**Lesson 12 – INTRO TO PLUGINS AND SIGNAL PROCESSING**

* Signal processing types divided into 3 categories
  + Frequency-based
  + Dynamics-based
  + Time-based

**WHAT IS AN EQUALIZER**

* Equalizers boost or cut specific frequencies in a signal
* Most common equalizers are tone controls
  + They tailor your sound to suit your genre of music
* Bass and treble knobs control low-pass and high-pass shelving filter
* Low and high pass filters remove portions of the sound spectrum
* Shelving filters just pump up or reduce one portion while leaving the rest alone
* Mid controls are found on 3-band EQs
  + Mid is sometimes called peaking or band pass filter
* GRAPHIC EQs
  + Set of filters that allow you to control the amount of boost or cut in each frequency band
  + Provide more flexibility and control than tone controls
  + Easy to use
  + Controlled with sliders
    - Frequency response resembles positions of sliders
  + Use set of band-pass filters designed to isolate certain frequency bands
    - Their job is to allow a small band of frequencies through
* PARAMETRIC EQs
  + Gives you the most flexibility
  + More difficult to use
  + Allows you to set the centre frequency and bandwidth
  + Can eliminate feedback by using a lot of cut (AKA Notch Filter) positioned at frequency that’s feeding back
  + Let’s you fine-tune the cut and keep all the good stuff
* Many amps have a presence knob that boosts the mid to high frequencies

**EQUALIZERS**

* Allow you to change the tonal balance of whatever you are controlling
* You can increase (boost) or decrease (cut) on band-by-band basis
  + Just desired frequencies
* You can select single channel unit or a 2 box 31 controls
* There are graphic models with slide controls (sliders) that roughly graph the eqs frequency response by the shape it forms
* The simplest and most popular are the 1/3 and 2/3 octave graphics
  + They offer best combination of control, cost and complexity
* Selecting graphic eqs – primary features to consider include…
  + Number of inputs/output channels
  + Number of boost/cut bands
  + Centre frequency spacing of each
  + Accuracy of output vs front panel settings

**USING EQUALIZERS**

* Equalizers decrease frequency deficiencies
* Equalizers can do wonders for a sound system
  + If you do measurements outside (no reflections off walls or ceiling) and up in the air (no reflections off the ground) you can get a very accurate picture or just the loudspeakers response
  + Free from room effects
* Equalizers improve the way each venue sounds
  + Reflected sound causes the problems
  + Every detail about the space affects your sound
  + Keep your loudspeaker out of corners whenever possible
  + Remove all restrictions between your speakers and your audiences including…
    - Banners
    - Stage equipment
    - Performers
  + You want your audience to mostly hear what’s coming directly from the speakers
  + You want to minimize all reflected sound
  + Since you know your direct sound is good now – all you have to worry about is minimizing the reflected sound
    - Use eqs to help with rooms troublesome features
  + Eqs are quite effective in controlling troublesome feedback tones
  + Use eqs to cut those frequencies that want to howl
    - Maximizing system gain before feedback
  + You can fix room related sound problems with equalization but you can move the trouble spots around
* Equalizers are useful in augmenting your instrument or voice
  + Enhances sound for your best personal expression…
    - Deepen the lows
    - Fill the middle
    - Exaggerate the highs
  + Gives you that something extra, that edge

**ANALOG EQUALIZATION**

* Analog EQs may be accomplished through use of passive or active filters circuits
* Active ones require power for their components
* The follow are 5 types of EQ filters commonly used in the analog studio…

1. **SHELVING**
   1. Filter changes signal’s response by constant amount of boost or cut
   2. Stops boosting or cutting at frequency which filter is set, levels off and continues to end of audio spectrum
   3. Equalizer identified at point where slop flattens out and becomes a shelf
   4. Example – shelving the bass and treble on a simple stereo system
2. **PASS FILTER**
   1. Cuts (reduces volume)
   2. Has a varying slope (18-24 dB per octave)
   3. A variation of this filter is a band pass filter where HI & LO pass filters are combined
   4. Differs from shelving because reduction continues at a steep slope and does not level off
      1. This frequency generally 3dB below the cut is called TURNOVER FREQUENCY AKA High or Low Cut EQs
3. **PARAMETRIC (PEAKING)**
   1. The selectable frequency equalizer
   2. Can move different control knobs, selecting centre of frequencies and boost or cut them
   3. Frequently referred to as a semi-parametric eq
      1. Semi because tis has a fixed bandwidth or Q
   4. A fully adjustable bandwidth parametric eq is called a parametric EQ
4. **THE NOTCH**
   1. Very small bandwidth fixed to one cut only
   2. Used to remove unwanted frequencies that are narrow in bandwidth
5. **GRAPHIC**
   1. Physical point of control gives a visual display of frequency boosts or cut across the audio frequency spectrum
   2. Each slider adjusts frequency boosts or cut at fixed setting of bandwidth and is fairly narrow
   3. More frequently found in live applications
6. **COMPOSITE**
   1. Consoles use this equalizer group by including them in its I/O peaking, shelving and pass filters

**Lesson 12 – MRT**

**THE WONDERFUL WORLD OF ANALOG, DIGITAL OR WHATEVER**

* Function of signal processor to change, augment or modify audio signal in wither analog or digital form
* Processing power of these effects harnessed in either hardware or software plugin
* Signal processing might be analog, digital or even acoustic in nature
* Embrace past tools and techniques when possible
* Never underestimate the power of your acoustic environment as an effects tool
* Spring and plate reverb units can add their own distinctive sound
* Biggest advantage to working in digital signal processing (DSP) domain is the face that software programs can be used to configure a processor to achieve a range of effects
* Processing a signal in the digital domain accomplished by combining logic circuits in a building block fashion

**PLUG-INS**

* Plug-ins are designed to be integrated in a DAW production environment
* The most popular standards are
  + VST (PC/MAC)
  + DirectX (PC)
  + AudioSuite (MAC)
  + Audio Units (MAC)
  + MAS (MOTU for PC/MAC)
  + TDM & RTAS (Digidesign for PC/MAC)
* Effects plug-ins operate in native processing environment
  + Means computer host CPU processors carries our DSP functions
  + Complex session still possible for your computer to run out of DSP steam
  + This can be dealt with in a few ways
    - Your computer processor can be beefed up to take full advantage of your system
    - Many DAWs offer a freeze or lock function that allows a track or processing function to be written to disc in a non-real time fashion in order to free up CPU
    - A DSP accelerator plugged into your computer to ct as a co-processor to share CPU processing workload

PLUG-IN CONTROL AND AUTOMATION

* Powerful aspects of working with plug-ins on DAW platform is the ability to control and automate many effects parameter
* Controls can be manipulated on screen or from external hardware controller
  + Allowing parameters to be adjusted, recorded, recalled into session track

**SIGNAL PATHS IN EFFECTS PROCESSING**

* Processing device can be inserted into an analog or digital chain in several
* Most common are…
  + Inline Routing
  + Parallel Routing

INLINE ROUTING

* Often used to alter a signal
* Occurs when a processor is inserted directly into a signal path in a serial fashion
* This approach passes from audio source – through the signal processor – then directly out to another device in the chain
* Generally used for processing single instruments, voice or group signal present on a particular line.
* Often, not always, device tends to be a level-based (EQ, Limiter, Compressor)
* Time and pitching changing devices can be used to tweak an instrument or voice in the signal chain
* Ho inline routing can be used…
  + Device can be plugged in to an input strip’s insert point.
    - This approach often used to insert outboard device directly into input strips signal path.
  + A console main output bus could be run through a device to affect an overall mix or submix grouping
  + An effects stomp box could be placed between a mic preamp and console input to create grungy distortion effect
  + DAW plug-in could be inserted into an input path to process only the signal on that channel

EXTERNAL CONTROL OVER AN INLINE EFFECTS SIGNAL PATH

* Certain inline effects processors allow for external signal source to act as a control for affecting a signal as it passes from the input to output of device
* Devices offering “key” input can be useful
  + Allows signal source to be used as a control for varying another audio path
    - A gate might take its control input from external key signal that will determine when signal will/will not pass to reduce leakage
    - Vocal track could be inserted into a vocorder’s control input to add robotic effect to track
    - Voice track could be used for vocal ducking at a radio station to fade music out when narrator is talked
    - External key input can be made to make a mix PUMP or BREATHE in a dance production

SEND ROUTING

* Often used to augment a signal
* Occurs when a portion of original signal is allowed to pass through chain while side signal is simultaneously fed to an effects device
  + Once effected – signal is proportionately mixed back in with the original signal to create a blended effect
* Simple form of side-chain routing can happen in 2 ways…
  + Signal source sent to effects device then mixed back in with original source at consoles input or effects return bus
  + Signal source sent to effects device that has an internal mix control serves as a side chain mix control for varying amount of dry signal to be mixed with wet

**EFFECT PROCESSING**

* THE SPECTRAL CONTENT OF A SOUND
  + Form of equalization or intelligent equalization and bandpass filtering
* AMPLITUDE LEVEL PROCESSING
  + Form of dynamic range processing
* TIME-BASED EFFECTS
  + Re-creation of room ambience, delay, time/pitch alterations and other special effects that can range from being subtle to in your face

HARDWARE AND VIRTUAL EFFECTS IN ACTION

* When using effects, most important asset is experience and own sense of artistry
* An audio EQ is a circuit device or plug-in
  + Let’s us exert control over the harmonic or timbral content of recorded sound
* EQ refers to alteration in frequency response of an amplifier so relative levels of certain frequencies are more/less pronounced than others
* EQ is specified as either plus or minus certain number of decibels at certain frequency
* The amount of boost or cut at frequencies other than one named is determined by…
  + whether curve is peaking or shelving
  + bandwidth of the curve
  + amount of boost or cut at named frequency
* Older EQs and newer retro system base their designs around filters that use passive components and employs amplifiers only to make up for internal losses in level
  + Called insertion loss

PEAKING FILTERS

* Most common EQ curve created by peaking filters\peak-shaped bell curve can be boosted or cut around selected center frequency
* The Quality Factor (Q) of peaking equalizer refers to width of its bell-shaped curve
* A curve with a high-Q will have a narrow band width with a few frequencies outside selected bandwidth being affected
* A curve having a low Q is very broadband
  + Can affect many frequencies around the center frequency
* BANDWIDTH
  + A measure of the range of frequencies that le between the upper and lower -3dB points on the curve
  + Q is an inverse measure of the bandwidth
* TO calculate Q…
  + Divide the center frequency by bandwidth

SHELVING FILTERS

* Refers to rise or drop in frequency response at a selected frequency
  + This tapers off to a preset level and continues at that level until end of audio
* Shelving can be inserted at either high or low end of audio range
* Curve type commonly found on home stereo bass and treble controls

HIGH-PASS AND LOW-PASS FILTER

* EQ types also include high pass and low pass filters
* Allows certain frequency bandwidth to be oassed at full level while other section are attenuated
* Frequencies attenuated by less than 3 dB are inside the passband
* Those attenuated by more than 3 dB are in the stopband
* Frequency where signal is attenuated by exactly 3 dB is called the TURNOVER or CUTOFF FREQUENCY
  + Used to name the filter frequency
* Attenuation is carried out at rates of 6, 12 and 18 dB per octave
  + This is called the slope of the filter
* High and low pass filters differ from shelving EQ because their attenuation doesn’t level off outside passband – instead cutoff attenuation continues to increase
* High-pass filter in combination with low pass filter used to create a bandpass filter with passband being controlled by respective turnover freq and Q by filters slope

EQUALIZER TYPES

* 4 most commonly used EQ types that incorporate one or more of the previous filters
  + Parametric EQ
    - Lets you adjust most or all of its frequency parameters in continuous fashion
    - Each band will have an adjustment for continuously varying center frequency
    - Amount of boost or cut is continuously variable
    - Control over center frequency and Q can either be selectable or continuously variable
    - Each set of freq bands will overlap into next band section to provide smooth transitions between frequency bands
      * Allows for multiple curves to be placed in nearby freq range
    - Has become standard design for most input strips, digi EQs and workstations
  + Selectable Frequency EQ
    - Has a set number of freq to choose from
    - Usually allos boost or cut to be made at a number of selected freq with pre-determined Q
    - Most often found on…
      * Console designs
      * Certain low cost production consoles
      * Outboard gear
  + Graphic EQ
    - Provides boost and cut level control over series of centre frequencies that are equally spaced
    - Octave Band
      * Might have 12 EQ controls spaced at octave intervals
    - 1/3 Octave EQ
      * Could have up to 36 centre frequency controls
  + Notch Filters
    - Used to zero in on and remove 60- or 50- Hz hum and other undesirable discrete frequency noises
    - Uses very narrow bandwidth to fine tune and attenuate particular frequency where there’s little effect to rest of audio program
    - Used more in film location sound and broadcast

APPLYING EQUALIZATION

* EQ is all about…
  + Compensating for deficiencies in a sound pickup
  + Reducing extra sounds that make their way into a pickup signal
* EQ should not be used as a band-aid
* Deal with problems from the get-go
* EQ best used in situations where…
  + There’s no time or money left to redo
  + Existing take was simply magical and shouldn’t be re-recorded
  + Track was recorded during previous session

EQ IN ACTION

* Helpful to know which frequencies affect an instruments to achieve effect
* Audio spectrum can be divided in 4 frequency bands
  + Low (20-200Hz)
  + Low-Mid (200-1000Hz)
  + High-Mid (1000-5000Hz)
  + High (5000-20000Hz)

**DYNAMIC RANGE**

* Dynamics of audio found between three level states
  + Saturation
    - Occurs when input signal is so large than an amps supply voltage isn’t large enough to produce required output
  + Average Signal Level
    - Overall signal level of mix resides