

Assignment: Audio Signals assessment 2020

Module Name: Audio Signals

Module Tutor: Jez Wells

Word Count: 1499

Introduction

The design of this plugin was inspired by the 'double tracking'¹ technique. The term 'double tracking' has come to be used to refer to an audio producing technique that recording the same content twice, and panning these two tracks to the opposite left and right position in order to increase the width and richness of the sound.

The plug-in named Mono Doubler is a unique combination of delay, tremolo, and distortion that is used for inverting a mono audio signal into a wider sound by sending the dry and delay signals into the left and right channel with different delay time. And each channel can be changed in gain, tremolo rate, and distortion amount, which provides a wider range of producing creative sounds. By implementing different amounts of delay time, tremolo, and distortion on each channel, it assists to create a double-tracking effect that can help make a wider and fuller sound in the mix.

Delay and Gain control

As for the first slider, the button 'Left/Right' controls which channel outputs the dry signal, and the second slider controls the delay time between dry and wet signals. Also, the third and the fourth slider are balancing gain controls which controlling overall volume of the left and right channel separately.

¹ Anonymous, 'Double Tracking',
<https://en.wikipedia.org>. Accessed 27 November 2020.
https://en.wikipedia.org/wiki/Double_tracking

The parameters of the delay time are from 0 to 0.05 seconds, which is a reasonable delay time range that human hearing response fuse dry and delayed signals into one. When the delay time is 0, the Left/Right will pan the signal to only one side. Once the delay time is over 0, the left and right channel output the same signal and there is a certain amount of delay time between them, and the Left/Right bottom decide which channel output dry signals that come first. To illustrate this, I processed an impulse signal in the left and right modes with different delay time settings and produced two time-domain plots to easily visualize how it works.

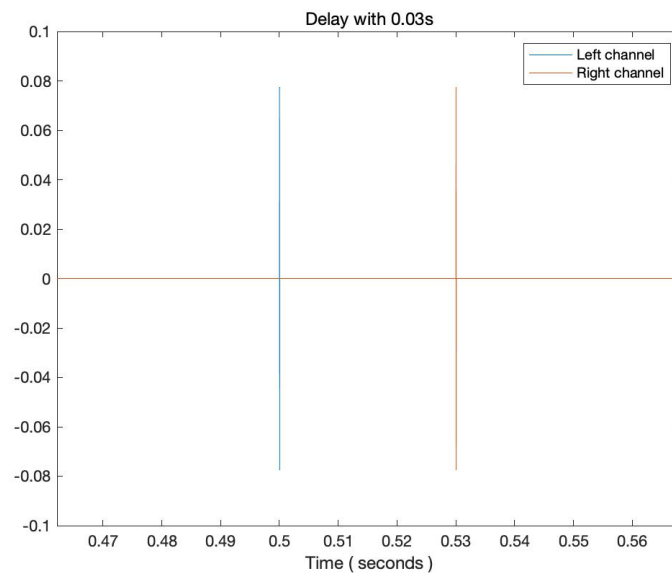


Fig 1. The first slider on the Left, delay time=0.03s, the time domain plot of an impulse signal processed with the plug-in

According to figure 1, when the first slider is on the left mode, the left channel outputs the dry signal at 0.5 seconds, and the right line presents the right channel output which is a copy of the dry signal at 0.53 seconds. Hence, the plot shows that there are 0.03 seconds delay time between left and right channels.

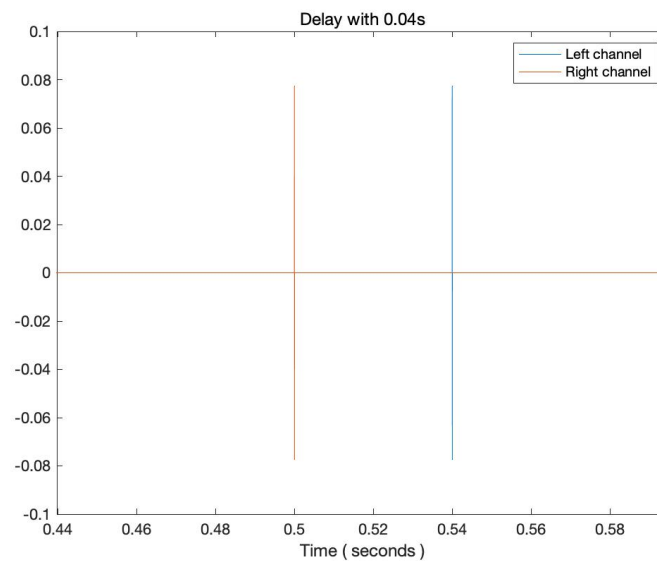


Fig 2. The first slider on the Right, delay time=0.04s, the time domain plot of an impulse signal processed with the plug-in

When the first slider turning on the right and the second slider was set to 0.04 seconds. According to figure 2, the signal was first output in the right channel and then output in the left channel 0.04 seconds later. In this way, by analyzing these two plots, I determined that the first and second sliders of the plug-in worked as designed.

However, before the plug-in outputting the delayed signal, the inputs in the left channel and right channel are combined into a mono audio signal. I discovered it is useful when processing on a mono track that only one channel has outputs. To be more specific, when a mono signal is mistakenly recorded in stereo recording settings, the signal only is output in one channel of the stereo track. This kind of mistake is easy to be made in the process of recording. However, when processing audio with this issue in the production, this plug-in can provide a solution to it since the inputs in both channels are combined into mono before processing with delay. To further demonstrate its usefulness, I recorded a problematic mono recording and processed it with this plug-in, and I attached the unprocessed and processed audio files follow the report (Test Audio 1 and 2).

Nevertheless, simply duplicating the same signal on each channel cannot achieve an excellent result of doubling effect. When the left and right channel output the same signal, these two sounds tend to merge as one since they are not distinguished enough from each other. In this case, by further applying different amounts of tremolo and distortion on each channel, the plug-in assists to process these signals distinctive but still similar.

Tremolo

The plug-in has the tremolo controls of the tremolo rate and the tremolo amount of each channel. Constantly changing volumes can not only make the sound more lively but also make a different volume output in the left and right channel, so that the double-tracking effect can be better achieved. Also, especially when applying trembling effects on guitars and synthesizers, varied in amplitude at a certain rate creates a vibrato effect which adds a fresh flavor to the sound.

For testing, I imported a pink noise audio file to the plug-in to observe whether the tremolo works functionally. Comparing figures 3, 4 and 5, there are obvious periodic variations of amplitudes in the plots, which indicates the tremolo function of the plug-in works properly.

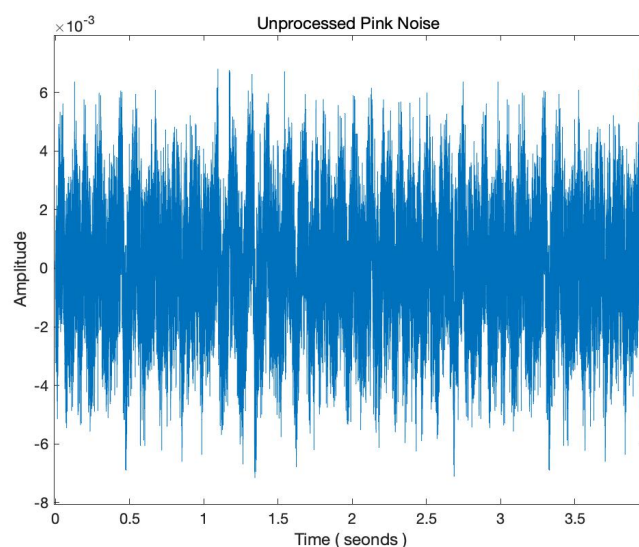


Fig 3. The time-domain plot of pink noise signals without any processing

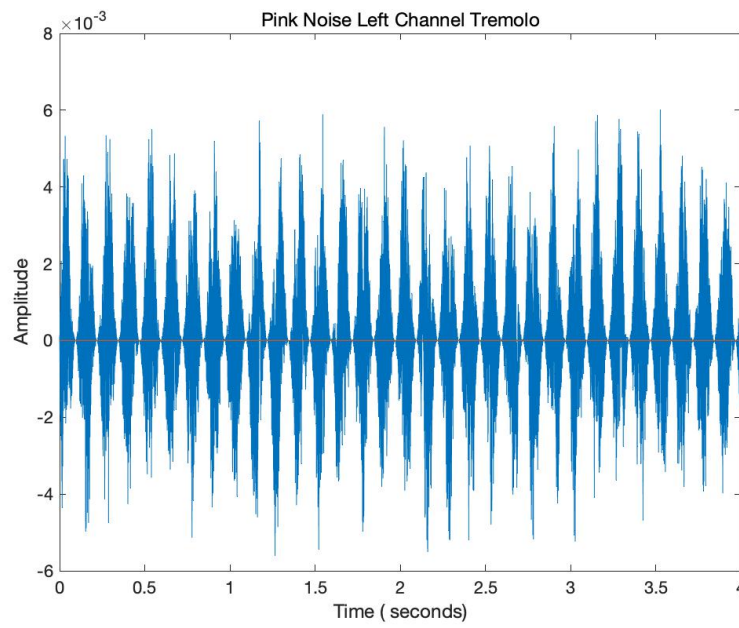


Fig 4. The time-domain plot of pink noise signals in the left channel that processed with the tremolo

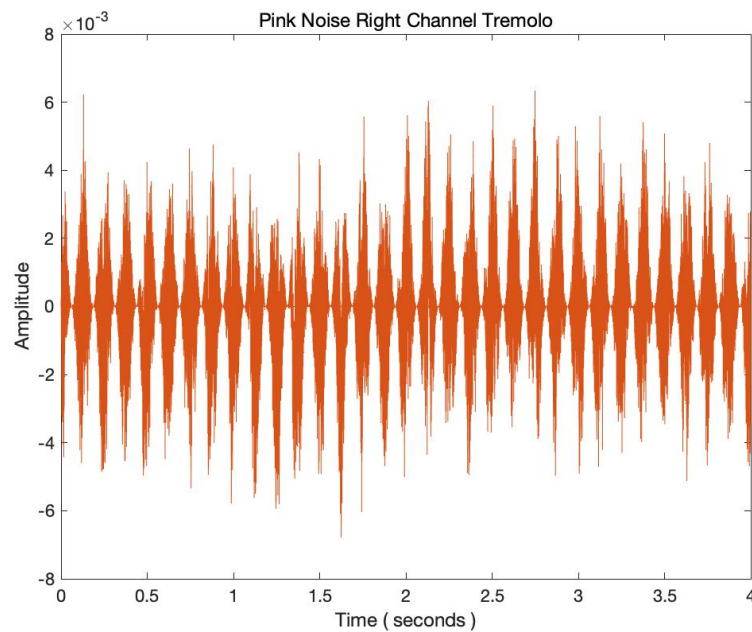


Fig 5. The time-domain plot of pink noise signals in the right channel that processed with the tremolo

Moreover, one unique feature of it is, the tremolo works in the sine phase in the left channel and works in the cosine phase in the right channel (See Fig

6). As a result, even when the tremolo parameter at the same value in the plug-in, it still creates different tremolo phases in the left and the right channel, and the volumes change alternatively which provides an interesting effect on audio processing.

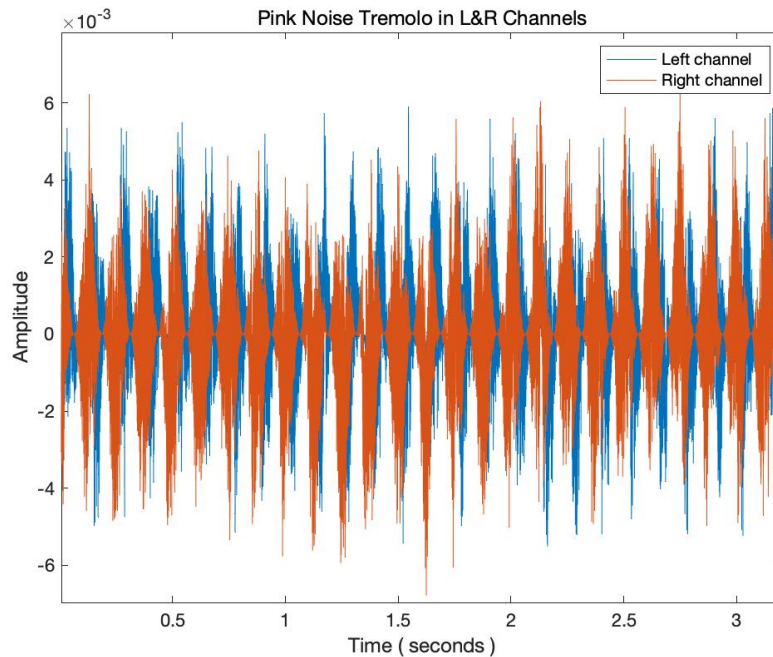


Fig 6. The time-domain plot of the signals in both channel after processing with the same amount of tremolo

Distortion

When it comes to producing a double-tracking effect, applying different modulation effects on each channel also helps to distinguish two tracks. Therefore, the distortion function of the plug-in assists to achieve that. By adding different amounts of distortions, the signals on the left and right channels can be different from frequencies, which prevents the two same signals from merging as one. For testing whether the distortion feature works in the plug-in, I imported a synthesizer audio and applied an amount of distortion to it. Here are the visualization plots of them:

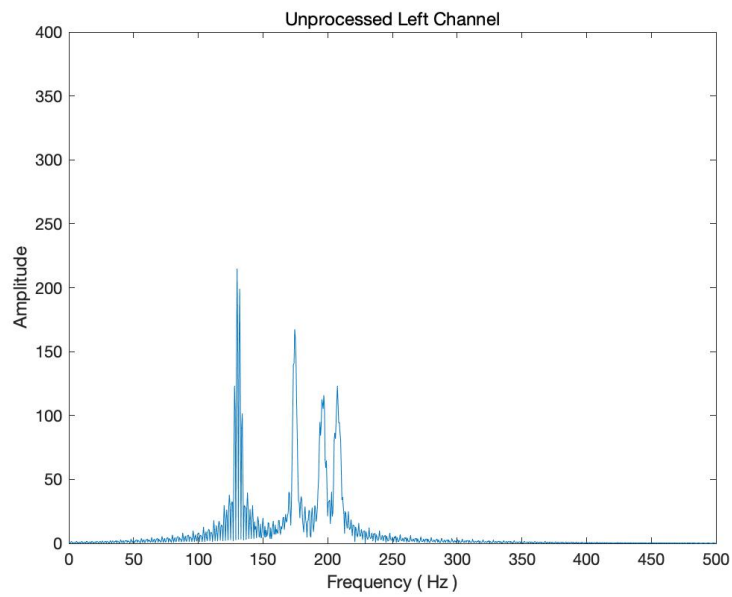


Fig 7. The frequency-domain plot of a synthesizer audio without any process

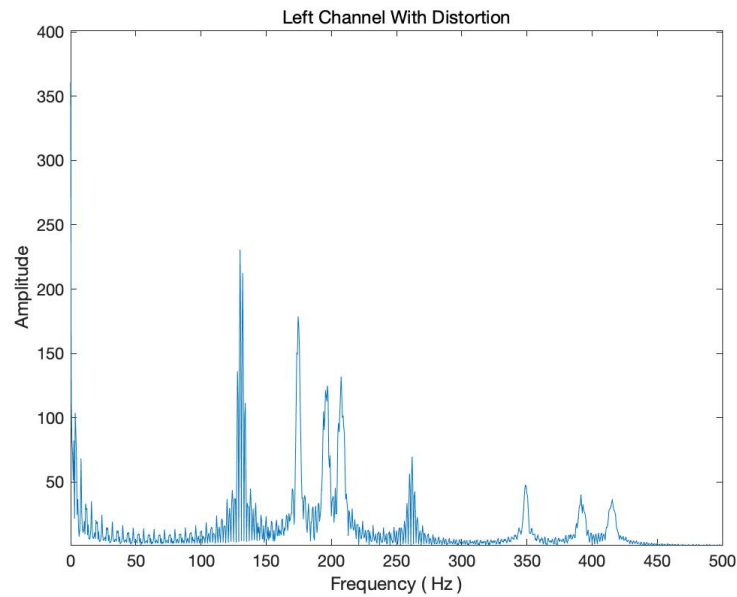


Fig 8. The frequency-domain plot of synthesizer audio processed with distortion

Comparing figures 7 and 8, we can find out that four additional components are created between 230 and 430 Hz. However, the new components are introduced by squaring a positive number which will generate a DC offset around 0 Hz. Therefore, in the process of editing and

producing the signal, the DC offset can cause a problem. Although is inaudible, but the flaw does exist in the distortion function of the plug-in.

The overall effect

One of the best advantages of the double-tracking technique is, it can broaden the stereo field of the sound. When these three functions working together, it achieves an exhilarating result. To observe how the sound field changes, the tool that I used is Waves PAZ Analyzer which provides real-time vector display with zoom.

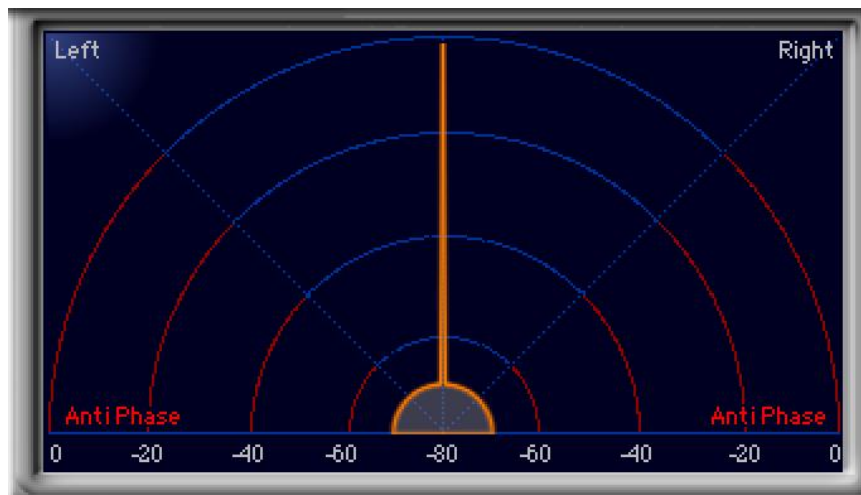


Fig 9. The sound field of a mono signal

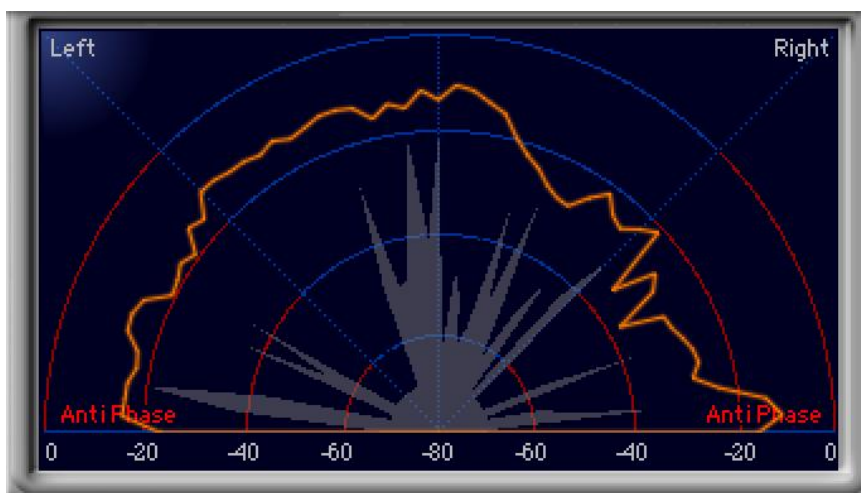


Fig 10. The sound field of a mono signal after processing with the plug-in
Mono doubler

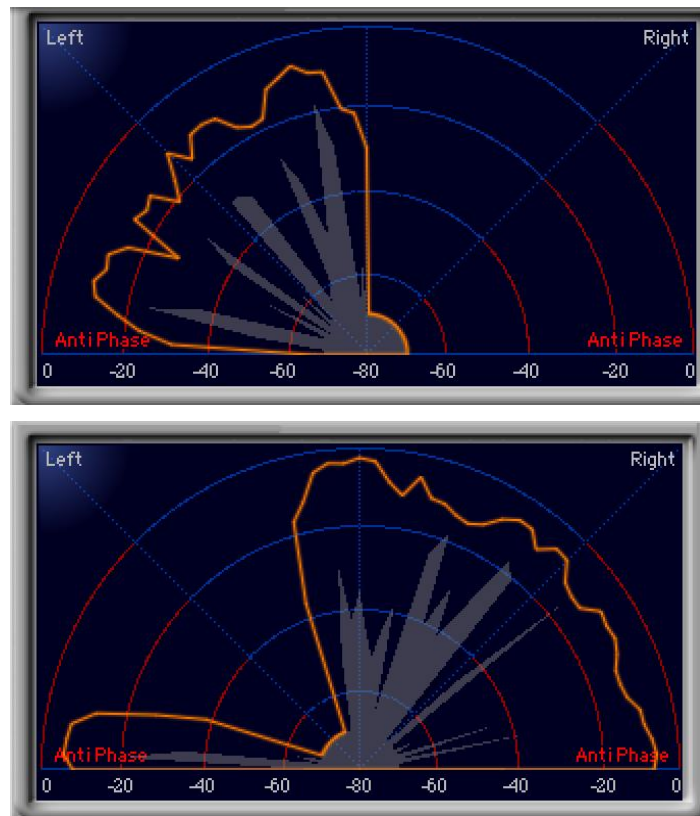


Fig 11. Two sound field images of a mono signal after processing with the Mono Doubler plug-in in different settings.

By comparing figures 9 and 10, the plug-in effectively widens the sound field. Moreover, figure 11 demonstrates that by setting different parameters, the plug-in can adjust the stereo phase position, which helps to handle over-masking and phase issues.

According to my experience of using the double-tracking technique, it can lead to an outstanding result. However, the disadvantage of this technique is quite obvious: more extra works would be included in the production process, such as retaking, editing, processing, and timing issue fixing which are time-consuming. For performers, it is challenging to overlay the same line twice. In this case, this plug-in is an immensely helpful tool that can help to produce a double-track effect with less time.

Conclusion

When it comes to mixing and producing music, this plug-in is a useful tool that can be applied for a great number of situations. I discovered that when the plug-in working on vocal tracks, it helps to make the chorus parts more powerful in a song. When processing with synthesizers, it provides interesting flavors and tones for the track. When applying on drums and percussion, it assists to create more rhythmic and live sounds. Experiment with delay times and variations in amplitude, tremolo, and distortion in the mixing, the plug-in provides a rich variety of sound effects, which is helpful for producers to be more creative and productive in producing music.

Recourse List

Reiss, Joshua D; McPherson, Andrew 'Audio Effect'. CRC Press 2014.

Kurosu, Masaaki, 'Human-Computer Interaction. Human Values and Quality of Life'. Cham: Springer International AG, 2020. Web.

Paul White, 'Double-tracking Vocals Sound Techniques',
<https://www.soundonsound.com/techniques/double-tracking-vocals>,
Assessed 1 December 2020