**Lesson #18 – Recording & Mixing Lab**

**MICROPHONE TECHNIQUES**

* Choosing appropriate mic is only half the work
	+ Placement is just as important
	+ Mic placement is an art form

**PICKUP CHARACTERISTICS AS A FUNCTION OF WORKING DISTANCE**

* 4 fundamental styles of mic placement are directly related to working distance of mic
	+ Distant miking
	+ Close miking
	+ Accent miking
	+ Ambient miking

DISTANT MIC PLACEMENT

* 1 or more mics positioned at a distance of 3 ft or more from signal source
* This technique shows the following results
	+ Pick up large portion of musical instrument or ensemble
	+ Preserves overall tonal balance of source
	+ To achieve natural tone
		- Place mic at a distance that is roughly equal to size of sound source
	+ Allows room acoustic environment to be picked up w / direct sound signal
* Used to pickup large instrument ensembles (Symphony, Choir)
* Pickup relies on acoustic environment to help achieve natural, ambient sound
* Mic should be place at a distance that will get both ensembles direct sound and room acoustics
	+ This balance determines…
		- Size of sound source
		- Overall volume level
		- Mic distance and placement
		- Reverberant characteristics of a room
	+ Adds a live open feel to recoded sound
		- Could be a disadvantage if acoustics of venues isn’t great
* Improper or bad reflection cause muddy recordings
	+ You can avoid this by…
		- Using absorptive or offset reflective panels
		- Place mic close to source and add degree of artificial ambience
* Raising the mic reduces reflection

CLOSE MIC PLACEMENT

* Micid often position 1 inch to 3 feet from sound source
* Generally resukts in…
	+ A tight, present sound quality
	+ Effectively excludes acoustic environment
* Only desires on-axis sound will be recorded – distant sounds won’t be picked up
* LEAKAGE
	+ Instrument mic picking up sound of nearby instruments
		- Levels in phase cancellation make it more difficult to have control over volume and tonal characteristics
	+ To avoid leakage try the following…
		- Place mic closer to sound source
		- Use directionsl mivd
		- Place acoustic barrier between instruments
		- Spread instruments further apart from one another
		- Use iso-booths and rooms effectively and efficiently
		- Seperation also achieved through DI boxes
* When mics are being miked close always try to put into effect the 3:1 distance rule
	+ Can even experiment with the 5:1 distance rule
* If tonal balances are changed – try the following
	+ Move mic along surface of sound source
	+ Place mic further back from sond source to allow for wider angel
	+ Change the mic
	+ Equalize the signal
* If additional isolation is needed use flats and baffles

ACCENT MIC PLACEMENT

* A mic is placed within a reasonable close range to instruments within larger ensemble
* Care should be taken with placement and pickup choices
* Should only add presence to a solo sound – not have every other instrument stick out or separated

AMBIENT MIC PLACEMENT

* Places pickup at such a distance that reverberant (room sound) is equally or more prominent than the direct signal
* Often a cardioid stereo pair or crossed figure 8 pair that can be mixed into a stereo/surround production
	+ Providing a natural reverb or ambience
* You can use ambient mic pickups in the following ways…
	+ Live concert recording
		- Ambient mics can help restore natural reverberation that was lost when using close mikin
		- Ambient mics can be placed over audience for reactions and applauses
	+ In studio recording
		- Ambient mics can add a sense of space or natural acoustics back into the sound

**STEREO MIKING TECHNIQUES**

* The use of 2 mics in order to get a coherent stereo image
* Used in either close or distant miking of single instruments or ensembles

SPACED PAIR

* Spaced mics placed infront of an instrument or ensemble in left/right way to get overall stereo sound
* Places 2of the same mics anywhere between a few feet to more than 30 ft apart
	+ Uses time and amplitude cues to create stereo sound
* Drawback
	+ Strong potential for phase discrepancies between 2 channels
* When mixed to mono – phase discrepancies results in various frequency response and partial cancellations in instruments or sounds

X/Y

* Uses only cues of amplitude to discriminate direction
* 2 directional mics of the same type are placed with grills close together as possible w/o touching and face at angles to each other
* Coincident pair system
* Mid-point between 2 mics pointed towards source and outputs are equally panned L/R
* Due to their proximity – rarely ever have phase cancellation
* Uses mics with cardioid polar pattern
* Uses 2 bidirectional mics that are offset by 90 degree to each other
* Excellent for pickup of overall ambience within studio/concert hall
* Good choice for picking up sources that are placed in the round

M/S

* Similar to X/Y technique
* Requires use of external transformer to work
* One of the mics capsules designated the M position pickup
	+ Generally a cardioid pickup pattern faces forward toward the sound source
* S capsule is generally chosen as a figure that placed sideways to on-axis pickup
* M capsules picks up direct sound
* S capsules picks up ambient and reverberant sound
* Advantage
	+ Absolute monaural compatibility
	+ Allows you to vary mix of mid to side during or/and after recording
* When L/R signals are combined – side signals will be cancelled and mid signals will be accentuated
	+ Record m to one track
	+ Record s to one track

DECCA TREE

* Time tested, classical miking technique
	+ Uses both time and amplitude cues to create coherent stereo image
* Consists of 3 omni-directional mics
	+ Originally NEUMANN M50
* A L/R mic pair is placed 3 ft apart – another mic is placed 1.5 ft out in front and panned in center of stereo field
* Favoured by orchestral situations
* Commonly placed on a tall boom above and behind conductor

**SURROUND MIKING TECHNIQUES**

AMBIENT SURROUND MICS

* Simply place a spaced or coincident mic pair out in studio away from sound source
	+ Can add sense of space to a group, drum set or instrument overdub

SURROUND DECCA TREE

* Places 5 mics onto a modified decca tree
	+ Adds 2 rear-facing mics to the existing 3 decca tree systems
* Simpler approach
	+ Place 5 cardioid mics in a circle

RECORDING DIRECT

* Signal of electric/electronic instrument can be injected directly into the console w/o mic using a DI (direct injection) box
* Produces, cleaner, more present sound
* Bypasses distorted components of head/amp combo
* Reduces leakafe into other mics by eliminating room sounds
* Serves to interface an instrument with an analog output signal to console in following ways..
	+ Rudeuces instruments line level outpit to mic level for direct insertion
	+ Changes unbalanced lines to balanced
	+ Isolated audio signal paths between mic/line preamps (reduces hums and buzzes)
* Instruments ouput is plugged into DI box and box’s output is fed into mic pre of console

REAMPING IT IN THE MIX

* Allows you to record your guitar sounds one way and then re-record it and make new tracks with different effects
* Gives total flexiblility
* Leakage problems are reduced

**MICROPHONE PLACEMENT TECHNIQUES**

* Depends on the sound you are looking for
* Dynamic mics
	+ Rugged more punchy character
* Ribbon mics
	+ Mellow sound that ranges from being open and clear to slightly croony
* Condenser mics
	+ Clear, present and full range sound
* Always attempt to use the GOOD RULE

**BRASS INSTRUMENTS**

TRUMPET

* Fundamental frequency ranges from E3-D6 (165 to 1175 Hz)
* Contains overtones that stretch upwards to 15 kHz
* Formats of a trumpet lie at 1 to 1.5kHz
* Using a mute dampens the frequencies
* Best to place mic slightly off bells center at a distance of 1 foot or more
* When closer placement is needed – a negative 10 to negative 20 dB can prevent input overload
* Use a windscreen to help protect diaphragm from windblasts

TROMBONE

* Most common trombone is the tenor
* Fundamental note range spanning from E2 to C5 (82 to 523 Hz)
* Produces series of complex overtones
* A single mic might be placed between 2 players
	+ Combining them onto a single channel

TUBA

* Bass and double bass tubas are the lowest pitched brass/wind instruments
* Overtone structure is limited
	+ Top frequencies ranges from 1.5 to 2 kHz
	+ Lower frequencies are evenly dispersed
* Isn’t miked at a close distance
* Working range of 2 ft or more and slightly off-axis to the bell

FRENCH HORN

* Fundamental tones range from B1 to B5 (62 to 700 Hz)
* Effective pickup can be achieved by placing an omni- or bidirectional pickup between rear reflecting wall and instruments bell
	+ Both receiving direct and reflected sound
* Pickups can also be placed in front of player

**GUITAR**

ACOUSTIC GUITAR

* Steel string acoustic guitar has a bright rich set of overtones
* A balanced pickup can often be achieved by placing a mic or (X/Y stereo pair) slightly off-axis and above or below sound hole at a distance of between 6 inches and 1 ft
* Condenser mic preferred for smooth extended freq response & excellent transient response
* Smaller classical guitar naormally strung with nylon or guts is played with the fingertips
	+ Gives it a warmer, mellower sound
* To make sure instruments full range is picked up…
	+ Place mic closer to center of bridge and at a distance between 6 inches and 1 foot

MIKING NEAR THE SOUND HOLE

* Sound hole serves as a bass port that resonates at lower frequencies (80 – 100 Hz)
* Miking close to the sound hole often popular on stage or around high acoustic levels
* To achieve a more natural pickup – mics output can be rolled off at the lower frequencies (5 to 10 dB @100 Hz)

SURROUND GUITAR MIKING

* Effective way to translate an acoustic guitar to the wide stage of surround is to record guitar using X/Y or spaces techniques stereo
	+ Panned front L/R
	+ Pant guitars electric pickup to rear center of surround field
* Extra ambient mics can also be used in an all-acoustic session

THE ELECTRIC GUITAR

* Fundamentals of average 22 fret guitar is from E2 to D6 (82 to 1174 Hz) w/overtones extending higher
* All of these frequencies may not be amplified b/c guitar chords attenuates frequencies about 5 kHz

MIKING THE GUITAR AMP

* Small practice type am/speaker system
* High-quality amps helps guitars high end by incorporating sharp rise in response range at 4 to 5 kHz – helps give it a clean, open sound
* Cardioid dynamic is the most popular mic used to pick up an electric guitar amp
* Dynamic mics give the sound a full bodied sound without extra amp’d noises
* Guitars mics have presence peak in upper frequency range – adding clarity
* For increased separation…
	+ Mic can be placed at working distance of 2 inches to 1 ft
* When miking at a distance of less than 4 inches – mic/spkr placement is critical
* For a brighter sound…
	+ Mic should face directly into the speakers cone
		- Placing it off cones center produces a mellow sound while reducing amplified noise
* Isolation cabinets…
	+ Used to reduce leakage
	+ Provide greater control over instruments levels w/I recording studio or control room

RECORDING DIRECT

* DI box often used to feed output signal of electric guitar into mic input of console
	+ A cleaner more present sound will be recorded
	+ Reduces leakage that results from having guitar amp in studio
	+ Can be assigned to one or multiple tracks
* During overdub – ambient image can be opened up…
	+ Mix a semi distant and distance mic with the direct mic
		- Can be mixed into stereo field or rear of surround field

THE ELECTRIC BASS GUITAR

* Fundamentals of electric bass range from E1 to F4 (42.3 to 343.2 Hz)
* Playing loudly with a pick adds harmonic range up to 4kHz
* Playing slap style or with pick gives a brighter, harder attack
* Finger style produces more mellow tone
* Recorded direct for cleanest possible sound
* Can be miked at amplifier or through DI box
* If amp is miked…
	+ Dynamic mic usually choose for deep rugged tones
	+ When combined with a boosted response of 100 Hz – large diaphragm dynamics give a warm, mellow tone that adds power to lower register
* Equalizing the bass sometimes increase clarity
* Compressor commonly used on electric and acoustic basses
* Fast attack (8-20 millisec)
* Slower release (1/4 to ½ sec)
	+ All 3 help to create a strong presence in the bassline

**KEYBOARD INSTRUMENTS**

GRAND PIANO

* Can be miked different ways depending on artist/producer/engineer
* Overall sound comes from pianos strings, soundboard and mechanical hammer system
* A minimum distance of 4-6 ft is need to capture full tonal balance
* Pianos miked at a distance that favours different parts of the instrument
	+ Strings / Soundboard
		- Holds a bright relatively natural tone
	+ Hammers
		- Holds sharp percussive tone
	+ Soundboard Holes Alone
		- Holds sharp full bodied sound
* 2 basic grand painos styles can be found in a recording studio
	+ Concert grand
		- Rich, full bodied tone
	+ Studio grand
		- Suited more for modern music production
		- Sharper more percussive edge to tone
* Mic placement guidelines
	+ Position 1
		- Mic is attached to entirely open lid
		- Most appropriate mic to use for pickup is the boundary mic
		- Can be permanently attached or taped
		- Uses lid as collective reflector
		- Provides excellent pickup under restrictive conditions
	+ Position 2
		- 2 mics placed in a spaced stereo configuration at a working distance of 6 inches to 1 inch
		- One mic positioned over the low strings
		- One mic positioned over the high strings
	+ Position 3
		- Single mic or coincident stereo pair is placed inside piano between soundboard and open lid
	+ Position 4
		- Single mic or coincident stereo pair placed outside piano facing into open lid
	+ Position 5
		- Spaced stereo pair placed outside the lid facing into the piano
	+ Position 6
		- A single mic or stereo coincident pair placed just over piano hammers
		- Placed at a distance of 4 to 8 inches to give driving sound

SEPERATION

* Associated with grand pianos
* Can be achieved in the following ways
	+ Place piano inside seperate isolation room
	+ Place separator between piano and its louder neighbour
	+ Place mics inside piano and lower onto short stick
		- Heavy blanket can be placed over lid to reduce leakage
	+ Overdub instruments at a later time
		- Lid can ne remover or popped up with large stick
			* Allowing mic to be placed at a more natural sounding distance

UPRIGHT PIANO

* Designed for home enjoyment
* Mic techniques are different
* Difficult to achieve respectable tone quality
* Try the following methods…
	+ Miking over top
		- Place 2 mics in a spaced fashion over an front of pianos open top
			* One over bass strings
			* One over high strings
		- If isolation isn’t a factor – open front face that covers strings
		- To reduce resonance angle piano out and away from walls
	+ Miking the kick board area
		- For a more natural sound – remove kick board at lower front part of piano to expose strings
		- Place stereo spaced pair mics over strings
			* About 8 inches over bass and high strings
		- If only one mic is used – place over high strings
	+ Miking the upper sound board area
		- Reduce excuessive hammering attack by…
			* Placing mic pair about 8 inches from soundboard above both bass and high strings
		- Reduce muddiness
			* Soundboard should be facing into room or moved away from walls

ELECTRONIC KEYBOARD INSTRUMENTS

* Signals from most electronic instruments inserted through DI box or directly into channel
* A good Hammond or organ can sound wonderfully dirty through miked loudspeaker
	+ Windscreen may be needed

**PERCUSSION**

DRUM SET

* Provides heartbeat of basic rhythm track
* Composed of…
	+ Kick drum
	+ Snare dum
	+ Tom rack
	+ Low toms
	+ Hi-hats
	+ Variety of cymbals
* 1960s – 1970s
	+ Drum sets were placed in isolation room called DRUM BOOTH
		- Acoustically isolated from the rest of instruments in the studio
		- More tightened drum sound
* Today engineers move drum set out of small room into larger open studio areas
	+ Sound can fully develop and take on room acoustics
	+ Can also be exaggerated by placing distant mic pair in room
		- Produces fuller sound
* Before session begins drummer should tune each drum will baffles and mics are being setup
* Once drums are tuned – listen to each channel for hums, buzzes, rattles or after rings
* Close miking picks up noises and desired sound
* To control extra noise, hums, buzzes or rings
	+ Use duct tape or masking tape to dampen them
	+ Place a cloth to dampen rings
	+ Paper towel or wallet can be taped to the head
* During recording, you should remove all damping mechanisms to get the natural sound of the drums
* Removing front head and placing blanket inside drum dampens kick drum
* Kick drums usually recorded with front heads removed

MIKING THE DRUM SET

* Treat each grouping as their own instrument
* Best place to start when miking drum set is to start with fundamental groups
	+ Place mic on kick
	+ And then on snare
* A drum kit at minimum can be pickup using 4 mics
	+ Which adds 2 over head pickups either spaced or coincident
* A mics frequency response, polar pattern, proximity effect and transient response should be taken into account when matching various drums
* Dynamic range is another consideration
* Chosen mics must be able to withstand strong peaks without distorting
	+ Still capturing delicate nuances of sound
* In a studio setting…
	+ Usually place drum kit on riser
	+ Reduces amount of low end thud that can leak through
* You may run into the following drum senarios…
	+ Drums could be placed in their own room – isolated from other instruments
	+ To achieve bigger sound – drums could be placed in larger studio room while other instruments are placed in the smaller studio rooms
	+ To reduce leakage – drums placed in studio can be enclosed by 4-foot or higher divider flats

KICK DRUM

* Adds low energy drive or punch
* Produces low frequencies at high sound pressure levels
* Necessary to use mic that can handle and produce signals
* Best mic choice is a large-diaphragm dynamic mic
* Moving mic closer to head can add warmth and fullness
* Moving it further often emphasizes high frequency click
* Placing mic closer to beater emphasizes hard thud sound
* Off center pickup captures more of drums characteristic skin tone
* A dull loose kick sound can be tightened to produce a sharper more defined sound by…
	+ Placing a blanket or other damping materials inside drum shell firmly against beater head
* Cutting back kick eq at 300 to 600 Hz can help reduce dull cardboard sound
* Boosting 2.5 to 5 kHz adds a sharper attack, click or snap

SNARE DRUM

* Snare mic aimed just inside top rim at a distance of about 1 inch
* Mic should be angled from other drum parts
* Rejection angel should be aimed at either hi-hats or rack toms
* Mics polar response is cardioid
* Bi-directional and super-cardioid offer tighter pickup angle
* Crisp, bright snare sound achieved by…
	+ Placing an additional mic on snares drums bottom head
		- Then combining 2 mics onto a single track
	+ Reverse bottom mics phase polarity
* Dampening rings used to reduce ring and deepen instruments tone
	+ Dampen by taping billfold or similar sized folded paper towel to top of drumhead
		- Few inches off edge

OVERHEADS

* Generally used to pick up high frequency transients of cymbals with crisp accurate detail
	+ Provides overall blend of entire drum kit
* Condenser mics chosen for accurate high end response
* One type of mic placement is spaced pair
	+ 2 mics suspended left and right sides of kit
		- Equally distributed to pickup in a more balanced fashion

RACK-TOMS

* Can be miked individually or by placing single mic between 2 at a short distance
* When miked individually a dead sound can be achieved by placing mic close to drums top head
	+ About 1 inch above and 1-2 inches from outer rim
* A more live sound can be achieved by increasing height above head to about 3 to 6 inches
* Choose hyper-cardioid pickup pattern is isolation or feedback is a consideration
* Reduce leakage and get a deep driving tone…
	+ Remove toms bottom head and place mic inside 1 to 6 inches away from top head

FLOOR-TOMS

* Miked similarly to rack toms
* Mics can be placed 2 to 3 inches above top and to side of head
* Can also have the mic placed inside 1 to 6 inches from head
* Single mic can be placed above and between 2 floor toms or each can have own mic pickup

HI-HAT

* Usually produces a strong sibilant energy in high frequency range
* Keep the following 3 points in mind
	+ Placing mic above top cymbal will help pick up nuances of sharp stick attack
	+ Open and close motion produces rush of air
		- When miking hats edge – angel mic slightly above or below the point where cymbals meet
	+ If only one mic is available
		- Snare and hi-hat can be pickup up using just the one mic
		- Place mic between the 2 facing away from tom racks as much as possible
		- Figure 8 mic can be placed between 2 with null axis facing towards cymbals and kick

**TUNED PERCUSSION INSTRUMENTS**

CONGAS AND HAND DRUMS

* Congas, tumbas, bongos are single headed, low pitched drums
	+ Can be individually miked at very close distances of 1 to 3 inches above head and 2 inches from rim
	+ Mics can be pulled back to a distance of 1 foot for fuller live tone
	+ A single mic X /Y stereo pair can be placed about 1 foot above and between drums
* a good pickup can be achieved by placing mic at a distance of 1 to 3 feet in front drum head

XYLOPHONE, VIBRAPHONE AND MARIAMBA

* Place 2 high quality condenser or extended range dynamic pickups above playing bars at a distance appropriate to size of instrument
	+ Follow 3:1 distant rule
* Coincident stereo helps eliminate possible phase errors
* Spaced pair gives a wider stereo image

**STRINGED INSTRUMENTS**

VIOLIN AND VIOLA

* Frequency range of violin is from 196 Hz to above 10kHz ; G3 to E6 (196 to 1300 Hz)
* A good flat frequency response mic should be used
* Important to use a mic thats flat around frequencies of 300 Hz, 1kHz, and 1200 Hz
* Fundamental range of viola is tuned a fifth lower than the violin
* Mic should be placed within 45 degrees of instruments front face
* Miking at a greater distance gives a mellow well rounded tone
* Closer mic positions give a scratchy more nasal quality
* Recommended mic distance for a solo instrument is between 3 and 8 inches
* Jazz / Rock styles…
	+ Mic can be placed at a close working distance of 6 inches or less
* Under PA
	+ Electric pickup or clipping mic can be attached to instrument.

CELLO

* Fundamental range is from C2 to C5 (56 to 520 Hz)
* Overtones up to 8 kHz
* Quality mic can be placed level with instrument and directed towards sound hole
* Chosen mic should have a flat frequency response and placed at a distance of between 6 inches and 3 feet

DOUBLE BASS

* Double bass one of orchestras lowest pitched instruments
* Fundamentals of a 4 string bass reaches down to E1 (41 Hz) and up to MIDDLE C (260 Hz)
* Overtones reach up to 7 kHz
* Mic can be aimed at the F holes at a distance of between 6 inches and 1.5 feet

**VOICE**

* The most important device in the signal chain is the vocalist
* Next concentrate on vocalist creature comforts
	+ Lighting and temperature
	+ Water
* Traps encountered when recording human voice
	+ EXCESSIVE DYNAMIC RANGE
		- Solved by micing techniques or inserting compression into the signal path
			* Compressor automatically rides the signal gain and reduces excessively loud passages
	+ SIBILIANCE
		- Occurs when sounds such as F, S, SH are overly accentuated
		- Results of tape saturation or distortion
		- Reduced by inserting a frequency selective compressor, DE-ESSER, into chain through EQ
	+ EXCESSIVE BASS BOOST DUE TO PROCIMITY EFFECT
		- Reduced by increasing working distance between source and mic
		- Using omni directional mic
		- Through use of EQ

MIC TOOLS FOR THE VOICE

* Explosive popping P and B sounds results when air blasts from singers strike the mic
* Can be avoided or reduced by…
	+ Placing pop filter over mic
	+ Placing windscreen between mic and vocalist
	+ Taping a pencil in fron of mic capsule
		- This breaks up plosive air blasts
		- Using omnidirectional mic
* Reducing problems due to leakage and isolation
	+ Choice of directional pattern
	+ Isolate singers with flats, barriers
	+ Isolate singer in a separate iso-booth
	+ Overdub vocals at a later time

**WOODWIND INSTRUMENTS**

* Flute, Clarinet, Oboe, Sax and Bassoon combine to make up the woodwind class
* Large part of the sound comes from the finger holes that span through entire instruments

CLARINET

* Commonly comes in 2 pitches
	+ B clarinet
		- Lower limits of D3 (147 Hz)
	+ A clarinet
		- Lower limit of C3 (139 Hz)
* Highest fundamental is around G6 (1570 Hz)
* Sound radiates mainly from finger holes at frequencies between 800 Hz and 3 kHz
* As pitch rises more sound comes from the bell
* Best mic placement
	+ Aim pickup towards lower finger holes at a distance of 6 inches to 1 foot

FLUTE

* Fundamental range is from B3 to C7 (247 to 2093 Hz)
* Mic placement depends on type of music being played and room acoustics
* Mic should be placed on-axis slightly above player at a distance between 3 – 8 ft
* Modern musical styles
	+ Distant ranges from 6 inches to 2 feet
	+ Mic should be placed at a point 1/3 to ½ the distant from instruments mouthpiece
* Placing mic directly in front of mouthpiece will increase level
	+ But breath noises will be accentuated

SAXOPHONE

* Most popular sax for rock/jazz is S-curved B-flat tenor sax
	+ Findamentals range from B2-F5 (117 to 725 Hz)
* E-flat alto sax fundamental range from
	+ C3 to G5 (140 to 784 Hz)
* Harmonic content rangesup to 8 kHz and can be extended to 13 kHz
* Mic should be placed roughly in the middle of the instrument at desired distance pointing slightly towards bell
* Keypad noises can be reduced by aiming mic closer to bells outter rim

HARMONICA

* Divided into 2 basic types
	+ Diatonic
	+ Chromatic
* Pitch determined by length, width and thickness of vibrating metal reeds
* Forming hands around instrument molds tone by forming a resonant cavity
* Tone can be deepened by opening and closing your hands