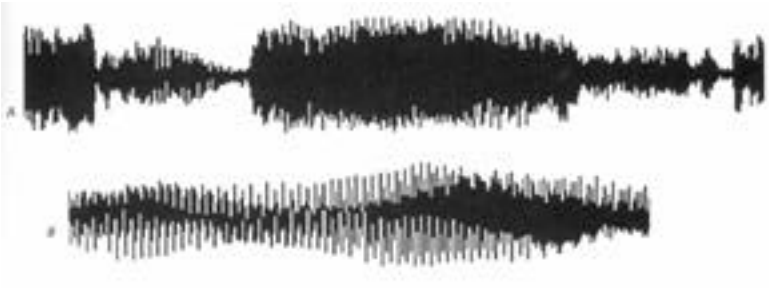
**EXPERIMENTAL ANIMATION TECHNIQUES**
MARGERY BROWN

**WHICH COMES FIRST THE SOUND OR THE PIX?**
It is often debated whether the sound track or the animation should be created first, and the truth is, there's no real answer.

If you're working in the classic cartoon style where you need accurate lip sync, then you'll definitely want to record a voice track first, analyze it, and create the animation using the voice track as reference. Many other types of projects benefit from following one or more elements from the sound track.

For most people starting out in animation, the picture comes first and accompanying music, sound effects, and voice elements are usually added once the picture itself is completed or "locked." Starting out with a locked-down track can actually be an impediment if your project is experimental or abstract. In such cases it's smart to make the visuals compelling before starting track work. If you can make your piecework without the benefit of any audio, bank on the fact that it will be even more powerful once your sound has been added. A truth whispered among animators is that 70 percent of a show's impact comes from the sound track.

It's usually a good idea to take the time early in a project's creative development to create a very rough sound track, or ***scratch track.*** Think of this as a loose outline, a first draft. A scratch track is usually built at the same time the storyboard is completed. It's common practice to fashion a scratch track as the audio portion of an animatic - a piece of film, tape, or computer animation that shows storyboard panels in sequence and that runs the same length as the anticipated project. An animatic's track will often have large "plugs" of silence where music or effects will subsequently be placed. Even if there are only a few known elements, some lines of dialogue, a piece of music, a few important sound effects (even if laid in as rough vocals) - whatever elements you can slug into the scratch track will provide valuable guidance as you work on the timing of scenes and animating them.



**Waveforms:** These two forms are the visual, digital expression of what sound looks like when it is edited on a computer. (A) Is a thunderclap and (B) Is music. There's not a human alive who can look at one of these images and discern what sound it represents. However, anyone can tell from the flattening down of the spikes when a sound ends and silence begins. And that particular piece of intelligence proves hugely useful when you are using digital tools to create sound tracks for your animation.

**TRACK BUILDING**
Our major focus will be on tools and techniques that allow you to capture audio using digital technology, the best way to undertake the process of creating a track for your animated film. We'll start with a scratch track and go to the final mix process. We'll also review the film-based technology that computers now replicate. Here's a breakdown of the track building process.

**SEPARATION**
Each track is recorded separately and kept as its own entity. Only at the very end of a project's completion will these tracks be mixed. Sometimes two or three individual tracks are recorded, sometimes as many as ten or more. With digital technology, the recording process begins by using any audio recorder. As digital technology has evolved, so have the audio editing and manipulation features. Today it's a common practice to completely create, mix, and output a high-quality sound track using a desktop computer.

**SOUND EFFECTS AND MUSIC LIBRARIES**
When watching your favorite cartoons or TV shows, chances are that what you're listening to is really a lot of the same sound effects repeated over and over again. Think of the classic whistle you hear during Wile E. Coyote's plummet off a cliff, or the metallic smash of an anvil as it lands on a character's head. This repetition of sound effects between one show and another exists because those stock sounds were probably pulled from the same sound effects library. Such commercial libraries have thousands of different selections ready for the animator and/or sound designer to choose and lay onto a single track. Because our ears are in some ways less finely tuned than our eyes, stock audio libraries are standard sources for everyday sounds like footsteps, wind, rain, clocks, birds, or street traffic, and even more for not-so-everyday sounds like explosions, gunfire, spaceships, bloodcurdling screams, or hippo mating calls.

There are also music libraries filled with every type of music imaginable, from classical to hard rock. Few music libraries provide top hits on the music charts since that would involve paying the artists and composer. Instead, you will find musical "beds" and 11stings" and "bumpers" that can be purchased for a simple charge per “needle drop”**.** This term comes from the days when a filmmaker would pay a separate fee for each selection used from a music or sound effects library. One didn't pay by the length of the cuts, just by the needle drops. We have an entire music and sound effects library housed in the Sound and Image section of the TESC Library Reference area. There are no royalties or needle-drop fees, they've already been paid for as part of the purchase price. Our collection is copyright free.

**FIELD AUDIO RECORDING**
If you don't want to rely on sound effects libraries, or if you need something so unique it can't be found anywhere, record it yourself! Using a tape recorder and a microphone you can record whatever sounds you come across.

If you choose to record your own effects, you'll have entered a the domain of animation called Foley. This often means taking everyday objects like old pairs of shoes, metal trash cans, rocks, doors, or even fruits and vegetables and manipulating them to create a distinct and effective sound. Foley artists have manufactured stabbing sounds by cutting a melon, punching noises by slapping a side of beef, and the sound of a neck breaking by snapping a stalk of celery. Ugh!

**RECORDING VOICES**
If your animation involves voices, whether in the form of dialogue or voice-over, you'll need to record these as separate elements from the sound effects and music. We’ll be using the Audio Mixing Benches in the Communications and Library Buildings.

**CAPTURING SOUND IN THE COMPUTER**
Once you've gathered all the sound effects, music, and voices for your project, these elements must be captured into the computer and stored as sound files. This process is sometimes called digitizing and has become extremely easy now that almost all computers come with multimedia features that let you record, play back, and edit.

If you're pulling music or a series of effects off of a CD, the process is simple. It takes nothing more than putting the disc in the CD-ROM drive and dragging over the icons for the desired

tracks from the CD to your file on the computer's hard drive. We will be using Deck and Peak audio software to record the sound effects while you play the CD. Either way, the resulting digital file can be named and saved for subsequent use in your sound track.

If your source sounds have been recorded onto audio tape you can use the tape deck on the audio mixing bench to capture and digitize the sounds you've recorded.

**TRACK LAYOUT AND MIXING**

Once every voice, sound, and piece of music needed for your animation has been gathered and captured in your computer, you'll need to carefully place each clip where it belongs, then mix them together to create your sound track.

To begin, open up your audio file, look at its waveform, cut-and-paste the sound elements into place. Then you can go back and add special effects such as fade, echo, dissolve, reverse, and to amplify sections. Save the finished audio track as a new sound file or as a QuickTime movie which can be laid down with your video track. Give yourself plenty of time to experiment. Since our software allows for multitrack audio editing, you'll be able to combine effects with music and dialogue tracks that allow you to cut, manipulate, and distort each sound in many different ways. The value of control over individual tracks is obvious. If a barking dog effect you've selected from a sound effects CD is too loud, you can lower its volume so it's more of a background noise. You could even change the pitch and tone so a giant Rottweiler suddenly becomes a tiny yipping Chihuahua. Using multiple tracks also lets you control the placement of your audio effects, down to a single frame. Any effect you've gathered can also be duplicated an infinite number of times. If you've recorded the chime of a clock that rings three times but you need it to chime for twelve midnight, the sound of a single chime can be copied by selecting a section on the waveform and paste it nine more times.

**DIGITAL AUDIO EFFECTS**

Applying a special effect to your audio tracks can give your sound track a unique focus, taking a mundane noise and turning it into something new. It involves selecting the area on the waveform where you want the effect to appear and then using the pulldown menu where all your options are listed. Think of effects as the audio equivalent to image filters in PhotoShop. They're a quick and easy way of altering preexisting sounds to create an effect that might be too difficult to create on your own.

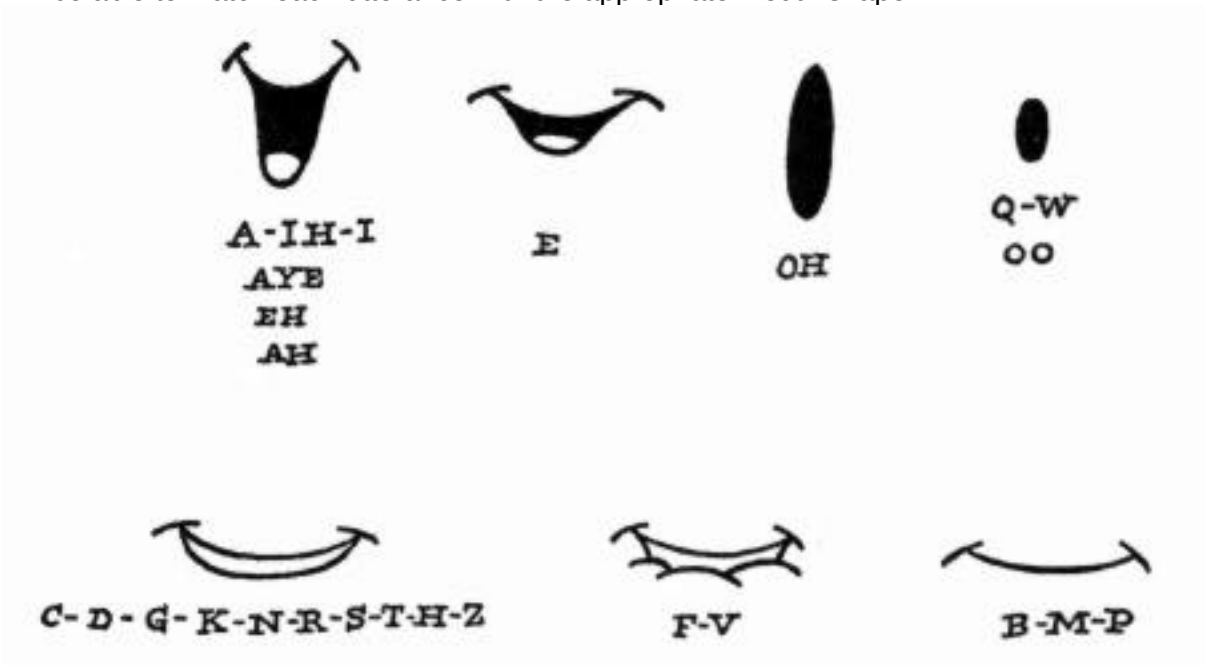
**TRACK ANALYSIS AND LIP-SYNC**

Once all the audio elements have been given their own track, you need to analyze them to see how they relate to each other and exactly where they occur. This is not so hard with a single sound effect that appears as a high-spike blip on its track. Using the waveform as a guide, you have a visual reference to locate exactly what time a certain sound effect occurs. You can place reference marks and notes right onto the audio track.

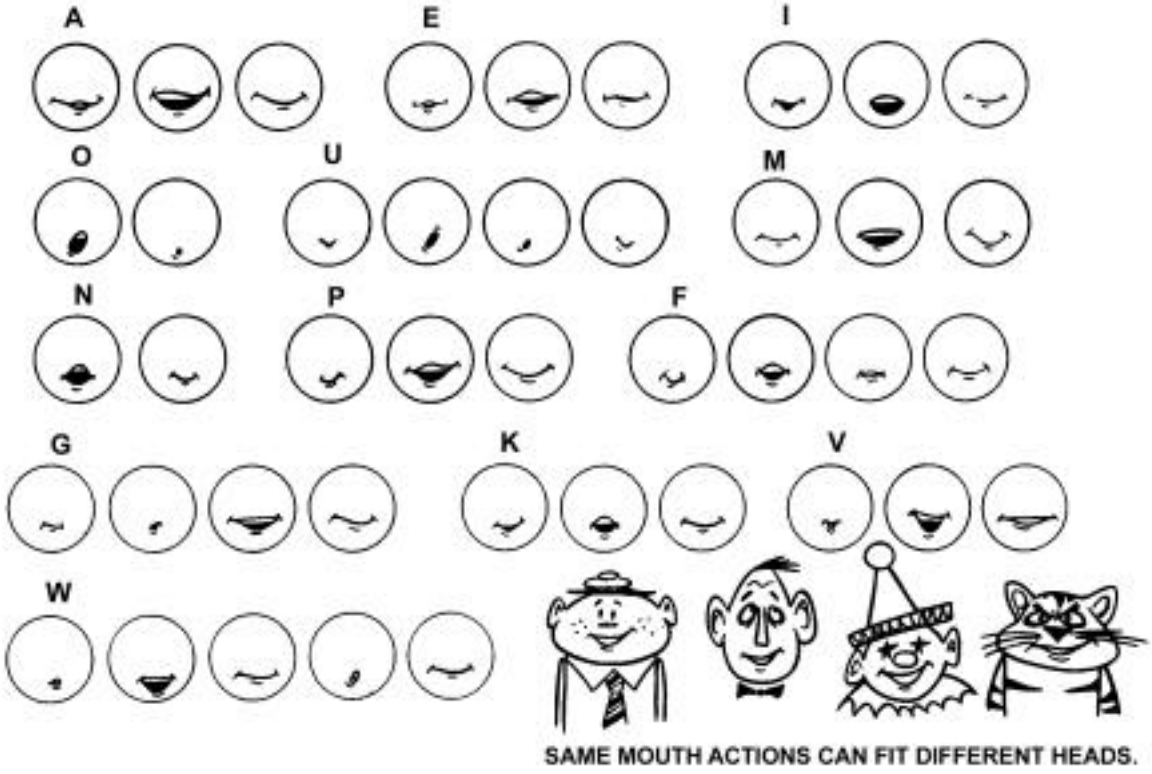
It's more difficult to mark the rhythm of a piece of music. The effort is worth it, when a piece of visual action is matched up to the cadence of music. Animators discovered the power of synchronous sound quite early and the phrase "Mickey Mousing" is still used to describe the effect when a character walks along with its footsteps perfectly in sync with a musical beat. It's generally impossible to discern rhythm from a waveform. Therefore, to do your own Mickey Mousing you will need to learn how to mark visual frames "on the fly," while the sound track is playing. By the process of trial and error, you will be able to find exactly which frame matches which beat or other place in the music track where you want to match picture and sound.

The precision with which it is possible to analyze a sound track enables you to locate individual words or parts of words. This makes it possible to create cartoon characters that move their lips with uncanny accuracy to the words delivered in the voice track. The effect, of course, is that the character actually talks.

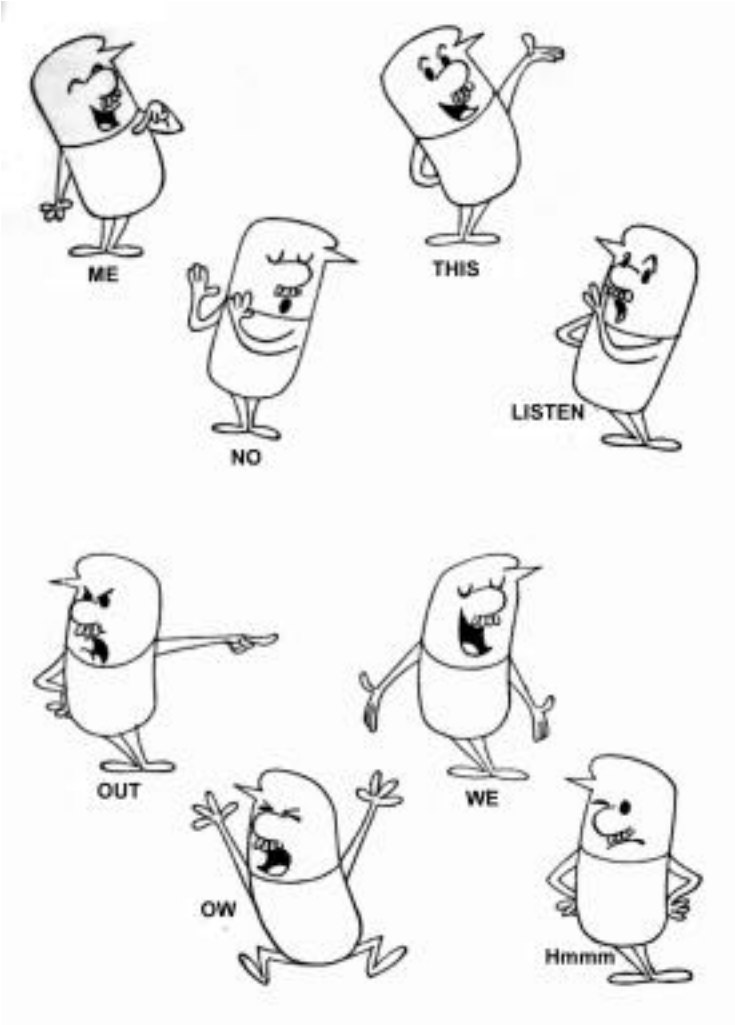
In order to create lip sync, you must analyze each voice track so that you know the location of each vowel and consonant sound in a given piece of dialogue. With this information, you will be able to match each utterance with the appropriate mouth shape.




Seven different mouth shapes and the distinct sound each represents. The way a character is designed will require modifications of these basic shapes.




Both track analysis and lip-sync drawing are laborious processes. It takes patience and practice to become proficient in determining what shape of mouth goes with a particular spoken sound. Animators often sit in front of mirrors in order to study the shapes of their own mouths while they try to determine how to match an analyzed dialogue track. Lip sync needs to be accurate. Poor track analysis will result in mouth shapes not matching the voices.




A real mastery of lip-sync animation requires control of head, neck, and body movement and the ability to create gestures appropriate to the meaning of individual words, to the character's distinct personality, and to the dramatic requirements of the scene.

**FIX IT IN THE MIX**

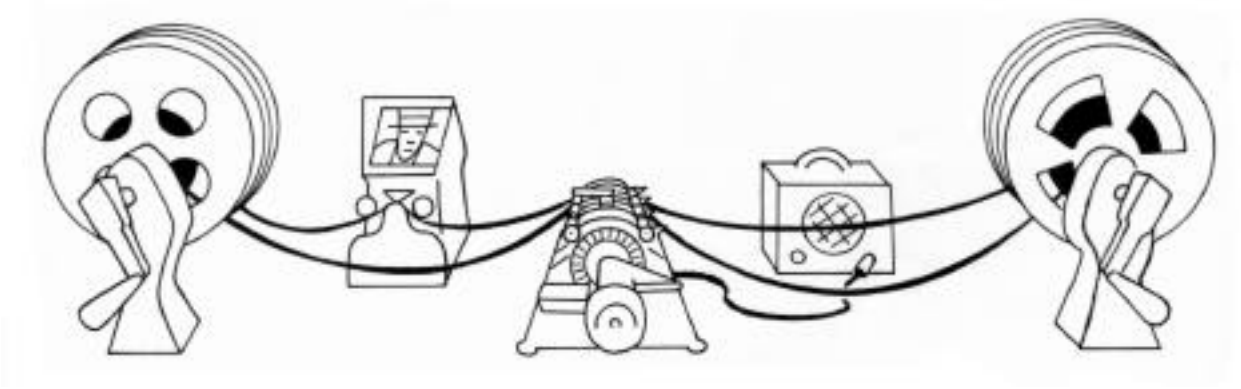
The creative juice of a sound track is always experienced as a surprising yet welcome jolt right at the end of the animation process, when individual tracks are mixed into a single track that goes with the finished piece. Its essential, that the mix be done "to picture" - that your edited and locked visuals are viewed up against all the individual tracks you have digitized and placed in their respective positions. Sometimes it is only in the final mix that you discover the need for one more effect or that a piece of sound you've positioned now seems unnecessary and can be dropped.

If you are working in the digital domain and the final animation will live in videotape or on a computer file, the last step is simple. At this point, the file can be brought into a video editing or special-effects application like Premiere or After Effects and laid down onto your digital video version of the animation. If you've done everything right, the picture and sound will match.

**MAGNETIC STOCK**

The film-based processes for working with sound is pretty similar to the digital process.

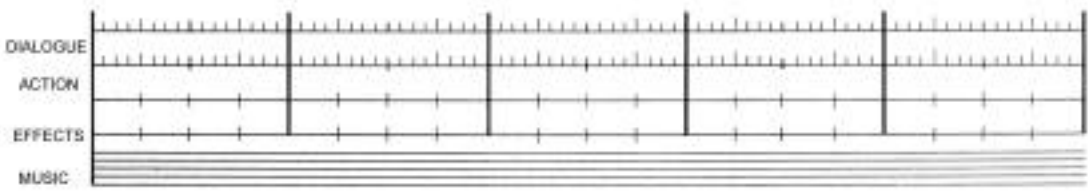
- Music, voice, and sound effects are recorded onto standard 1/4-inch audio tape. It is recorded at a speed of 7.5 inches per second sometimes 15 ips is used with music to get the highest quality recording. The source tapes are transferred via a Magna-Sync machine onto a form of audio tape that has the exact same physical configuration as motion picture film. A similar format is used intentionally for both movie images and sound recordings, mag stock allows you to locate any given sound according to a specific frame on the visual film. When editing, film and sound can be played simultaneously.
- It is standard to use three separate tracks, one for voice, one for music, and one for special effects. If there are may sounds and they overlap, additional tracks can be prepared. In the final mix all the tracks are played at the same time.
- There is not a film equivalent to the digital waveform to serve as a visual guide to see what sound is being played at a specific place on the sound track. In order to mark the specific sounds, a section of mag must be analyzed on a frame by frame basis. You need to listen to the section over and over again at various speeds. The exact location of every significant piece of sound, word, musical note, recurring rhythm and sound effect is found by counting frames from the start mark.
- Analyzing a recorded track requires either a flatbed or upright editing with a variable-speed motor that will simultaneously project the film and "read" (play back) the sound track that has been transferred to mag stock. By playing the machine at a slow speed and by going forward and backward over a particular stretch of sound many times, you can identify the exact place where a sound begins or ends.



Another tool used to analyze a sound track is a gang synchronizer. It is equipped with a magnetic sound head that reads the analog track and then amplifies it with a speaker, called a squawk box. You have control over the rewind reels which allows you to run the track under the sound head many times until the precise location of a sound is determined.

**SOUND READING**

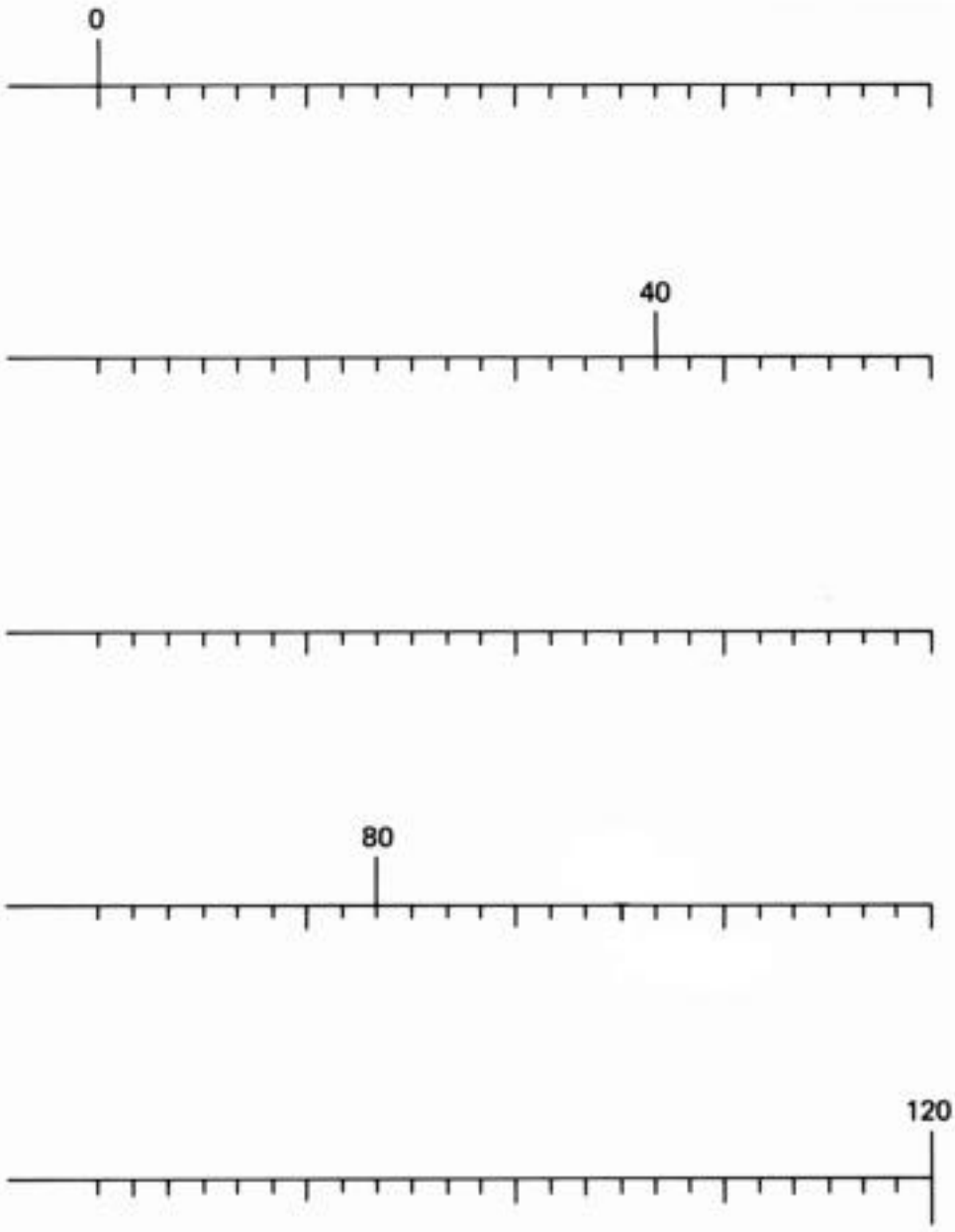
- Place film in the synchronizer under the sound head.
- Maneuver back and forth until the first frame of sound is heard. This is the reference point and should be marked with an X in that frame.
- Unlock the release and move the X frame of audio track to frame L on the wheel indicator.
- Lock wheel number to 0 position.
- Set footage counter to 0000
- Feed film from left to right through synchronizer.
- Try to maintain an audible speed - close to 24 FPS.
- Locate the next word, or if reading music, use the next high point, rhythm, or beat.
- Write key words on the bar sheet as visual reference points.




**BAR SHEETS AND CUE SHEETS**
You'll need to keep careful and accurate track of the various elements in the film's sound tracks. ***A*** bar sheet is the standard notation system which animators record their analysis of a sound track. It provides places to log words, sound effects, and music. You should note specific frame locations on the cue sheet. This is also used as the guide to provide directions to the animation camera operator.

**SAMPLE BAR SHEET** on the next page

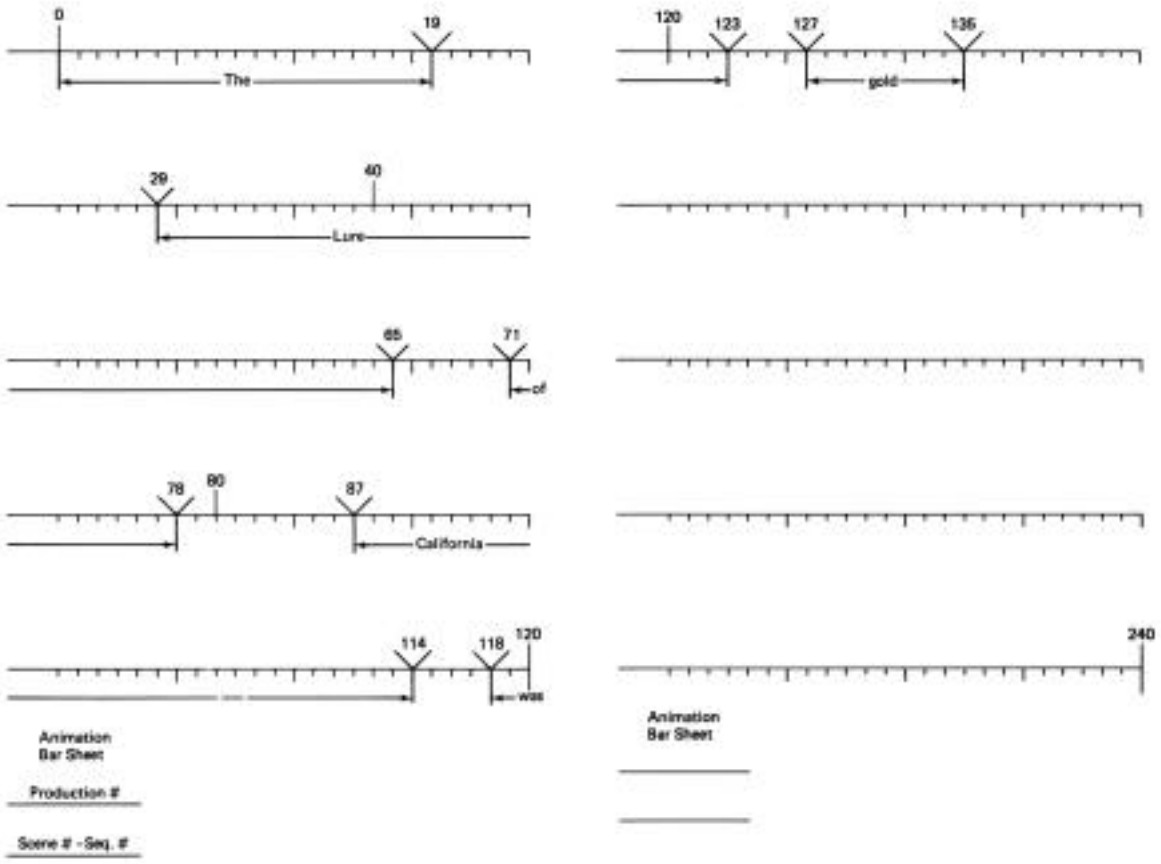
- A bar sheet is broken into lines, which are in intervals of 24 frames.
- 24 frames equals 1 second
- Every 6 frames are indicated by a longer line to divide the track into 1/4 second units.
- 5 lines on each page = 5 seconds of audio time.
- 6 feet = 4 seconds
- 16 frames = 1 foot
- Number bar sheets cumulatively left to right.
- Keep sheets together to form a unit long enough to cover the screen time of the film.
- Pre - number all page units in advance.




Animation
Bar Sheet

Production #

Scene # - Seq. #




A completed bar sheet

**THE MULTI TRACK FILM MIX**

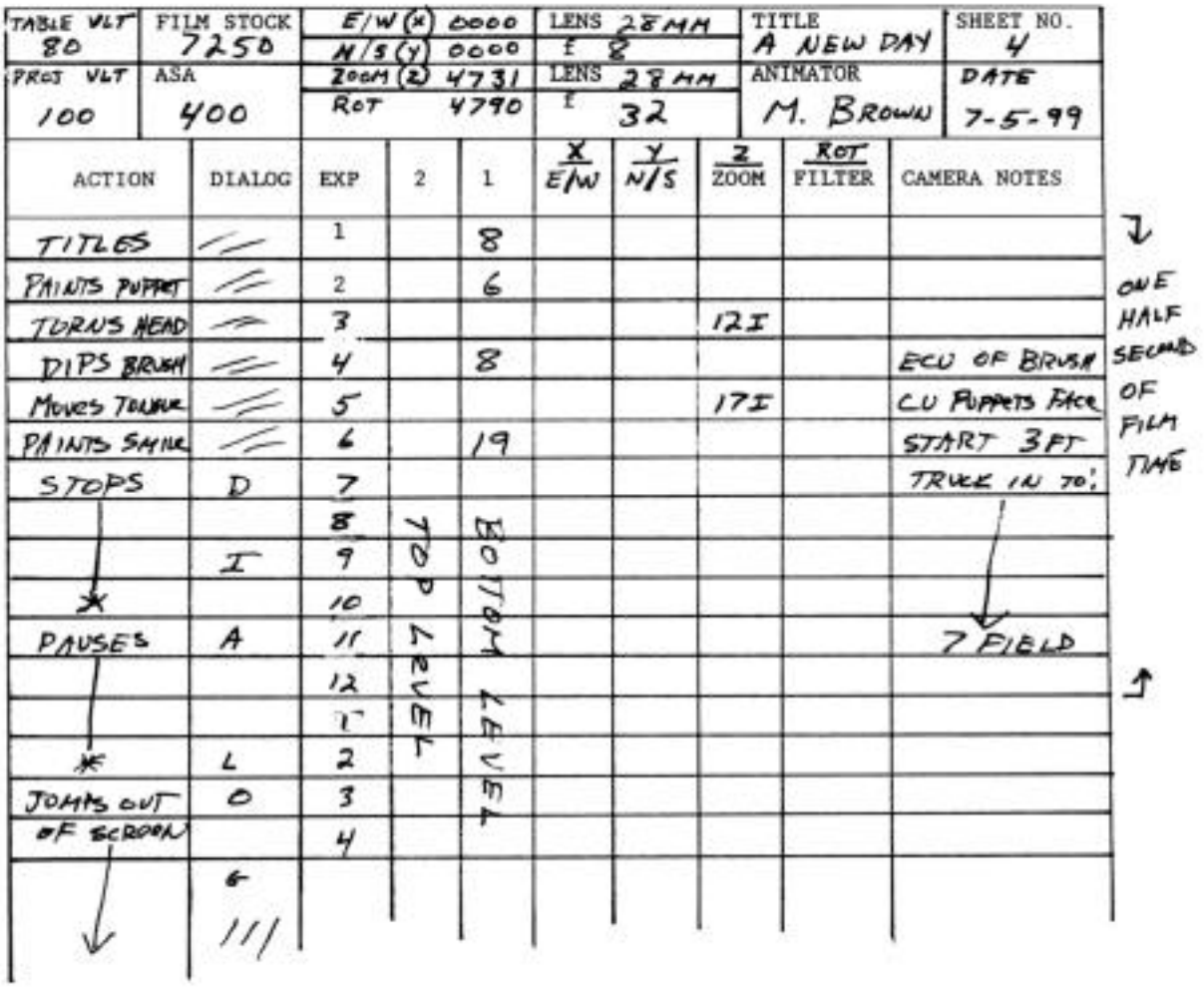
When the film has been "locked" after final editing, you'll take tracks for a sound recording mixing session where all the separate tracks of magnetic stock are mixed down to a single track. The new mixed track is lined up with the sync mark at the head of the film leader now you can watch the completed film while all the sound tracks play at the same time.

**OPTICAL TRACKS**

There are many different soundtrack formats that exist within the animated film process (as opposed to digital animation). Most have optical tracks that are "read" by the movie projector, which then plays the amplified sound track to the audience over conventional sound speakers. The process of converting a mixed magnetic master track to an optical master track, which is used when printing the finished film, is done at a film lab.

**THE EXPOSURE SHEET**

The exposure sheet is the road map of animation. The exposure sheet makes provision for virtually every aspect of animation photography. Be sure to fill in the rostrum (camera and table) information each time you use (calibrate) the stand. The main body of the exposure sheet is divided horizontally and vertically. Each horizontal line represents one frame of film. There are 36 frames represented on one sheet or 1-1/2 seconds at 24 FPS (frames per second). Note the headings across the top of the exposure sheet. The action column requires a brief description of the action. Most exposure sheets are set up for 4 cels and a background. Ours are designed for 2 cels. Effects are marked on each sheet as standard editing effects. Most often we use the filter column for this. The zoom counts and table movements, N / S and E / W, are taken from the counters. The EXP or numbering column is essential. Numbering on the exposure sheets is cumulative and begins with frame 1 of the film. In addition, zooms, pans, and compound moves must also have their special beginning and end numbers entered in the appropriate frames. Be sure to keep the exposure sheets numbered in sequence in the sheet number column. <u>Be sure to keep lots of camera instructions and notes.</u> Remember, many times you will be correcting only one scene out of many and the exposure sheet is your only working guide. You cannot trust your memory when it comes to individual frames of animation.



| TABLE VLT 80 | FILM STOCK 7250 | E/W (X) 0000 | LENS 28MM | TITLE A NEW DAY | SHEET NO. 4 |
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| | | N/S (Y) 0000 | f 8 | | |
| PROJ VLT 100 | ASA 400 | ZOOM (Z) 4731 | LENS 28 MM | ANIMATOR M. BROWN | DATE 7-5-99 |
| | | ROT 4790 | f 32 | | |

| ACTION | DIALOG | EXP | 2 | 1 | X E/W | Y N/S | Z ZOOM | ROT FILTER | CAMERA NOTES |
|---|---|---|---|---|---|---|---|---|---|
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| PAINTS PUPPET | // | 2 | | 6 | | | | | |
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ONE HALF SECOND OF FILM TIME