Interactive Tutorials For Duende


Tutorial One - 'Compression & Limiting'

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Compression and limiting

A compressor is a device to automatically control the dynamic range of a signal, with a limiter being essentially a compressor with an infinite ratio. In their simplest terms these are devices which reduce the volume of the signal passing through them according to the volume of the incoming signal and the chosen settings of the device.

The compressor in the Duende channel has not only the legendary SSL sound which has been sought after by DAW users for years, but many functions making it extremely versatile and easy to use.

The theory
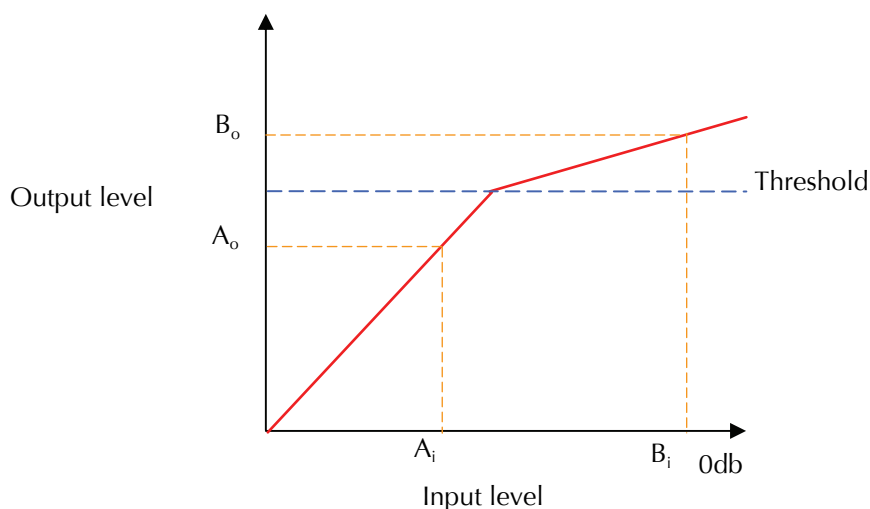
Refer to the diagram above; the red line shows what happens to the signal level when it is passed through a compressor. As you can see when it hits the threshold, the output no longer equals the input; it is lower.

If we pick an arbitrary point 'A', where A_i is an input level of say -20db. A_o is the output level of the compressor for that input level. Here, A_i is equal to A_o because the compressor is not changing the gain of the signal as the input level is below the threshold. If we now pick another point of a higher level, 'B', you can see that the output level B_o, is lower than the input level B_i. This is because the compressor is reducing the gain as the signal is above the threshold point.

Soft/Hard Knee

The channel compressor in its default setting is of the soft-knee type which means that gain reduction won't just suddenly start happening at the threshold. Instead this point is rounded off so just below the threshold some gain reduction will take place and increase up to the threshold point where the reduction will be according to the ratio. This would be shown in the above diagram as a curve on the red line, instead of the abrupt change in angle. A soft knee compressor will generally sound more gentle and musical, where as in hard knee mode a more aggressive sound can be achieved.

Make Up Gain

Because a compressor lowers the level of the signal passing through it, it is necessary to 'make up' for this attenuation at the output. Many compressors will have a make-up gain control to manually compensate for the gain reduction carried out by the compressor. The Duende channel however does this make-up automatically, leaving the user with one less control to think about. As you vary the amount of compression applied to a signal the output level will stay roughly constant, which means in use the compressor is easier to operate as you don't need to be constantly adjusting the make up gain.

Time Constants

The Duende Channel compressor features a switchable attack time and constantly variable release time. The attack time is the time taken for the compressor to carry its gain reduction when it is presented with a level above it's threshold. The release time is the time taken for the gain to return to normal once the signal has dropped below the threshold.

Bear in mind that due to the speed of the attack and release on the Duende channel that it is possible to distort the audio when these are set too fast with large amounts of gain reduction. In this scenario it is generally worth increasing the release time slightly, decreasing the ratio or using the long attack setting - unless the distortion is a desirable effect!

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Leveling out vocals

Solo the *vocal* track and open the corresponding Duende channel.

Play the track through with the Channel in BYPASS ALL. Notice how some of the words are higher in level than others. This may not seem a problem when the vocal is in solo because we can easily hear all of what is sung. However, when the vocal is against music and backing vocals for instance, controlling the level can really help the vocal sit in the mix and ensure all of it is heard over the music.

Now press the BYPASS ALL button to bring the processing into place. Notice that the vocals now sound more even and controlled. The compressor is bringing down the level when the signal is above the threshold, and leaving it alone when it is above. The longer attack setting has been used to allow the initial transients through.

- Try pressing the FAST ATT button and notice how more gain reduction happens and the vocal tends to sink back slightly.
- The release is set to 300ms. This is short enough to catch the peaks and long enough to avoid pumping.
- The threshold is at -4db and the ratio at 7:1. These make the compressor apply a small amount of gain reduction on the quieter words and about 6db on the louder parts.

Changing the character of drums

Load tutorial 1, solo the *room mic* track and open the corresponding Duende channel.

Listen to the dynamics in the room track, noting the difference in volume between the low level and high level content. Now press the BYPASS ALL button to kick in the compressor and notice immediately the increase in energy, loudness and punch!

Settings

- You can see that the threshold is set to about -12db, which means any part of the signal above this level will get reduced in gain by the amount set by the ratio control. Any part of the signal below this threshold will be left untouched.

- The ratio is set at 3:1 which means anything above the threshold will get reduced in volume by a factor 3. For example, if the signal is 12db above the threshold it will be reduced to 4db. Now increase the ratio and you can see the yellow gain reduction meter going into the red indicating the compressor is working harder as it is reducing

the gain of the signal by increasingly large amounts.

- The FAST ATT button is off so the compressor lets through the initial attack of the drums before working. If the FAST ATT button is now depressed the compressor can be heard starting to work almost straight away at the beginning of the transient, which kills the beginning of the hits somewhat.

- The release is set to its fastest setting meaning the compressor brings the signal back up to its normal level very quickly and is ready to catch the next transient. Try increasing the release time and you can hear that the compressor doesn't cause the signal to jump up in level between transients and a smoother sound is achieved. But if the release time is set too long the compressor does not recover quickly enough to catch the next transient and the process does not work properly. A longer release will generally give a smoother sound, where as a short release will give more intensity and energy to a signal.

- The PK (peak) button puts the compressor into a hard-knee mode, whilst also forcing the compressor to react with more attention paid to the peak level rather than average level (rms).

Limiting

Limiting can be achieved on the Duende channel by setting the ratio to ∞ and depressing the PK button. Do this and you can hear that anything above the threshold gets reduced in gain to a fixed level. This can be useful for making a signal generally louder, but the transients are sacrificed. Try bringing the threshold down with a high ratio and fast attack and notice how that all important information at the beginning of a drum hit is compromised.

If too much compression or limiting is used it can make the sound lifeless and dull as it kills the transients. It's a process which should be applied with discretion, and beware of the trade-off between loudness and transients.

Dynamic Control

In the DAW project for tutorial one, the purple *kick, snare, hats* and *toms-oh* tracks have all been dynamically altered to simulate what it might sound like if the material was badly recorded. A signal may appear something like this if the compression has been set wrong on the input, the drummer did not play the kit with even and controlled dynamics or the microphone stands were not steady. In these cases the Duende channel compressor can be

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used to compensate for these shortcomings.

Mute the room track for the time being and solo each of these four tracks in turn. Listen to how uneven the levels are and the way the drums tend to jump up or down in volume. Let's try and level out the *kick* track first.

Solo the *kick* track and open the corresponding Duende channel. Use the BYPASS ALL button to place the compressor in circuit and notice how much more even the kick drum sounds.

- The attack has been set fast to catch the peaks as they are quite apparent and the PK button is depressed so the compressor responds to the peaks rather that the average signal level.
- A ratio of 1:8 is used as there is quite a large swing in the dynamics so a fair amount of gain reduction is required to even out the peaks.
- The release is set to 0.2s so the compressor recovers quickly enough to catch the next peak yet doesn't come back too quickly to cause a pumping effect.
- Finally the threshold at 2.5db is low enough to catch the peaks yet leave the lower end of the dynamic range alone.
- A small amount of expansion has been used to reduce the lower level content (bleed, ambience etc.) which has been brought up as a side effect of the compression.

Now take the *kick* track out of solo and solo the *snare*.

Again by switching the dynamics section in circuit a more controlled signal is heard. Similar processing to the kick track has been applied to the snare, with a fast attack to catch the peaks but this time with peak mode disengaged as a smoother dynamic is produced. Again the expander has been utilised to reduce the hi-hats between snare hits.

Let's look at the *hi-hat* which provides a slightly different challenge as it contains mainly high frequency content with an attack portion which must be treated with care. The snare bleed present in this track is the over-riding energy, i.e. when the snare hits the signal is at its highest level. This makes it difficult to control the level of the hats as the snare will govern the gain reduction.

- A medium ratio and fast attack have been used to catch the peaks but as the average level is just as important in this signal the PK button is up.
- Quite a long release time is used so the hats don't jump around too much and sound dynamically even without the compressor getting too eager.
- Note that the high-pass filter is engaged to cut everything below 500Hz which serves to reduce the amount of snare in the signal.

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Now solo the *tom-oh* channel and listen to both the uncompressed and compressed signal using the BYPASS ALL button.

This track presents a similar problem to the *hi-hat* track as it contains not only hats but snare, kick drum and some ambiance. You will notice two Duende channels inserted over this track, and if you look at them you can see why.
The object of this exercise is to even out the level of the *tom-oh* track, whilst not bringing the level of the ambient portion up too much.

- The first is set up with a low threshold and low ratio, making it compress nearly the whole signal by a small amount. This serves to generally even out the dynamics.
- Placed after this is another channel set up in a limiter configuration with fast attack and infinite ratio. Looking at the gain reduction meter shows us that it is catching only the highest peaks and reducing these by about 6db.

Finally all these tracks have been sent to a bus and compressed lightly using the Duende bus compressor. This serves as a final 'polish' to bring the together the drums and add some punch. The use of the Bus Comp is covered in tutorial 5.

By A/Bing the two bounces at the bottom of the screen the difference in dynamic control is quite apparent.

See the tutorial on side-chaining for ways in which the EQ section can interact with the dynamics for even more control.

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