panned in one single spot.

One argument for panning the drums from the drummer's perspective is that if you were to place the hi-hat on the right, it would be hidden by the high end of the piano. There is less masking from the high end of the piano when the hi-hat is placed on the left.



Visual 191. Panning With High End of Piano on Right and Hi-Hat on Left (see color Visual 191C)

NOTE: If you don't have enough tracks to record the piano in stereo, you could actually pan the piano from left to right when the pianist plays from low to high notes; this is a great way to cheat with a lead break. When they go up the keyboard, pan to the right; when they play lower notes, pan to the left. Cheap stereo, but it works.

GUITARS

Panning guitars is based on concerns similar to those for piano and keyboards. Often the guitar is placed in a particular place based on the placement of everything else: crowd control. If you want the guitar to be more interesting or present, you might try fattening to spread it in stereo.

HORNS/STRINGS

It is interesting that horns and strings are almost always spread in stereo completely left and right across the stereo field. The horns or strings can be recorded with more than one mic, played twice, or a time-based effect can be used to make the instruments stereo. The horns or strings might not be spread completely in stereo (partial stereo or mono) if there isn't enough room in the mix.

EFFECTS

Effects like delay, flange, chorus, phase, harmonizer, and reverb can be panned separately from the instrument sound they came from.

Delay

When the delay time is greater than around 30ms, it is perceived as a separate sound. This separate "sphere" is often placed wherever there is room for it (crowd control). The further from the original dry sound that the delay is panned, the more intense the dynamic created. However, it is easy for this effect to overwhelm the song. Sometimes it is quite effective to pan the delay right on top of the original dry signal.

When the delay time is less than 30ms, the sound is stretched between the speakers. As previously covered, this effect is called fattening. The primary consideration for fattening is the duration of the dry sound. Fattening is rarely used on staccato sounds. They just seem to take up too much room for something so quick. If you were to use fattening on a sound with a short duration, you might not pan it so wide—maybe only 11:00-1:00 (or just around the dry sound itself if it is panned off to one side).

On the other hand, sounds that are longer in duration (legato) are often panned completely left and right in stereo with fattening.

Once the drums and bass are mixed, you should calculate which instruments will be spread in stereo with fattening and which ones will be in one spot. This calculation is based on the style of music, the number of instruments/sounds in the mix, and whether each sound is staccato or legato. Once the entire mix is up, you can always change your mind and either add or delete fattening.

Flanging, Chorusing, Phasing

Because these effects are based on a short delay time, like fattening, they are panned based on the same criteria. The only difference is that these effects are much more noticeable; therefore, they might not be panned quite as wide as fattening.

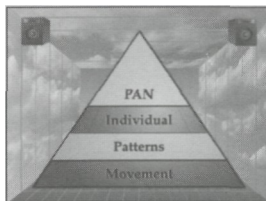
Reverb

Reverb is most commonly placed in stereo, completely left and right. This is to simulate the natural sound of reverb in a room: It comes from everywhere around you, as if you are trying to simulate a live situation. This is especially common when putting reverb on drums.

Of course, you can place reverb anywhere you want. For example, you could put a guitar in the left speaker and place the reverb in the right speaker. It is also quite effective to place the reverb right on top

of the dry sound. For example, place a keyboard on the right and put the reverb in the right speaker also. This can be very interesting especially when using short reverb sounds or gated reverb. Any placement of individual instruments other than the above norms might be considered creative or unusual, depending on your perspective.

Level 2 Dynamics: Patterns of Panning Placement



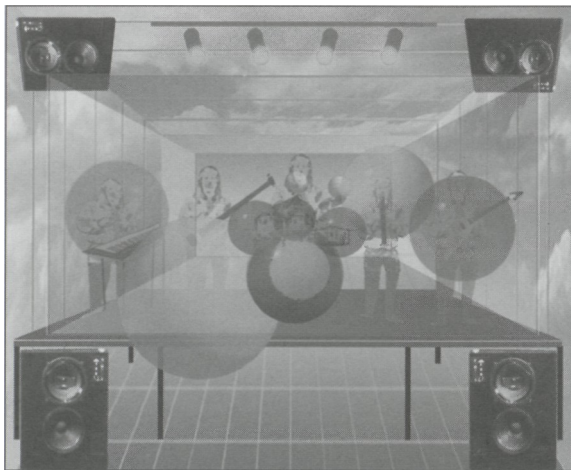
The overall pattern created by all of the panning settings together is even more important to the style of mix than any individual panning. The type of music tends to make the biggest difference as to the overall panning in the mix. And again, certain styles of music have developed more strict traditions than others. Also, the details of the song, especially the density of the arrangement, can affect the overall placement left to right. Often the more instruments in a mix, the wider the overall panning.

There are a few different ways to look at the types of patterns that can be created. We can base this overall panning on natural panning, balanced vs. lopsided panning, or crowd control.

NOTE: Before stereo became popular, mixes had to be created so all the sounds could be heard with no panning at all. This is good to keep in mind. In fact, you should always doublecheck your mix in mono to make sure that is OK in the first place, before using panning to create clarity. After all, listeners are often not seated in the correct position between the speakers to hear true stereo.

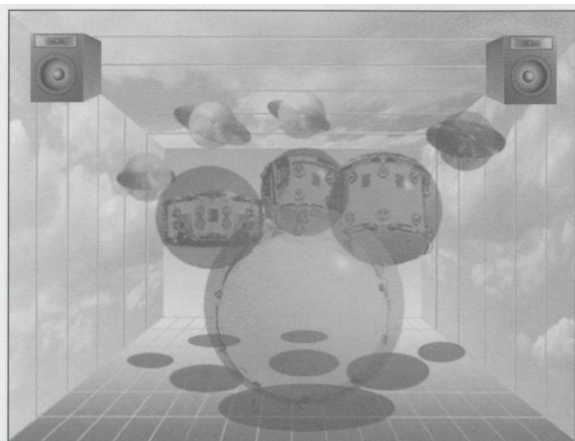
NATURAL PANNING

If we think of the space between the speakers as a pallet on which to place sound colors, we can place sounds left to right, filling in the space in any way we want that seems to work. There is an infinite number of different structures of mixes that can be created with simple panning. However, sometimes panning is done so that it corresponds to the placement of the band, as if onstage, or the way they are set up in the studio.



Visual 192. Panning as If Onstage (see color Visual 192C)

Sometimes the drums might be panned exactly the way the drum set is physically set up.



Visual 193. Natural Panning of Drum Kit (see color Visual 193C)

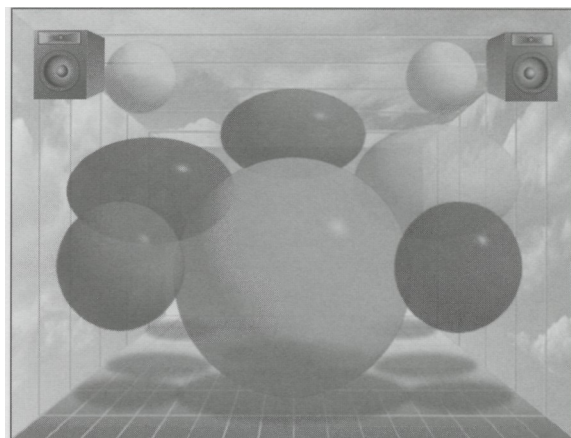
Again, it is often the style of music that determines if panning is to be natural. For example, you can practically do whatever you want in hip hop or techno; whereas in big band music, it is very important to pan everything in the same way that the band sets up onstage. Acoustic jazz is also sometimes panned just the way the band sets up live.

An engineer will sometimes place the musicians in the studio as if they were live onstage, just so they feel comfortable. For example, a folk group or chamber orchestra is commonly set up in a semi-circle out in the studio, then panned exactly the same way in the mix. Technically, the imaging will be better; there is less chance of phase cancelation and the relationships between the instruments are kept in their natural state. This helps to create the illusion that you are there with the band.

In classical music, it is an extremely strict rule that the panning is done exactly the way the orchestra sets up. In fact, there are very particular rules when it comes to setting up an orchestra onstage, so everyone can hear the rest of the orchestra correctly.

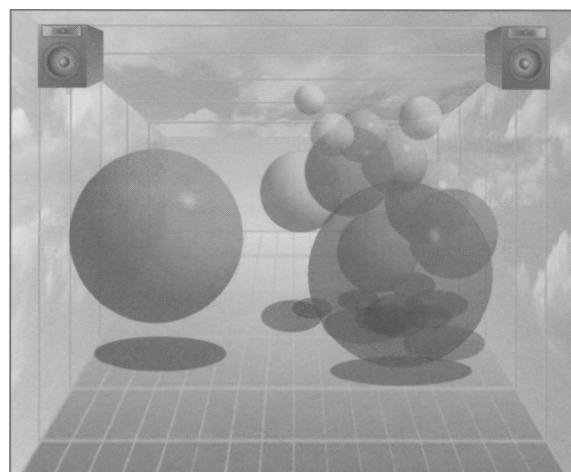
BALANCED VS. LOPSIDED PANNING

Probably one of the strongest dynamics that can be created with patterns of panning is the difference between a balanced (symmetrical) mix . . .



Visual 194. Balanced (Symmetrical) Mix (see color Visual 44C)

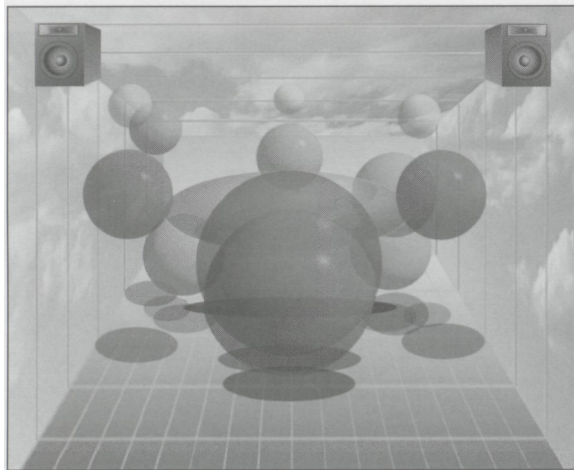
. . . and a lopsided (asymmetrical) mix.



Visual 195. Lopsided (Asymmetrical) Mix (see color Visual 45C)

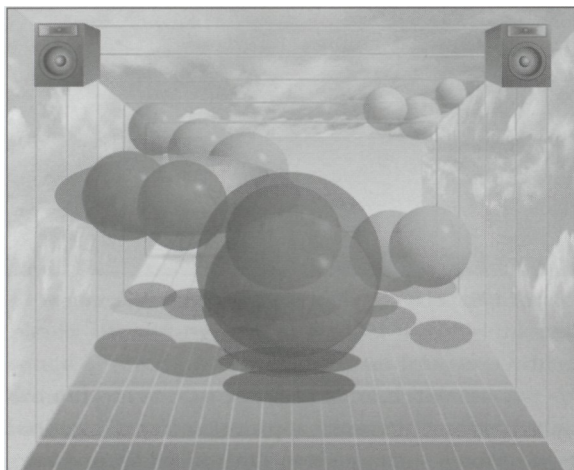
A symmetrical mix might be used to create a balanced type of dynamic appropriate for a balanced type of song, such as a love song, a ballad, or a song about a balanced ecology of mind. Whereas an asymmetrical mix might be used to create a bit of tension appropriate for an unbalanced type of song, such as a song about psychotic, unbalanced behavior.

A mix is often made to be balanced or lopsided at each frequency range. For example, if you are creating a symmetrical mix, you might put a hi-hat on the left and place a shaker or acoustic guitar on the other side to balance the high-frequency range. In the midrange, you might put a guitar on the left to balance a midrange keyboard on the right. In the bass range, the kick and bass would be placed in the center.



Visual 196. Mix Balanced at Each Frequency Range (see color Visual 196C)

On the other hand, if you're creating a lopsided mix, you might put all of the high-frequency sounds on one side and put the midrange instruments on the other side. Then for a bizarre effect, put the bass guitar on one side and the kick drum on the other side. Because this type of mix is out of the ordinary, it creates a component of tension.



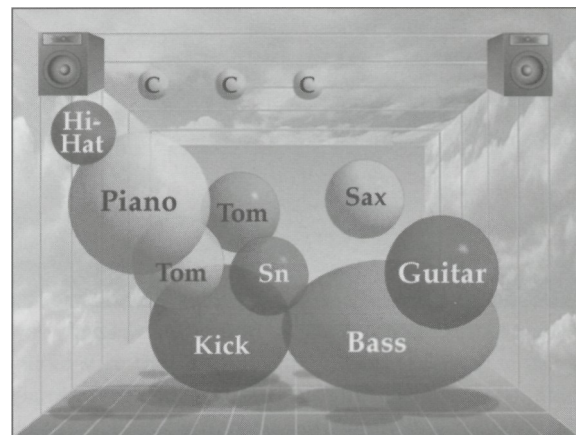
Visual 197. Unbalanced Mix at Each Frequency Range (see color Visual 197C)

As you can see, the possibilities are endless, depending on the song and what you want to do. Creating balanced versus lopsided mixes can be an especially effective dynamic when it is appropriate.

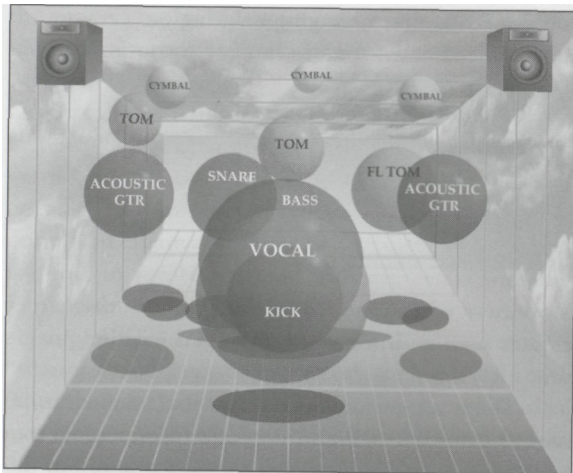
CROWD CONTROL

Natural panning can be . . . natural, but these days it is actually much more acceptable to not pan instruments as they are on stage. This pallet between the speakers is a different medium than that of a live show. Why not utilize it to its fullest? Most people pan things to wherever they sound the best, coolest, or most interesting, instead of basing their placement on where the band members happen to stand on a stage. Therefore, if we think of the space between the speakers as a pallet, then the panning can be based on crowd control. How close are the members of the crowd to each other? Are they far apart, just touching, overlapping, or right on top of each other?

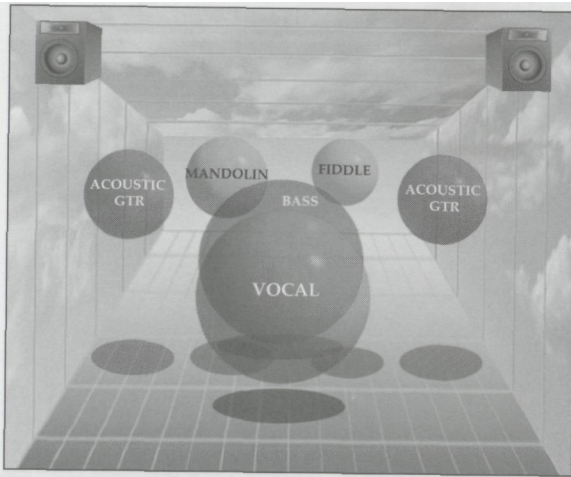
You might want some sounds to be panned as far from each other as possible, in order to create clarity, so they don't touch each other. Such a dynamic might be appropriate for certain types of music, like acoustic jazz, folk music, or bluegrass.



Visual 198. Clarity Style of Mix: Acoustic Jazz (see color Visual 198C)

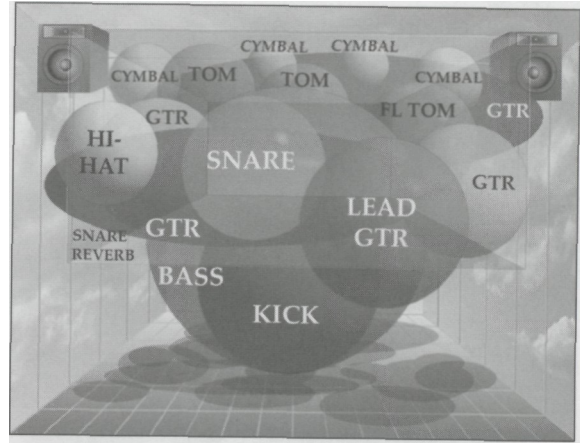


Visual 199. Clarity Style of Mix: Folk Music (see color Visual 199C)

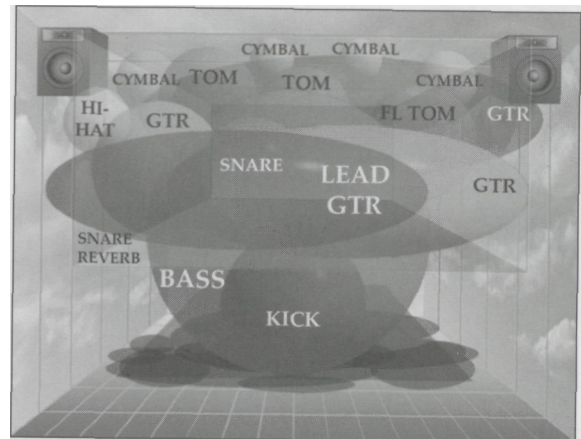


Visual 200. Clarity Style of Mix: Bluegrass (see color Visual 200C)

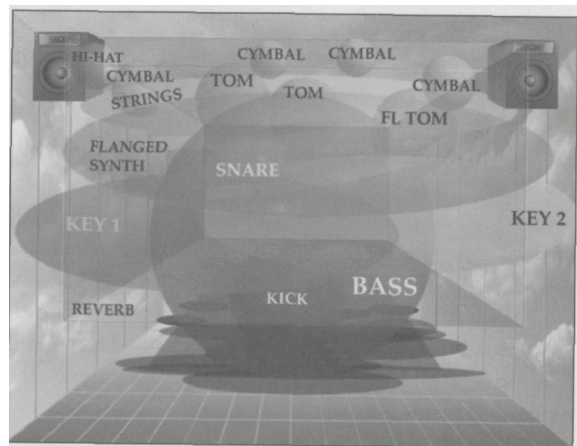
On the other hand, sounds may be panned to overlap in order to create a wall of sound, making the mix seem more cohesive. This is commonly done in heavy metal, alternative rock, and new age music.



Visual 201. Wall of Sound Style of Mix: Heavy Metal (see color Visual 167C)

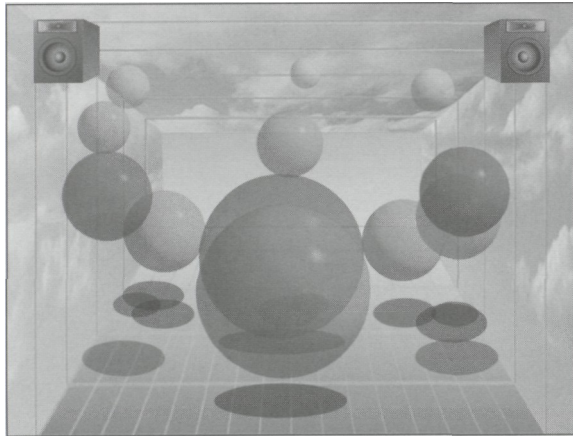


Visual 202. Wall of Sound Style of Mix: Alternative Rock (see color Visual 168C)



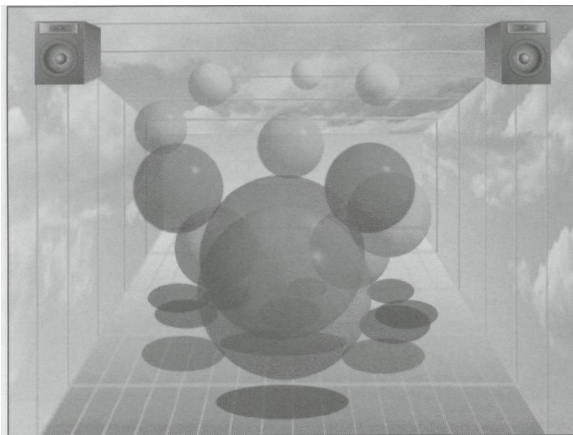
Visual 203. Wall of Sound Style of Mix: New Age (see color Visual 203C)

Besides the way that sounds overlap or not, there is also the difference between panning an entire mix as wide as possible between the speakers . . .



Visual 204. Mix With Extremely Wide Panning Overall (see color Visual 204C)

. . . versus not so wide.

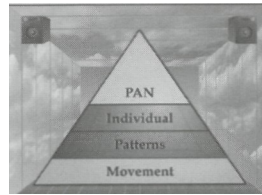


Visual 205. Mix With Panning Not So Wide Overall (see color Visual 205C)

The advantage of panning things as wide as possible is that it provides more space between the sounds, thus creating more clarity. The disadvantage is that it can make the band sound less cohesive. By making the spread narrower, the band and all of its parts sound more like they are playing together. It all depends on the density of the mix and the style of music.

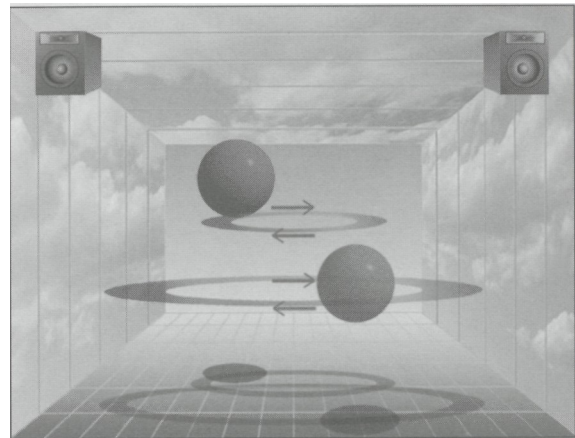
With 3D sound processors and surround sound, you actually have more space to work with. Therefore, the possibilities for panning and placement are expanded tremendously.

Level 3 Dynamics: Changing Panning



Movement of a sound from left to right during a mix creates such an intense dynamic that most engineers save such dramatic creativity for special occasions.

There are a number of ways that sound can be moved from left to right, creating innumerable patterns of movement. First, you can pan a sound in different distances. Possibilities range from short, minuscule moves to wide, sweeping moves that span the entire distance from speaker to speaker.



Visual 206. Wide vs. Narrow Sweeping Panning

But you can also pan sounds at different speeds, ranging from pans that move slowly to pans that zoom back and forth between the speakers. You might cause some serious goosebumps by making the speed, or rate, of the pan equal to, a fraction of, or a multiple of the tempo in the song. And aren't goosebumps the goal most of the time?

Changing panning is so intense that it will usually pull attention away from the song itself. However, if the panning is done skillfully, it contributes to the music as if the panpot is an instrument itself. Obviously, when it is appropriate for the song, this can be a great effect. Hendrix did it a lot, especially in the song "Crosstown Traffic." Led Zeppelin went bananas in "Whole Lotta Love." Extensive movement of panpots has become quite common in hip hop and techno.

One of the most intense, fun, or chaotic things you can do is move the panning of multiple instruments in various ways all at once. Such a strong

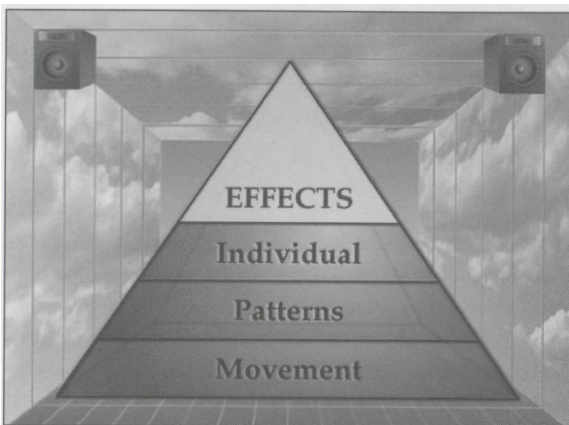
dynamic is normally reserved for songs where it might be appropriate and when the band will let you.

As you can see, you can create a plethora of emotions by how you set or move panpots in a mix. If you set them based on tradition, the dynamic is often unnoticeable. However, if you set them different from the norm, you create a stronger dynamic. If you set all the panpots to create patterns, you are really wielding some power.

A balanced mix will probably fit in and not be noticed. But if you make a lopsided mix, it will more than likely stick out, almost as if it is another musical part in the song. Finally, if you move the panpots during the mix, you aren't fooling around. Go for it, if appropriate.

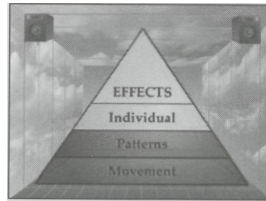
SECTION D

Time-Based Effects Dynamics

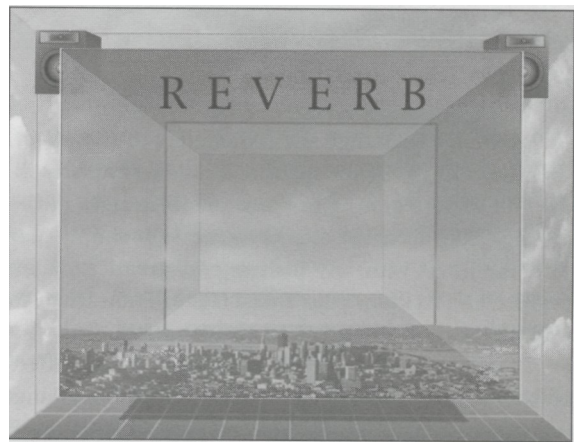


There is an incredibly wide range of effects, and the dynamics that they create range from subtle to shocking, mesmerizing, and world changing. Furthermore, when we use multiple effects together to create a pattern, we can elicit a conglomeration of feelings and emotions that can be overwhelming or just good, clean fun. But changing the levels of effects, which can include changing the parameters of effects, during the song opens up entirely new avenues of creative expression. I'll now go into more detail on each of the three levels of dynamics that can be created with effects.

Level 1 Dynamics: Individual Effects Placement and Relative Settings

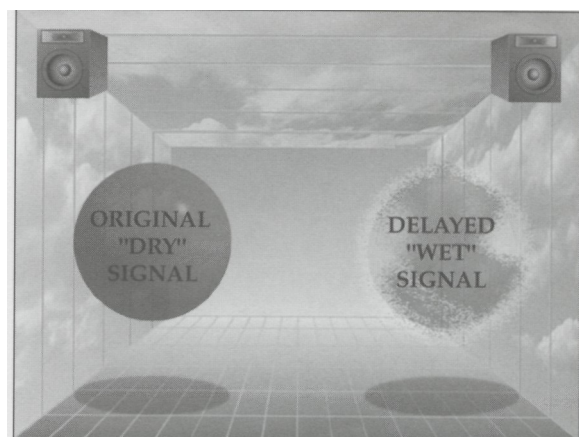


Each and every effect in the studio has its own world of emotional dynamics associated with it. For example, reverb creates a more spacious (pick your own adjective) feeling:



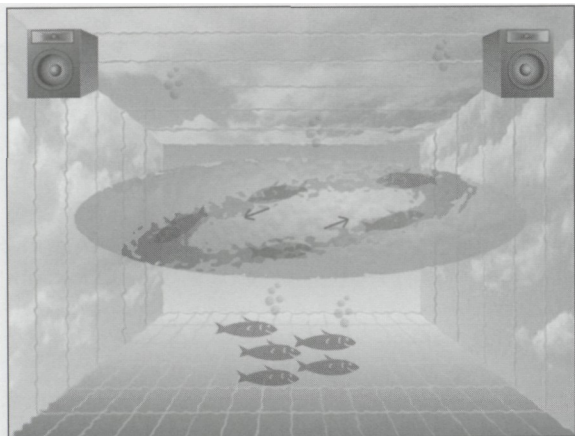
Visual 207. Spacious Reverb

Long delay times create a dreamy effect:



Visual 208. Dreamy Delay

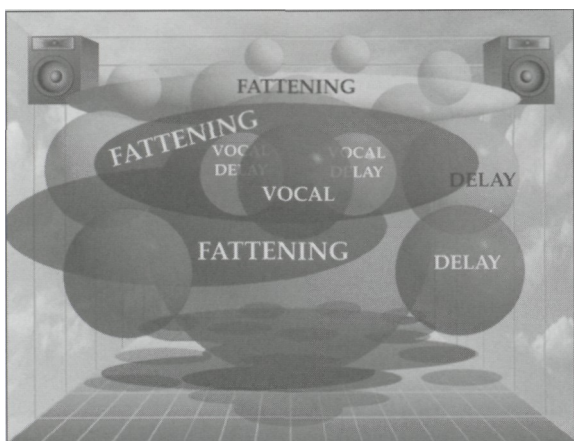
And flanging brings up a floating, underwater-type feeling.



Visual 209. Underwater Flanging

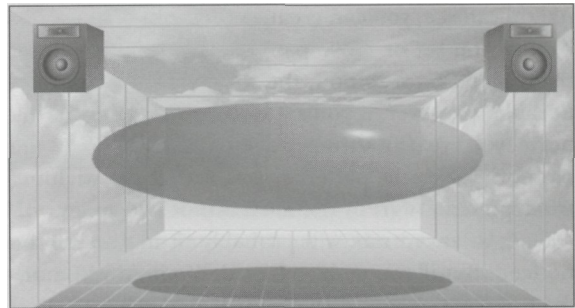
When you change the parameters of the effect, you also change the feeling that it creates ever so subtly. The trick to getting to know the intricacies of the feelings that different effects create is to simply play with them. As with any instrument, practice makes perfect. Get to know your tools. Get to know them so well that you can then create art with them.

Regardless of the type of feeling that an effect adds to a mix, time-based effects, such as delay, flanging, chorusing, phasing, and reverb, all add more sounds to the mix, filling out the space between the speakers. Therefore, they all add a dynamic of fullness to a mix. The question is whether more fullness is appropriate for the style of music or song.



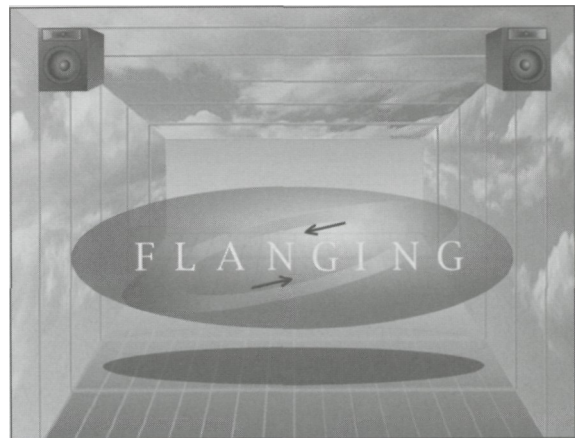
Visual 210. Mix With Lots of Different Delays Filling Out Mix (see color Visual 210C)

As previously covered, fattening stretches a sound between the speakers, filling out the mix.



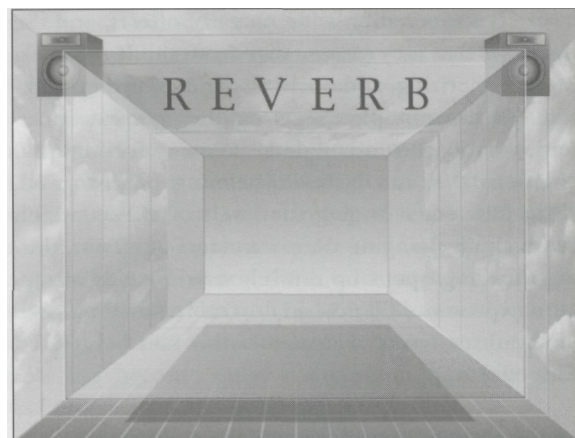
Visual 211. Fattening

Flanging, chorusing, and phasing are also based on short delay times, so they, too, will tend to make the mix sound bigger and fuller.



Visual 212. Flanging

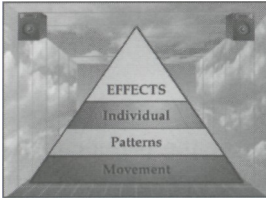
And, of course, reverb is really made up of hundreds of delays, so it takes up a lot of space in a mix and fills out the mix tremendously.



Visual 213. Reverb

All effects make a mix fuller, bigger, and badder (depending on your perspective). However, they also make a mix busier, so watch out.

Level 2 Dynamics: Patterns in Effects Placement



Time-based effects add extra sounds to the mix. When you add a delay, you now have two sounds. Add feedback and you could have ten sounds. Add reverb and you have added hundreds of sounds (delays). Therefore, when you add multiple effects, you can very easily and quickly fill out this limited space between the speakers.

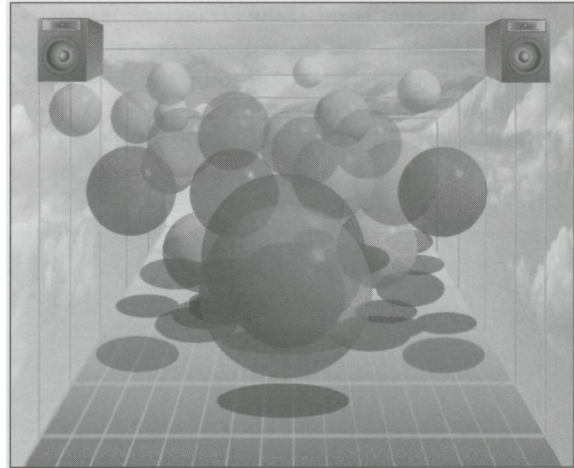
SPARSE MIXES

Sometimes you add very few effects to keep the mix clear and sparse, with plenty of space between each sound. For many styles of music, like folk, bluegrass, and many forms of jazz, it is required that there are virtually no effects to obscure the pure clarity of the natural sounds. Also, you shouldn't obscure the natural beauty of a pure song, if that is what you have. After all, it is the song that counts.

FULL MIXES

Sometimes it is appropriate to use effects to make a mix sound fuller and bigger, like a wall of sound. Many styles of music, such as new age, alternative rock, and heavy metal, often have a large number of effects to fill in all the spaces between the sounds, creating a full mix. In some songs, the entire song is about effects. This is often the case with rap, hip hop, techno, and space rock. In this case, it is fine to have a ton of effects.

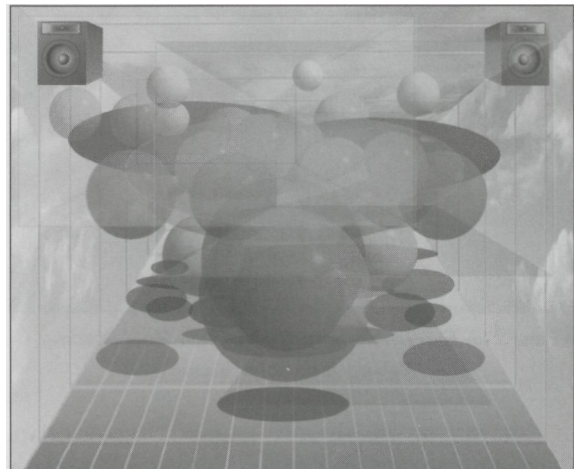
The main thing that makes a mix sparse or full is actually the number of sounds and notes in the song. Some songs have a busy arrangement in the first place; while others have a sparse arrangement. Therefore, when you approach a mix, one of the first steps is to check out the density of the arrangement. If there is a lot going on in the arrangement, you normally use fewer effects, simply because there is not enough room left between the speakers. This is commonly the case with salsa and symphonies where so much is already going on. The music of the Talking Heads is another good example of busy arrangements with clean mixes.



Visual 214. Extremely Busy Mix With No Effects (see color Visual 214C)

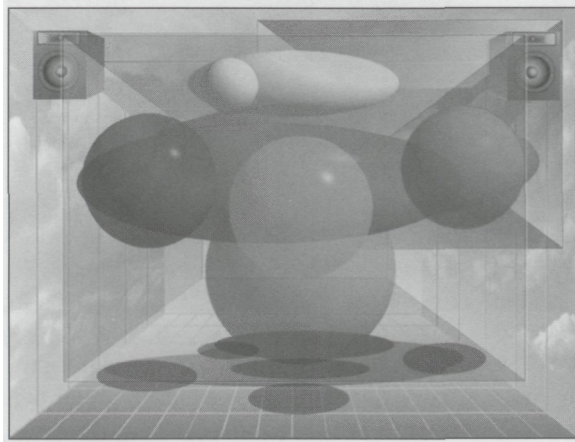
However, there are times when you might want to make a busy arrangement even bigger. Often bigger is better with new age, alternative rock, heavy metal, and other hard rock. The more powerful, the more awesome. Therefore, you might consider adding effects to such a mix even if things are already crowded. Forty-eight guitars may not seem so clean and clear, but it creates such a massive wall of sound that it can blow people's minds.

It was Phil Spector who was first known for creating this style of mix. In fact, he even did it in mono. For the longest time, everybody was addicted to clarity. Then Phil started adding more and more instruments to the mix and started using reverb to really fill out the space between the speakers. His mixes were dubbed "The Wall of Sound." These days we have taken this concept to the extreme. You might take a moment to think of the songs you know that have a busy arrangement with a full mix.



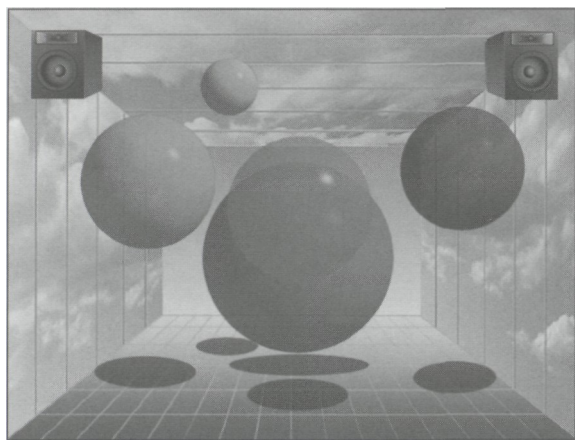
Visual 215. Extremely Busy Mix With Lots of Effects (see color Visual 215C)

On the other hand, if the arrangement is sparse in the first place, and if the tempo is slower, you have plenty of room for effects. You could use fattening to fill out the space between the speakers. This just might mean the difference between a garage band sound and something that sounds like a real CD.



Visual 216. Extremely Sparse Mix With Fattening and Reverb (see color Visual 216C)

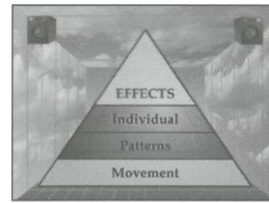
Occasionally, an extremely sparse arrangement is left that way. In this style of mix, every single sound is completely separate from every other sound in the mix. This makes each sound easily distinguishable from all the other sounds. As mentioned, bluegrass, acoustic jazz, and some folk music are commonly mixed this way. Steely Dan is a good example of this style of mixing: Very few effects are used to create as clean and clear of a mix as possible.



Visual 217. Extremely Sparse Mix With No Fattening and Reverb (see color Visual 217C)

A full or sparse mix might be appropriate depending on the type of person you are working with, the nature of the song, and of course, the style of music.

Level 3 Dynamics: Changing Effects (Types, Levels, and Parameters)



Changing the levels of effects or the parameters of effects during the mix is one of the most intense dynamics you can create. It is such a strong dynamic, it must certainly be appropriate in every way.

There are a number of ways that you can create movement with effects. You can turn up a delay on the end of a word, word, word or add reverb on the end of a solooooo. You could add flanging to a line in a song about "floating through life." Or take all the reverb off a particular line to make it more up front and personal.

Adding or taking away an effect, or just changing the level of an effect, is such a strong dynamic that it often becomes the sole focus of attention for the moment. Therefore, the effect should be done skillfully, so that it fits in with the song and the music. Some performers, like Frank Zappa, Mr. Bungle, and even Pink Floyd, have actually created songs based around changing effects.

You can simply turn the amount of effects in the mix up or down, but you can also change the type of effect or change the parameters within each effect. The capabilities of doing this are much simpler now with MIDI controllable effects. You could actually have the effects change based on the pitch of the note being played. Or you could use some sort of MIDI controller to play the effects like an instrument.

Of course, you can only create such overwhelming dynamics if the band will let you. You might keep a lookout for those bands that write songs with changing effects in mind. This is why rap, hip hop, and techno can be so much fun to mix.

Even if a song doesn't have completely different sections where you can use completely different effects, you can still create subtler variations between the sections of a song. You might add a little more reverb to the snare for the chorus section of the song, change the type of reverb on the snare for a lead break, or add fattening on the lead vocal during the chorus. Commonly the reverb on the snare is boosted ever so slightly at the end of a song when it gets rocking.

It is extremely cool to create subtle differences in various sections of a song, so when someone is listening closely they will hear more detail. When they listen over and over and over, they will always hear something new and will never get bored.

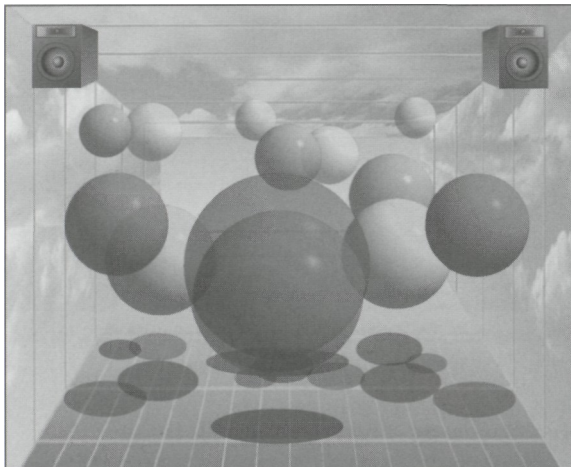
CHAPTER 6

Styles of Mixes

We have now covered the levels of dynamics that can be created with the four tools in the studio—volume, EQ panning, and effects. You can stack effects, then use volume, panning, and EQ to place the effects in various places. But when you use the four tools together to create a certain style of mix, it's even more powerful. The most powerful effect is when the four tools together create a certain style of mix and then are changed to a different style of mix in a single moment.

USING COMBINATIONS OF MULTIPLE SETTINGS TO CREATE HIGH-LEVEL DYNAMICS

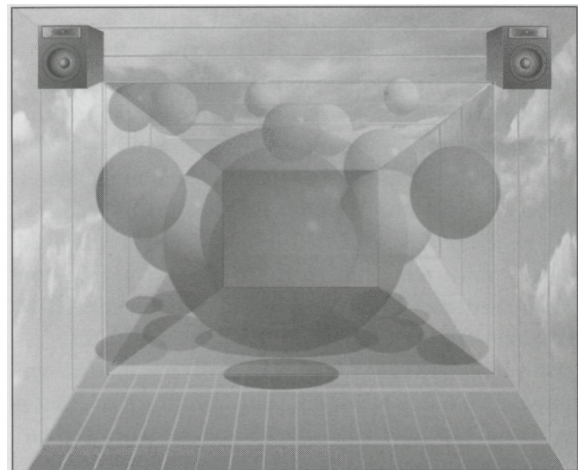
You can make an instrument more present and out front by using volume. Compression will make it more stable so that it seems even more present. If you brighten it a bit with EQ, it will be clearer, and keeping it clean with no effects makes it more present. Panning it to the center will also help. And if it's spread in stereo, it will really seem like it's your face. Using all of these techniques simultaneously will make the sound jump right out of the speakers.



Visual 218. Clean and Clear Mix (see color Visual 218C)

To make a sound come even further out front in a mix, start with a mix that has a good amount of reverb in it. Then, take the reverb off and the sound will seem to move forward. This can make a sound jump so far out front it seems like it could smack you in the face.

If you want to put a sound in the background, do just the opposite: turn it down, make it dull with EQ, pan it to one side, and add long delays and reverb.



Visual 219. Distant Mix

You can also send a sound out for delay, have it return on a channel of the console, send the delayed signal to the reverb, and then pan the reverb separately from the delay (both of which might be in a different place from the original dry sound). The volume of the delay compared to the reverb can be adjusted to make the nuances fit your taste. You could even EQ the delay differently from the reverb and from the original dry sound.

An especially effective trick is to turn up the feedback on the delay before it is sent out to the reverb, then take the delay out of the mix by unassigning the mix button (if you simply turn off the delay channel, it will also turn off the signal going to the reverb). What you end up with is reverb with a really long predelay and feedback. It is an extremely smooth effect that, when put on a vocal, makes it sound like you have a vocal synth in the background. Many guitarists, including David Gilmore, like it on their guitar as well.

Another interesting effect is to send the output of flanging, chorusing, or phasing to a reverb unit. This is often much nicer than simply putting these effects and reverb in the mix.

One of the most interesting combinations of effects is to send out for fattening (flanging, chorusing) on a sound, and then send the fattening to a 3D sound processor, surround sound, or multiple speakers. This way you can bring the fattening effect out in front of the speakers or even behind you.

A similar effect is to send reverb to the 3D sound processor, surround sound, or multiple speakers. You can make the reverb sound extremely spacey by putting it out in front of the console (right in front of your nose—but in stereo).

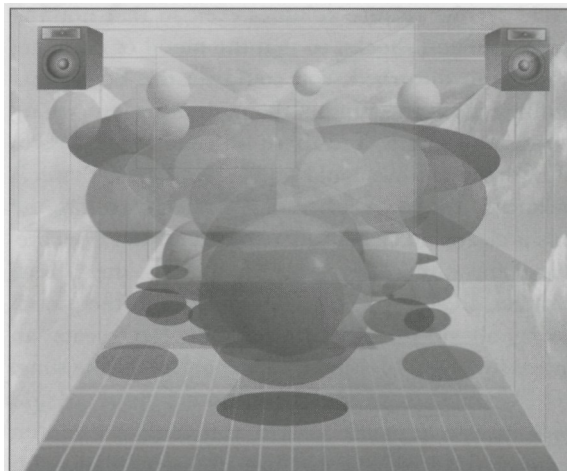
One of the most exhilarating effects is to put a delay with lots of feedback in the 3D sound processor and use the joystick to rotate it around the room (what a business we're in, huh?).

There are certainly a huge number of really cool combinations of effects. See if you can come up with some new ones on your own. If you come across anything that is death-defying—or just really nice—let me know (e-mail: virtmixr@hooked.net) and maybe I'll put it in the next version of the book.

CREATING A CONTEXT OR STYLE OF MIX

By using all of the tools together to create combinations of dynamics, you can create all the different styles of mixes in the world. One style of mix is the wall of sound. Just using multiple effects will fill in the space between the speakers quite well; spreading sounds in stereo with delays or adding reverb will quickly fill in every hole in the mix. But, when you also boost the low end a little on each of the sounds, they will all take up more space. You can also use panning to spread sounds in stereo if the two sounds are similar (like when you have two mics on a guitar amp); then, when you pan the two sounds completely left and right, they will pull together so that the sound is stretched between the speakers—making the mix much fuller. Panning sounds so that they overlap a bit makes a stronger wall of sound. If you have very few sounds in the mix, making the volumes more

even will contribute to a fuller mix. On the other hand, if you have a really busy arrangement, uneven volume placement will actually take up more space, creating a fuller mix.

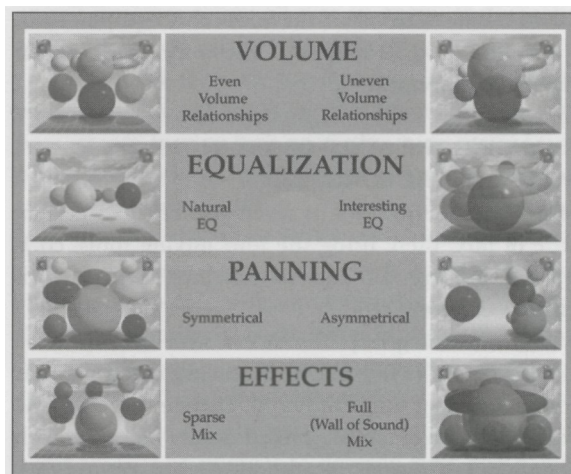


Visual 220. Making Mix Fuller

Because the main thing that makes a mix full in the first place is the number of sounds and notes in the song, you can help make the mix fuller by having the band play more parts. For example, you might have the band doubletrack or play the same part three times. Multiple mics on one sound can also add to the density of the mix.

As you can see, using all of these techniques together can build a huge mix. On the other hand, if you want a mix to be sparser, cleaner, and clearer, do the opposite: fewer sounds, fewer effects, brighter EQ, wider panning, and appropriate volume settings.

With these four tools we can create the following dynamic patterns. These are some of the emotions and feelings that we can create with the technical equipment in the studio.



Visual 221. Dynamic Ranges Using 4 Mixing Tools

By changing any of these tools in real time, we can create additional movement and much more intense dynamics. And we can use all four tools to create an incredibly powerful dynamic.

For example, if you're mixing a love song, you could set the relative volumes even so that nothing jumps out and shocks, so that the mood of the emotion is not disturbed. You could set the EQ so that nothing is too irritating in the midranges, everything is nice and bright, and there isn't too much bass to blow the mood. We could set the panning so that it is balanced. We could use very few effects, so that the mix is clean and clear. And we could refrain from creating any unnecessary movement with the faders, panpots, EQ, or effects so as to not spoil the mood. Using all of these tools together can create an intensely beautiful dynamic appropriate for the song.

On the other hand, if you're mixing some wild rock 'n' roll or exotic techno, you could set uneven volume relationships, so that we would have soft sounds followed by loud sounds, creating a very exciting dynamic. ROCK 'N' ROLL!!! You could set EQ to get lots of highs and lows. And you could EQ some sounds so that they cut through and are edgy in the midrange, making the whole mix jump out and grab your attention, forcing you to dance. You could set the panning to be unbalanced, creating tension and making the mix unusual. You could also add several different effects, making the mix interesting at every single moment.

Let's have some serious fun. Enough of the status quo. We could have things zooming left and right with panning, volumes going up and down, EQ changing throughout the mix, and effects and their parameters going up and down, as well as their parameters changing constantly. Using all of these tools together, we can create an intensely beautiful dynamic totally appropriate for the song.

These are two extreme types of mixes that we could create with all of the tools and equipment in the studio, and all mixers in the world fall between these two extremes.

CHANGING THE STYLE OF MIX IN THE MIDDLE OF THE SONG

More intense, however, is when you create a certain style of mix, then, using the four mixing tools, completely change all the parameters, creating an entirely different style.

The rock group Yes did it with "Owner of a Lonely Heart." They play a screaming electric guitar sound and, in a single moment, change to a '50s style recording of a drum set, miked twenty feet away with a dull EQ. Then all of a sudden, they return to a screaming guitar/synthesizer type of sound that is

extremely edgy. Sudden changes in multiple mix parameters can be extremely effective.

Sting also did it with the song "Englishman in New York." The song goes from a jazzy groove—very few effects, very clean, small snare sound—to a huge drum sound with tons of reverb instantly. Then, in a flash, it is back to the simple, clear jazz mix.

Of course, you can only create such dramatic mix dynamics if they are appropriate for the song. This was obviously one of Frank Zappa's favorite techniques, and Mr. Bungle has taken this concept to the extreme; every 30 seconds, the song and the mix change completely.

To change the entire mix in a single moment can be shocking. It can blow people's minds. It can show people that their reality is just an illusion that can change at any moment. But best of all, it shows perspective. It shows people that they don't need to stay stuck in their current reality. They only need to put a different mix on the situation.

All the mixes in the world are created with just these four tools: volume, EQ panning and effects. It's what *you* do with them that counts.

The Relationship of Musical Dynamics Created by Equipment to the Musical Dynamics Found in Music and Songs

Now that we have discussed all the dynamics that can be created with the technical equipment in the studio, let's return to the basic concept: *The art of mixing is the way in which the dynamics we create with the equipment in the studio interface with the dynamics apparent in music and songs.* You can now begin to explore all the different relationships between mixing dynamics and the dynamics that people perceive in music. The trick is to remember what you did when you find something that you really liked in a mix.

Remember what you do—especially when what you do creates magic! After a couple of years of keeping track of the magic, you become a magician.

Putting It All in Perspective

Now you know what is required of a recording engineer. Besides learning the technical side of the equipment and how to work well with a wide range of strange, unusual, and wonderful people, a recording engineer also deals with refining a diverse array of aspects—even the music itself. The mix is only one of many aspects that contributes to a great recorded piece of music.

You've learned many of the details of the dynamics that can be created with studio equipment. You now have a mixing framework, designed to include all of the musical possibilities, to help you get a good perspective on all that you can do in the studio.

Just as a great musician must, at some point, learn

and incorporate aspects of theory and technique into his or her actual playing, so must the aspiring recording engineer incorporate theory into practice. This process varies for different people. Some people are fanatics (driven by parents, childhood experiences, or from something above), will take the bull by the horns and study until they are blue in the face, and have it all down. Others will incorporate the aspects that stick out in their minds the most. One or more ideas will sneak into your recording projects over the next few months. You might also reread some sections of this book from time to time and gather a few more tidbits to incorporate. Regardless of your style of learning and how you incorporate this learning into practice, you now have an overall structure to see all that an engineer does, and you can focus on what it takes to become great at it.

The trick is to use the dynamics created by the equipment to enhance, accentuate, highlight, support, create tension or just let the music itself shine through (whichever is appropriate for the song and style of music). The way in which these dynamics interface with the music is the art of mixing. The art of the recording engineer is to seek out the relationships between the equipment and the music that are the best—whether they be magical, beautiful, amazing, world-changing, people-changing, or just cool. *Don't stop until you get goosebumps.*

Different people have different ideas of what great art is. The point is to develop your own values about what you think is great art. **Then, make it!**

About the Author

David Gibson has been teaching, engineering, and producing groups in major 24-track studios since 1982 and is the founder and owner of California Recording Institute in San Francisco. Before that, he taught recording at Cabrillo College in Santa Cruz for five years. He has been using the concepts and visuals presented in this book in his classes since 1986.

Previously, Gibson owned a commercial music production company called Creative Music Services in Atlanta, Georgia. He has recorded many jingles for the Santa Cruz Boardwalk.

David has also done recording for James Brown's band, Bobby Whitlock (Derek and the Dominoes), the Atlanta Rhythm Section, and Hank Williams Jr.'s band, as well as having worked with members of the Doobie Brothers, Lacy J. Dalton's band, Herbie Hancock's band, and It's a Beautiful Day.

Gibson co-produced a double album with Jonathan Segel of Camper Van Beethoven and has produced a variety of other albums ranging from new age to heavy metal to hip hop and techno music.

Gibson is also the inventor of the patented "Virtual Mixer," which displays a mix visually in real time. He created a customized version on the Silicon Graphics computer that shows the visuals in 3D with 3D glasses.



Appendix A

Dynamics Created by Studio Equipment Categorized by Emotional Effect

The key is to establish a connection between the technical equipment in the studio and the feelings and emotions found in music. The following chart will help you understand this concept. The middle column shows the tools. Columns two and four show the types of dynamics that can be created with the tools. And columns one and five show the types of feelings and emotions created by the dynamics.

<u>Mellow Emotions</u>	Even volume relationships with little variation between each sound and successive sounds from song beginning to end	<u>Volume</u>	Volume relationships that vary drastically between sounds and from section to section	<u>Intense Emotions</u>
ordered				interesting
structured				exciting
even				wild
fun				creative
gothic			Interesting EQ between instruments calls attention to particular ones because they sound noticeable	crazy
stable	Natural EQ between all instruments; they all fit well together and are "natural," as if you were there	<u>Equalization</u>	"different," unnatural, or unique	new
normal				fun
romantic				unbalanced
balanced				complex
simple				
	Balanced, symmetrical placement	<u>Panning</u>	Unbalanced, asymmetrical placement	
<u>Positive Values</u>				<u>Positive Values</u>
warmth	Dry, clearly EQ'd, uneffected instruments, placed in positions in the mix to be separate from each other, leaving "space" between the sounds	<u>Effects</u>	Wet, bassy, and "full" EQ; fattened, thickened, and delayed sounds, placed overlapping positions in the mix, leaving no "space" unfilled between the speakers	fun
peace				creativity
love				catharsis
security				intrigue
atmosphere				perspective apparent
centeredness				
<u>Negative Values</u>		<u>Stabilization vs. Movement</u>	Panning, changing volumes, adding or changing EQ, and changing effects make the sounds less stable	<u>Negative Values</u>
boredom	Use of compression makes the image of the sound more stable because it moves less			frenetic
triteness				crazy
status quo				annoying
commercial				psychotic
simple				abnormal

Appendix B

THE MIXING PROCESS

Different engineers have their own procedures to follow when developing a mix. What follows is a process that will help you build the mix most efficiently.

1. Equalize Each Instrument Individually

You need to make each individual sound good; this means making the sound either natural or interesting. If you have heard the entire song, you can also EQ the sound so it will sound good in the mix. Don't spend too much time working on a sound by itself—what the sound is like with the other instruments is what counts. Just get it in the ballpark, and if it ain't broke, don't fix it. Also, when in solo, always EQ it brighter than you think it should be. High frequencies are easily masked by the other sounds in the mix.

2. Bring Up the Mix

a) Bring Up Fader/Volume

The order and manner in which you bring up and balance out the levels of all the different instruments is important. It is helpful to establish and stick to a specific order. Here is the outline of a commonly followed order:

Drums: kick drum, snare drum, hi-hat, overheads, toms

Bass Guitar

Basic Rhythm Instruments: rhythm guitar, keyboard rhythms

Lead Vocals

Lead Instruments

Background and Harmony Vocals

Percussion

It is a good idea to build the foundation, or rhythm parts, of the mix first. Some engineers will bring up the vocals after bringing up the kick drum.

b) Pan to Taste

Pan each sound as you bring it up.

c) Add Effects

Many engineers will add effects as they bring up the instrument in the mix. However, you can't set the final level of the effects in solo because effects get masked by other sounds in the mix. Therefore, you

must always set the final level of effects while in the mix, with all sounds up.

3. Refine Equalization, Volumes, Effects

Then, do it again and again and again . . . until you're satisfied or almost out of time.

4. Plan Out and Practice Moves to be Done During Mix

There are four types of moves that can be done during a mix: panning changes, volume changes, effects changes (volume and type), and equalization changes. If there are too many moves to remember easily, map them out on paper. Practice your moves before recording onto the mixdown tape.

MIX MAP

You use a mix map to facilitate remembering multiple moves (such as volume, panning, EQ, and effects changes) during the mix and performing them precisely, as well as to preserve all your settings and moves should you need to mix the song again.

You begin by mapping out the song structure (verse, chorus, bridge, lead, break) with times. The Reset column is to remind you to reset all of your settings for the beginning of the song whenever you play the mix again.

Notice here that the kick, snare, and bass are brought up to level 2 during the Lead Break and then to level 3 during the Vamp (repeating Chorus at the end). These precise levels are marked on a piece of masking tape next to the fader or with a grease pen. The snare has reverb turned up on the Bridge and then turned down on the Lead Break. The overheads are boosted for the Intro of the song, then brought down at the beginning of the First Verse. The keyboard is panned to the left at the Bridge, then returned to left and center spread at the Lead Break. The rhythm guitar is panned to the right at the Bridge, then returned to a right and center stereo spread at the Lead Break. The guitar fills are swept from left to right during the Lead Break. The lead guitar is panned more toward the center and brought up to level 2 during the Lead Break. The vocals are brought up for the first verse, taken down for the

Trk	Inst	Reset	Time	00:00	00:42	1:20	2:15	2:35	3:10	3:55	4:20	4:44
				<u>Intro</u>	<u>Verse 1</u>	<u>Chorus 1</u>	<u>Verse 2</u>	<u>Chorus 2</u>	<u>Bridge</u>	<u>Lead</u>	<u>Vamp</u>	<u>End</u>
1	Kick									2	3	
2	Hi-Hat											
3	Snare	1							RvbUp	2	3	
		Rvb								RvbDn		
4	OHL	1			2							
5	OHR	1			2							
6	Toms											
7	Bass	1								2	3	
8	Keys								L	LC		
9	Rhy Gtr								R	RC		
10	Gtr Fills	Pan								Pan		
11	Lead Gtr	1								2		
		L/R								Ctr		
12	Vocals	1			2	3	2	3	Rvb		4	
											RvbOff	
13	Horns	DlyDn								Dly		
14	Perc	EQ								EQ		

Mix Map Chart

Choruses, and brought to level 4 for the Vamp; reverb is added for the Bridge, then taken off for the Vamp. The horns have a delay that is added in the Lead Break, and the percussion has an EQ effect that is done in the lead break.

Once you have completed the map, place it where you can follow it throughout the mix. This enables you to do an incredible amount of moves very precisely and shows you where you have a lot of moves to make at once, which might require some practice or some help from a band member. When you do an automated mix, this information is stored in the computer.

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