Microphones: A Personal View

By Malcolm Chisholm

Many moons ago, the writer cut a tune titled "Don't start me talking; I'll tell everything I know".

That title is a fair description of most mixers, who double as semi-pro B.S. artists (some not so semi) and whose favorite audience is other mixers. Boy, do we talk.

We talk shop. Give two mixers ten minutes in a corner and they'll swap more information than a magazine can publish in an entire issue. This piece of equipment, that technique, and the other guy's solution to an interesting problem. All this at breathless speed, interlaced with oddball example stories for spice, and all the natural result of the fact that mixers love their work, and talking about it is at least as much fun as doing it.

One result of these tiny seminars is a folklore of recording techniques.

When a mixer discovers a better way to do something, he (sometimes she, but mostly he) can't wait to pass it on. New techniques spread at the speed of a vicious rumor, and the folklore builds.

Recording is not unique or even unusual in this respect. Every occupation has a body of common knowledge built on the experience of it's workers, who exchange new ideas and methods as they develop, and who use the accumulated wisdom to explain "How we do it here" to the new guys.

By and large, this is a good thing. There is a down side to every good thing, however, and there are a couple of extra negatives in recording due to the nature of the profession. No two mixers hear music in quite the same way, so no two use quite the same techniques in recording, which means that what's great for one mixer sucks for another.

It follows that only a small proportion of the hot ideas that come around will be useful to any individual, and since most of us are over-scheduled, when a recommended technique doesn't sound particularly good or fit in with an individual's style, it's abandoned without further ado.

Figuring out why something works or doesn't work is lots of fun, but it takes lots of time, and time is in short supply.

If it sounds good, we use it and if it doesn't we don't, and that's that.

Very pragmatic thinking. Very realtime. And very hard on general case theory, which is pretty thin on the ground to begin with, and not helped by the fact that most of the stuff

passed around concerns specific solutions to specific problems rather than broadly useful methods which allow one to predict how well a method or bit of equipment will work in a given situation.

Microphones are a case in point. In fact, they are a worst case in point for the most part, as there is almost no information published as to how or why one microphone sounds different from another. We all know they do, but microphone makers aren't into comparative advertising, let alone dissertations on why this microphone type is good for that instrument.

In fairness, the manufacturers get so much contradictory feedback from the field that they'd be damn fools to put that kind of material into print.

It wouldn't work anyway. For every mixer who likes dynamics on a piano there's another who thinks condensers are the answer, and a third who knows the other two are out of their minds, as ribbons are only way.

And since every mixer is mostly paid for his particular taste in sound each one is right.

All of which leaves everybody re-inventing the wheel day by day and microphone by microphone, helped only by experimental or anecdotal evidence rather than general case data.

Those data are the subject of this article. And so to work.

First; Microphones are not good or bad. Microphones have characteristics.

Second; Those characteristics are a function of how a microphone converts sound to electricity, and there are only three basic designs in general use. Condenser, Dynamic, Ribbon.

To be sure, there are some variations in sound between one dynamic microphone and another, and a zillion to choose from, but the dynamic ain't born that sounds like a condenser or a ribbon.

The same applies to the other families of microphones, each of which perceives sound differently because it works differently.

Using that fact eases the pain. Instead of choosing between umpteen thousand mike models, select a family.

All the mikes in a family will have the same primary characteristics, and most of them will sound very similar to each other. The track record on blind A-B comparisons between family related mikes is pretty dismal.

Since the characteristics are a function of the pickup elements, a word or two about those elements is in order.

Taking the families in order of their commercial success:

CONDENSERS: These come in three flavors of electronics including High voltage, FM, and Electret, none of which have much effect on primary characteristics.

The fundamental fact of a condenser is the weight of it's pickup element(s). These are made of extremely thin plastic with a metal coating a few molecules thick, resulting in a very flexible diaphragm with virtually no mass at all. It's fly wing rather than fly weight, and the elements can be as little as 3/8 of an inch across, making them very nearly nonexistent.

The results of this kind of structure are that almost no energy is needed to put it in motion, and it will move very, very fast.

DYNAMICS: Just the opposite of condensers. A dynamic is a teeny tiny loudspeaker used in reverse, and at an inch or so across the element is relatively humongous, to say nothing of stiff. It won't move fast, and takes a fair amount of energy to get moving at all.

RIBBONS: No diaphragm, which makes them quite different from condensers and dynamics, and the length of the ribbon ranges from near 4 inches to 3/8 inch, providing more variety in this family than in the others.

Ribbons are single wire generators with the (usually) corrugated aluminum ribbon hung in an extremely powerful magnetic field. Some of the older models will take your Timex apart for you, and if a bit of metal gets into the gap the mike has to be demagnetized to remove it, which explains the traditional avoidance of steel wool in studios.

The active element appears to act as an infinitely damped string (of which more later) which needs little energy to move, and whose slew rate varies with length. The 3/8" ribbons are very quick indeed; a 3+" RCA 44BX pretty slow.

CHARACTERISTICS: Mike manufacturers publish all kinds of specifications for their products, very few of which are useful to an engineer, and almost none having anything to do with music. Frequency response, as an example, is specified for sine waves, and up to awesome figures.

Very impressive, but there ain't no sine waves up there; just a few raggedy harmonics and cymbals, so the specs are meaningless.

Patterns are better, but still a little (unintentionally) deceptive, which leaves good figures on sensitivity and impedance and who cares?

That is not a criticism of the manufacturers. There is no practical way to test mikes with music, and they're not in the studio business anyway, so they leave the whole thing alone and publish only what they can be sure is demonstrably accurate data.

The data given below are not scientifically accurate. They are ballpark opinions based on nothing more than some studio experience and thought.

On the other hand, they have proven useful and reliable tools during several thousand recording sessions, they are my friends, and I intend to stand by them no matter who they offend.

The characteristics given are:

ONE: Frequency response. To real instruments really playing real music.

TWO: Transient response, as above.

THREE: Isolation or wanted to unwanted sound. How much off-mike junk you hear as compared to what's in front of the mike.

PATTERNS: Viewed in three dimensions as to size and definition, and expressed as the pickup balloon.

Data first, explanations later.

	Frequencies	**Transients**	**Isolation**	**Baloon**
Condenser	5 Hz-12+ Khz	Extreme	Terrible	20'
Dynamic	80 Hz-8+ Khz	Terrible	Medium	6’
Ribbon	40 Hz-8/10 Khz	Variable	Extreme	1’-6”

Condensers, with that very light element, have wonderful frequency response, and are getting better as we go. The low end can present problems with rumble too far down to hear, as monitors don't do much below 40 Hz, but cutoffs work, and the top end is unbeatable.

This is largely a case of how fast the element can move (slew rate) and some of the back plate electrets used as announcer's lavaliers are getting close to the slew rate of the rivets on a sizzler cymbal. Cheap.

Goooood.

Condenser transient response is another matter, and requires some care.

Condensers on drums are no problem, as they're big, and take considerable time to get into resonance, but a condenser 6 inches off a cowbell or a pair of claves will produce a square attack waveform.

You won't hear it, because the speakers can't move that fast, but the tape machine will digest most of it, and when it gets to the reproduction channel, that zero rise time attack will cause the CD, cutter head, or light valve to spit up all over itself. Big trouble.

The condenser is not a good percussion mike when used close up, and a piano has hammers. Enough said.

Condensers don't isolate worth a damn, and the patterns are weak to the point that on the multiple pattern units it's hard to tell one from another. That's bad if you want a lot of isolation, but just the ticket for something like a string section where you need to stay away from individual instruments (which sound like rasps calling their mates when close miked) and pick up the whole section.

And the extreme reach and transient response that will pick up somebody scratching himself at twenty feet is terrific for timpani, as they're so big that the mike needs be 8 to 10 feet off to avoid proximity problems.

As the reader probably knows, there are some national differences between condensers, with the German mikes sounding relatively bright, the Japanese and Danish relatively dark, and the American stuff somewhere in between.

The differences are more apparent on room sound than instruments, but they exist. Some of the Japanese condensers also seem to be almost constant presence, which is very handy for recording a moving target, like a dancing sax player. (I wish they wouldn't do that.)

Condensers have characteristics, not virtues and faults.

So do dynamics. The great strength of dynamics is the great strength of dynamics.

They either can't be hurt, or (in a few cases) you can't tell when they have been.

They're great for stage work, great for shoving down the mouth of a cannon or a bass drum, great for setting out where they may get kicked.

Any time you need to put a mike where you wouldn't put your head, use a dynamic. If you're recording something with limited frequency and transient response (like an instrument amplifier loudspeaker) use a dynamic. It'll pick up less cymbals and room boom. And if you need to close mike serious percussion instruments, use a dynamic.

Claves at 6 inches require a mike with slow transient response, and a dynamic is the only safe bet. Same applies to bongos and such, with the added advantage that dynamics seem to sound better than other families on small drums.

There are some new dynamic designs that sound better than the older standard models, and the big bird cages that were used on stages until recently can produce astounding results.

Worth a try.

Ribbons are a class of their own, and the weapon of choice for live studio work.

That is partly due to the inherent isolation of the family, and partly to it's transient response, which appears to match speakers, cutter heads, and the like; but mostly they're popular because of the peculiarly clean, pure sound they produce.

Ribbons cancel distortion.

Specifically, ribbons cancel out of tune distortion from vocal groups, muted brass, and small mixed sections.

Other mikes multiply studio intermodulation, and I've never heard an explanation as to why ribbons don't, so I've made one up.

The human ear has been described as an infinitely damped resonant network, and I think (hypothesis) the ribbon acts as another, reacting like a string in resonance to the loudest signal driving it and ignoring everything else including stray noise and out of phase signals as well as out of tune.

The double ribbon design, which probably squares the effect, produces some really phenomenal results. I've recorded singing drummers with more drums than voice on the channel in which the drums (not a bad sound, by the way) did not clutter the vocal sound at all. Weird.

If the hypothesis is correct, it explains why ribbons sound so much like whatever's in front of them.

If not, it doesn't matter, as ribbons are still the only mikes that allow a listener to identify a singer after hearing one or two notes (Bing Crosby, Nat Cole, etc) because of their unique ability to accurately reproduce the harmonic structure of a source. They have been and remain the highest quality mikes available and have the interesting habit of sounding better and cleaner on small speakers than on large.

You actually hear more vocal on the Auratones than on the main monitors.

Again, weird. But good.

Ribbons are commonly thought to be exceedingly delicate.

I don't recommend them for driving nails, (and Lou Burroughs of EV used to do that with dynamics) but if they're treated like any other studio instrument they last forever.

I've only seen one murdered, and that by an idiot who thought mikes should be tested by blowing in them. There is also a pretty good story about a sound effects man with a starter's pistol, but by and large the delicacy bit is overdrawn.

If confronted with a "check check poooo" type, one can always roll a condom over the mike or set out a dynamic for the vocalist to abuse with a ribbon back of it for recording purposes. Throw in a condenser and explain that you're testing which kind of mike sounds best on the singer.

Works every time. You might even like one of the others.

And that's about it. Keeping the characteristics of the mike families in mind, a mixer can make generic mike selections that will work as expected in virtually every case, saving any amount of experimental time and even better, avoiding having to memorize all those damn numbers.