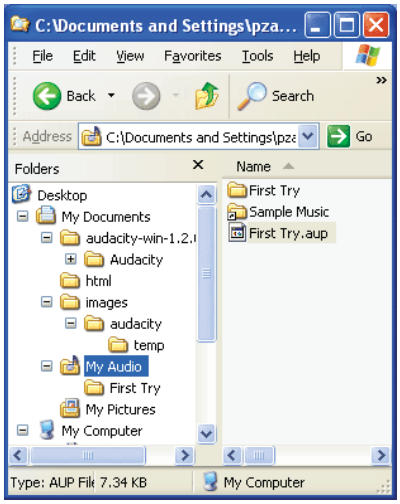
Another window will appear asking you to set the parameters for whichever effect you select.

I recommend using "**Normalize**" on all your audio files. What this does is adjust the volume of audio files to a standard level. If you set your input levels correctly when you digitized your audio, then you should have "decent level" signals being digitized. When you normalize, Audacity looks through your audio file to find the loudest section of the audio, makes sure not to distort that, and shifts the levels up as much as it can, without distortion. Usually, I normalize to 95 percent of maximum. This will give you a good audio level for all your files, without needing to worry about distortion. It is not a coincidence that the only normalization value for Audacity is -3 dB, since this corresponds to 95 percent.

One thing to watch out for: if you captured your audio at too low a level (i.e. you spoke too quietly or were too far away from the microphone), and then you normalize it, you'll probably hear a bit of noise in the background. With a little experience, you'll learn the best way to record to avoid this situation.

Saving Your Files

Audacity is great because it forces you to be organized! Right when you create a new Audacity session, you should go to the File menu, and then choose Save Project As... Audacity asks you to name your session. I suggest you have an "audio" folder on your computer and place all your audio files in this folder.



I named my Audacity session "First Try," and Audacity created a folder with that name. In the image above, you'll notice the the "First Try.aup" session file, and the accompanying "First Try" Files folder.

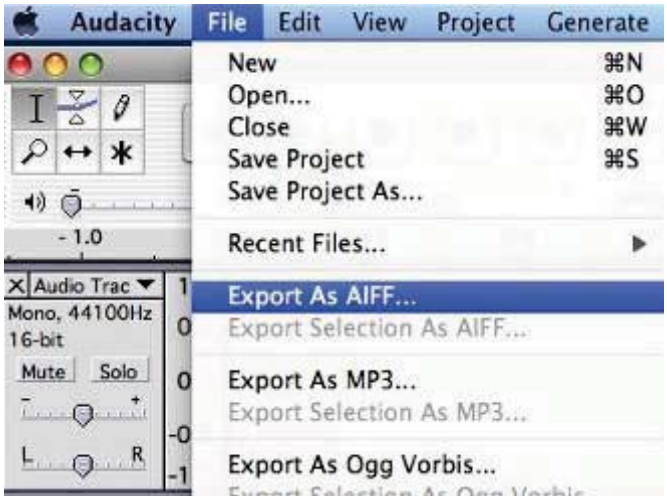
The **session file (.aup)** is just the instructions that tell Audacity how you want your audio edited. If you only copy the session file, and not the entire session folder to other disk (for backup), you wont have the actual audio files --your tracks will be blank when you open your session.

In other words, the session (.aup) is tiny in file size because all it does is tell your computer which audio files to play, when to start each file, how loud to play it etc. But, the audio files themselves are all found inside the "First Try" files folder. You can think of the session file as a really smart shortcut, or alias to your audio files.

Creating a Mix Down

Once you have a completed edit of your audio, you need to create a final mixdown of your piece. You want to do this so you can let other people hear your audio, without making them have to have a copy of Audacity. In Audacity this is called an "**Export**..."

Think of it like this: if you have a word processing file that you saved as a Microsoft Word document, only those people with Microsoft Word could open that document. But, if you saved that file as a .txt, or .rtf, or even .pdf file, most people, regardless of what they use for a word processor, will be able to open your document.



We'll do the same courtesy for our audio files. Plus, you'll need to be able to do this if you want to put your audio on the Internet, or use it combined with your graphics and video in multimedia presentations. Exporting to disk lets you create a new audio file with all of your edits made into a single contiguous region. Exporting is not only useful for combining "submixes" but is also the process used to create a master mixdown file.

Exporting uncompressed audio from Audacity

Maybe I'm just really compulsive. But I, absolutely, always save out an uncompressed version of my edited audio. Why? Well, maybe, someday, there won't be an Audacity anymore (they've been around a long time, and they are not going away anytime soon). Hey, I was a Mac user in 1984 and I've got files that I wrote using MacWord that I can't open anymore. Yeah, yeah. That's more than 25 years ago, and I don't even have a floppy drive anywhere, let alone a 400K floppy drive that would read those disks (except I do still have that original Mac as an heirloom, and it does still run!). The point is, you'll need to change with the times.

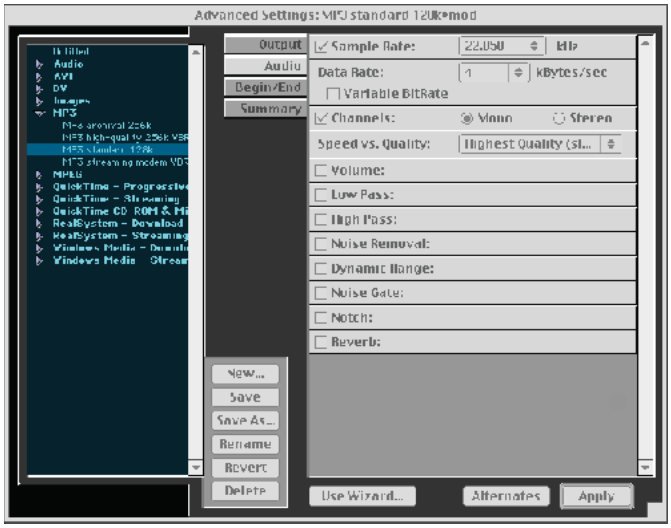
Okay, I know, I'm straying from the point with a sob story. But, let's say that, in 10 years, you want to use your audio for some other purpose, like adding video to it, or something we can't even imagine yet. Wouldn't it be really nice if you could start with pristine audio for your new project, rather than starting with MP3 audio? I mean, in 10 years, we're all going to think about MP3 like we think about "car phones" from the 1990s - you know, those big things that took over the center console in your car, and had curly wires coming from the unit to the headset. And they weighed like 20 pounds.

So, it takes 30 seconds to "Export As AIFF" (Mac) or "Export As WAV" (PC) from Audacity. And I've never regretted doing this. Go to the File menu and then "Export As AIFF" (Mac) or "Export As WAV" (PC) from Audacity.

You'll see the standard "Save File As..." dialog box asking you where to save the mixdown uncompressed audio file. Make sure you save it to the Audio Files folder of your existing session. This way you'll always know where you placed it.

Understanding Audio Compression

Audio (and video) compression is a course in itself. But, you're getting a pretty good taste for it. I use a program called Media Cleaner to encode my audio and video files. When I first started with it....wow, was it ever intimidating. Here, take a peak.



Pshew. That's a lot of options! And that's just for compressing audio into MP3 format.

Compressing Audio for streaming on the Web

Let's say you recorded a great speech of yours (maybe your latest paper) into your computer using Audacity. Then, you edited it so that there are no "um's" and mis-spoken words in it. What's the next step involved in getting it on the Internet for everyone to hear?

You'll want to encode the audio to a format that works well over the Internet. Just like graphics need to be .jpg or .gif to be on the web, audio needs to be encoded and compressed into file formats and bit rates that work for people on a network connection.

Encoding is the term used to describe the process of preparing audio or video files to be streamed or downloaded over the Internet. Encoding transforms a signal into a form optimized for transmission or storage. The primary concern when delivering audio or video over the Internet is **file size** and **data rate**. Files that are too large will take too long to transfer, ruining the end-users' experience. To make sure that your media files play smoothly over the Internet, the media needs to be encoded and **compressed**. On the other hand, files that are tiny may sound terrible, totally wrecking the user experience. It's a trade-off between file size and quality. How do you know what to do?

Most people put up a few different audio files, each with a different compression. Heavy compression so people on slow 56k modem connections can hear something, and less compression so people with Cable or DSL get higher quality audio.

128 - 300 kbps (kilobits per second)
Ideal for users with T1, T3, Cable Modems, or High Speed DSL. MP3 quality. Not quite CD, but very clear if you want to relay every nuance of your audio presentation. Best option for music, or pieces that have a lot of very subtle sounds. Huge file size, however, and if you want to share your work with those who don't

have a consistent high-speed connection you will have to do a different encode just for them.

64-96 kbps
Near MP3 quality. Still sounds pretty darn good for music, and radio features. Speech is clear and you can still hear most of the aural nuances of the original recording. You are still limiting your audience to higher speed users, and if your piece is basically speech with a bit of background noise or music, you are sacrificing a larger audience for quality you may not be able to hear in certain types of sound files.

56.6 kbps
Ideal for users with a 56.6k modem. This is the most widely accessible bandwidth. Though you lose a noticeable amount of fidelity, dynamic range, and frequency spectrum from the original recording, it is clear enough that the most important parts of the audio are there. Though there are few audio artifacts present after the encode, they are negligible and will probably not distract the listener.

14.4 - 28.8 kbps
Let's just call this the AM radio option. If you are doing primarily speech and want to ensure your piece can reach absolutely everyone, then this is what you want. Music, however, will become noticeably garbled and you will probably hear more unwanted artifacts. Hardly necessary anymore.

Streaming
After you compress your audio file as a streaming file, you need to place it on a special "streaming" server, or RTSP server. We covered this a little bit before, but its good to talk about it again here.

You can set up any computer as a server, but if you want to stream audio or video from a server, you'll want to get as fast a computer as you can get. You can use a Real Server to stream RealAudio files, a QuickTime Streaming Server for MP3s, MPEG-4 video (more on this later). With QTSS you'll need a fast machine, but the software is free!

Streamed audio is never stored on an end-users computer. They click play, after a short moment, the audio begins to play, and when they stop listening, its gone. If they want to listen to it again, they need to go back to the Internet, and play it again.

Downloadable audio
Even if you don't intend to stream your audio, you'll still want to compress it for people to download it over the Internet. You still need to deal with the file size vs. sound quality issues, but, in general, you can deliver good sounding compressed audio as a downloadable file. MP3 is the format of choice for now, though this is also starting to change as new codecs are designed.

Downloaded audio files exist on an end-users computer. You can create "copy protected" files, so they can't be massively duplicated, but if you let someone download your audio - you're giving them the file. Podcasts (which we'll discuss in a moment) are popular examples of downloadable audio.

How To Place Audio on the Web
Yes, I know, we are not an HTML class, but this is pretty simple, so I wanted to take you through the whole process. Once you have your audio file on a server, you'll need to make a web page that calls the audio file.

Simplified, it would look something like this:
```
<embed src="http://yourserver/youraudio.mp3">
```

So on your web page, you force the browser to look for the file you placed on the server.

The end user then uses a media player to listen to (or view) your content. This could be QuickTime Player, Windows Media Player, or RealOne depending on how the file was encoded. Or, their browser may have a plug-in that controls playback rather than a stand-alone player.

Stay tuned for changes that HTM5 will bring for putting audio or video on the web. Life should become a lot easier!

What are MP3s?
MP3 is simply an audio compression format. It's the JPEG of the audio world in that it compresses audio files to tiny file sizes, but it doesn't degrade the audio quality too much that you can't stand to listen to it.

You can export audio out of Audacity to MP3 format (using the LAME MP3 encoder). You can even use iTunes to create MP3 files.

The Great Audio Debate

I figure we should at least mention ye old Napster debate in this class. It still exists - and people are still "stealing" music online. So lets start at the beginning.

First of all, Napster was/is an online (meaning Internet) service that allowed regular computers to act as audio file servers - sharing MP3s over a large network called the Internet - the largest network of computers in existence. Meaning, I have a computer that is on the Internet, and I agree that I want anyone on the network to be able to "share" my audio files. So, my entire music library, from The Cars to Tom Waits is now "sharable" by anyone on the Internet. This is often referred to as a "peer-to-peer" network.

The record companies saw this as infringing on their "rights" to owning and selling music. I mean, why buy a CD if you can just log on and download it for free?

Just so you know, a similar debate started a very *long* time ago, like with the invention of the record player. Symphony orchestra conductors thought no one would go to hear live music anymore if they could listen in the comfort of their own home. The same debate began again when the VCR became so popular (in the late 1970s and early 1980s), which the movie industry tried to banish. Up until recently, the quality you'd get at home was typically not even close to what you'd get at, say the symphony, or a movie theatre. This is changing quickly, as each home gets equipped with its own home theatre, complete with Dolby Digital Surround Sound, 60+ inch LCD televisions, and even stadium seating for the home!

Back to Napster. While you're in the "peer-to-peer" networked system (online), Napster let you see directories of other users who want to share their MP3 files. All the MP3 directories - of all the users online - were stored in the Napster database. And, they all were searchable. If there were enough people using Napster, you could usually find any song you might want to download to your machine, for free. Once downloaded, your copy was also listed in Napster as a file that can be shared with others.

Napster itself did nothing more than hold the users' directories, allow a search of the master directory held in the Napster server, and make a physical IP connection between one users computer and another users computer. The music never went through Napster, but rather transferred from machine to machine. It never touched a Napster server (it went from peer-to-peer).

It's a good debate - whether to buy music, "rent" it, or "share" it. I suggest researching the progress of the battle on the web. In fact, if you try going to Napster.com nowadays, you'll find the "free" has turned into "monthly fee" and "pay per song" service. It has joined ranks with legal music downloading operations, like the ever-popular Apple's iTunes Store.

Legal Alternatives

Of course we didn't have this section of the course a few years ago! There are now several places you can legally purchase and download music from the Internet. One is Apple's iTunes Store (available for the Mac and Windows). You use iTunes to connect to Apple servers and you can find and listen to millions of songs they've encoded into AAC format (slightly better quality with smaller file size than MP3, but contains copy-protection mechanisms). There's popular and obscure music, available for you to legally purchase and download over the web. Buy a song or an entire album. Search their databases to find stuff you've totally forgotten about. If you purchase music, it just automatically appears in your iTunes Library. And, you can play it on your iPod, use it in video projects, and even burn it to your own CD. And best of all, no more waiting hours and hours for somewhat flaky downloads that Napster had, with unreliable quality encoding. Every song is encoded in high quality, and downloads are fast.

Everyone else is jumping on the bandwagon - including Microsoft, Real Networks and WalMart. It continues to grow...but Apple seems to have cornered the market on this one for now.

Exporting MP3 files from Audacity

Most people don't want to open up your Audacity project and see all your tracks and edits. Plus, they can't play the Audacity project on their iPod or other MP3 player. Nor can you play it on the Internet. Really, it can't be played anywhere but on your own computer. Exporting lets you create a new audio file, with all of your edits made into a single contiguous region.

In Audacity, go to the File menu, and then choose "**Export As MP3...**". If your "Export As MP3..." option

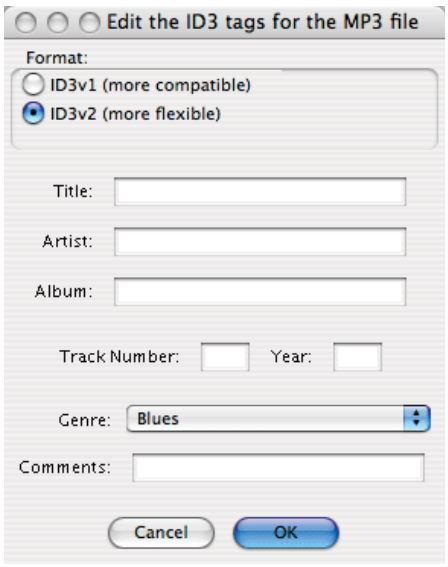
is greyed out (not available) that means that you haven't yet downloaded the LAME MP3 encoder - a plug-in to Audacity that let's it export MP3 files. You can download the encoder at http://audacity.sourceforge.net/help/faq?s=install&item=lame-mp3

Once you download the file, you'll need to unzip it and then I suggest moving it to the same folder that holds your Audacity application files.
You should be able to relaunch Audacity and then get a working File > Save As MP3 menu option.

Using LAME for the first time
If you have downloaded the LAME MP3 Encoder, the first time you use it, you'll need to tell Audacity where it's stored on your computer. You do this by first Exporting as MP3 and when it asks you where the .dll file is, just point Audacity to that plug-in folder you downloaded - inside it you'll find a .dll file.

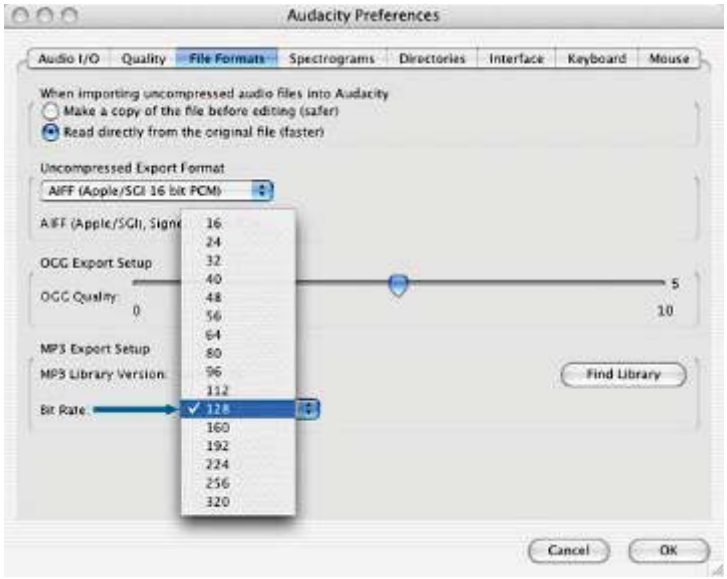
After you choose "Export As MP3..." you'll see the above "Warning" message, which is nothing to get alarmed about. It's just notifying you that, no matter how many tracks your Audacity project has, they'll all get mixed down to standard two stereo tracks (based on how you set the Pan while you were editing). This is a good thing -- just click OK.

Then, you'll get the standard "Save File As..." window, asking you where to save the MP3 file. You might want to save it to the Audio Files folder of your existing session. This way, you'll always know where you placed it.



After you give your file a name, you'll see the window shown above, asking you to edit the ID3 tags for the MP3 file. These ID3 tags are "extra" information that you can embed right into your MP3 audio file. This "meta data" is used by iTunes and other applications to display certain information, like song title, artist, genre, etc. You can fill in this information, or just leave this information blank, and click OK.

Setting the LAME MP3 encoder settings
I've always just used the default setting, but if you want to change any of the export options, they are located in the **Audacity Preferences** (shown below, and in the File Menu) under "File Formats."

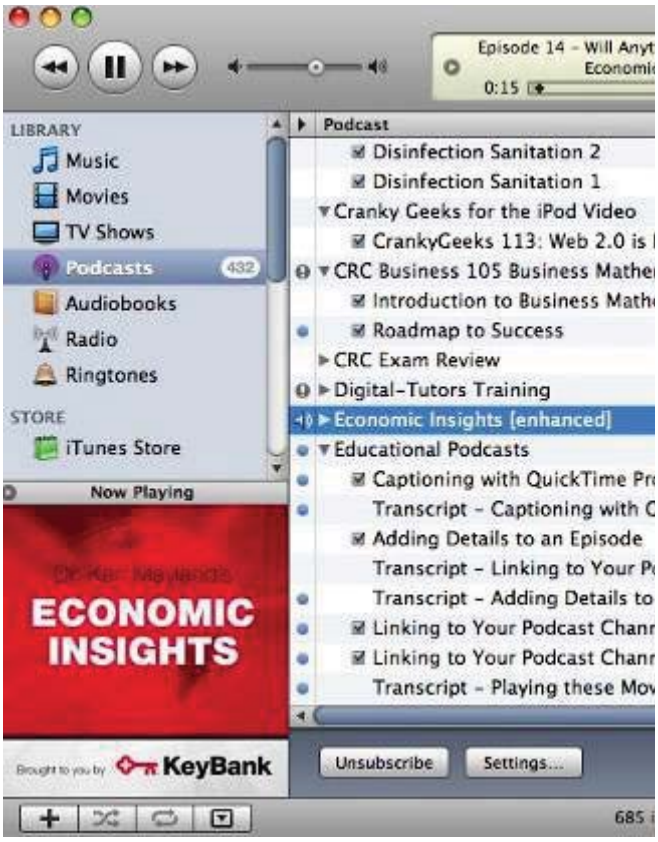


The "standard" Bit Rate is 128kbps (kilobits per second). Higher bit rates produce slightly better quality, but add to the overall file size. Lower bit rates produce slightly worse sound, but, correspondingly smaller file sizes. If you export your audio at the standard 128 setting, and find the quality not up to your standard, then, by all means, feel free to change it. In my opinion, it's not worth trying to save a few K by making the bit rate less than 128.

Podcasting

I'd be completely remiss to not talk about Podcasting. Way back when, in 2004, a new way for individuals to get our stories out came along -- podcasting. It's called this due to the incredible popularity of the Apple iPod, but in fact, you don't need an iPod to either become a content producer, or be a listener. And, many podcasters are using Audacity to record and edit their audio - so you're half way there!

Basically, podcasting is "do it yourself" radio. You can pick from what others have already produced, and choose what exactly what you want to hear - and listen to it when you want to hear it. Or, you can produce and deliver to your listeners whatever content you want to put in your own show. It's bringing radio to the masses, and you can be a part of it if you want.



But its a bit more than this, because you can "subscribe" to people's podcast channels, and get new episodes "pushed" to your computer and/or portable MP3 player as they are published. So you can easily keep up with the latest whatever-it-is that you're interested in. It's very popular and you can easily find podcasts right from within iTunes. To find podcasts, just go to the iTunes Store and choose Podcasts over there on the left of the window. You can search based on keyword descriptions or show titles.

The RadioShark Alternative

So you'll find lots of your favorite radio shows also have podcasts of their shows. You can get the NPR story of the day, or stuff like this. But what about the shows you love that are not available as a free podcast? I use a RadioShark (http://www.griffintechnology.com/products/radioshark2/) for these. Don't confuse this with Radio Shack. A Radio Shark is like TiVo for radio. You plug is this little "shark fin-like" USB device to your computer. It gets you the ability to listen to AM/FM radio off the airwaves on your computer. You can even listen to and record Internet radio. You can schedule recordings to occur automatically, and they appear right in your iTunes library. Perfect. So you can listen to your favorite radio shows whenever you want. Its a pretty nice alternative to recording cassette tapes of your favorite shows!

And Satellite Radio
And we must include Satellite Radio as another viable alternative broadcasting environment. (Hey, maybe we should include low-power FM stations too?!) The two biggies are XM and Sirius, and they are in the process of trying to merge. These satellite stations somewhat "globalize" radio - so that you can listen to stations that broadcast on satellite wherever you go - so you never drive out of range of your favorite satellite radio station. It's pay radio, but it is turning out to be an interesting player in the broadcast world - partially because they are not regulated by the FCC.

Oh, and HD Radio
Maybe you've heard your "regular" FM radio station talking about HD Radio. It's basically a way to use the standard "sidebands" of the FM signal to transmit multiple "streams" of data over a single channel. It can split bandwidth, so, in a world where the FCC regulates all the airwaves, and the dial is just getting more and more crowded, HD radio is a way to have distinct stations that are really close in frequency. In other words, it's possible to have a really great station at 91.2 and a totally different station at 91.3 and they never interfere with each other.

Another cool feature - because the signal is digital, text-based data such as traffic, stock info and song titles can be sent out as well. And, the audio that is broadcast is at CD-quality!

Like satellite radio receivers, you need special HD radio receivers to pick up these stations. They aren't as cheap as "normal" radios ($125 or so in 2008), but the price is coming down every day. And, once you buy the receiver, the programming is free - no monthly service charges. And they can receive both HD and analog radio stations.

Internet Radio Stations
You can have your own radio station that plays over the Internet, 24-hours a days. Or conversely, you can listen to other people's stations right through your web browser or another application. Let's take a look a few networks where you can find stations.

Live365.com - If you use iTunes, Live365 provides your "radio stations" in iTunes. So, you can listen through either your browser or iTunes. Choose the type of music you want to hear, and you'll find plenty of choices.

If you don't have iTunes, just use your web browser to go to http://www.Live365.com and you'll get all these live radio stations - and more! Live365 and iTunes lets you listen to streaming MP3 quality audio. In the graphic above, notice how different stations are broadcasting at different bit rates?

If you are interested in starting your own Internet radio station, find out more about Live365's packages (start at $10/ month). http://www.live365.com/broadcast/ There are many others out there too.

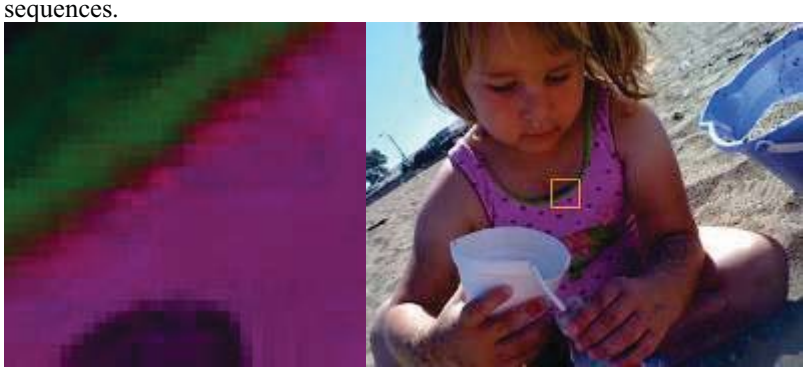
SHOUTcast - is also a network of streaming MP3 audio stations, with even more music. Thousands of choices, you're sure to find one you like. And, you can set your computer up as a server and broadcast your

own station (they say its free!). http://www.shoutcast.com

Other popular online radio stations include: AOL Radio Network (http://music.aol.com/radioguide/bb), Yahoo! Music (http://new.music.yahoo.com/) and the UK's own AbsoluteRadio (http://www.absoluteradio.co.uk/)

What You Already Know
Although you may be new to editing video, there are a lot of things you already know about video on a computer. You know some things about text file formats, graphics, and audio on a computer. In this book we're discussing the fundamentals, and the commonalities between all these digital disciplines.

Video is a series of still images, displayed in rapid succession, that give the illusion of movement on screen. Video exploits two ways that your brain works to create this digital illusion - pixels and image sequences.



First, as you've seen with still images, each image is a combination of tiny dots (pixels) that, when put together, our brain interprets as an image. Zoom in and you'll see each pixel, zoom out and you'll see the image.

Then, add to this the dimension of time, and you've got video. Sequence one of these still images after another, and play them fast enough and you've see motion. Slow succession you see a slideshow, fast succession and you'll see motion pictures.

Televisions
We've already talked a little bit about computer monitors and how they display an image. A television is similar, but different. A picture is "drawn" on a television or computer display screen by sweeping an electrical signal horizontally across the display, one line at a time.

Starting at the top, all of the lines on the display are scanned in this way. One complete set of lines makes a picture. This is called a **frame**. This sequence is repeated quickly enough that the displayed images are perceived to have continuous motion. This is the same principle that low-tech "flip books" use; you rapidly flip through pages of still images to create a moving picture.