

## Science In The Studio: FranPan VST plugin

### Disclaimer

FranPan is free audio processing software which is provided without warranty and no responsibility is accepted for loss or damage arising from its use. By using this software you are agreeing to these terms of use.

### What is this document?

This short manual describes how to install and use the FranPan plugin. It also explains what the plugin does to audio.

### What is FranPan?

FranPan is a panning tool to be used in any VST plugin compatible program running on a Windows PC (such as *Cubase*, *Reaper* or *Wavelab*)<sup>1</sup>.

### I've already got a panner, why do I need FranPan?

There are two ways in which we can position mono sounds at, or somewhere between, two loudspeakers: we can represent the position as a difference in level (or volume) between the two loudspeakers, or we can represent position as a difference in timing between the two loudspeakers. Most panners (nearly all, in fact) just use level difference - the position of the pan control just adjusts the difference in level between the two loudspeakers. FranPan allows you to use level or time differences or different amounts of both to position a sound between the loudspeakers. There are two separate controls: one for level difference, the other for time difference.

### Why offer two different ways of panning?

Because they produce different results and give mix engineers, producers etc. different ways of presenting sounds at the same position. The other purpose of this plugin is to provide a tool which allows those studying music technology and sound recording to investigate something known as the Haas effect, which is also known as the law of the first arriving wave front, and other aspects of human perception of two-channel stereo.

### What is the Haas effect?

It is named after the scientist Helmut Haas. He discovered that humans perceive speech as coming from the direction of a person speaking even if there is a louder reflection (echo) from a surface in another position. Actually it's a little more complicated than that: if the echo arrives less than 30 ms after the direct sound from the speaker then the sound is perceived as arriving from the position of speaker, provided the echo is not more than about 10 dB higher in level than the direct sound (this would be unlikely in most situations). This ability to determine the direction of a sound source by using the first arriving version of the sound, and ignoring subsequent reflections, is very handy for

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<sup>1</sup> Any 32 bit Windows application that can support VST 2.3 format plugins, to be precise.

human beings. It means that we don't get confused about where sound sources are in reverberant spaces. If a reflection arrives after 30ms, then it is perceived as a separate sound event (an echo, in other words). If the reflected sound arrives very soon after the original event (less than a millisecond or so) then the difference in level required to override this effect is lower than 10 dB. Different experiments have come up with different level and time difference figures since this extent of this effect depends on the type of sound. A good place to find out more about this is Howard and Angus' *Acoustics and Psychoacoustics* or Rossing's *The Science of Sound*.

### So why is this plugin called FranPan?

Partly because its catchier than HaasPan (which also sounds a bit too much like saucepan), but mainly because someone called Nico Franssen was one of the first to analyse experiments into how level and time differences could be combined to place sound sources at different positions between two loudspeakers. Franssen worked at Philips and was the first, along with two other researchers called Schodder and Meyer, to come up with data on where listeners perceive sounds as coming from between loudspeakers when different combinations of time and level difference are applied. He reported that a relative time delay of less about 3 milliseconds was sufficient for a sound to appear to emanating only from one loudspeaker, even when the sound energy being emitted by both loudspeakers was the same. With that delay of 3 ms, the amount of energy coming from the other loudspeaker needed to be increased by 16 dB (i.e. be about 40 times greater!) in order for the sound to appear to be coming from the position of the other loudspeaker. With the same delay (3 ms) the sound level needed to be about 8 dB higher (i.e. roughly 6 times as much energy) in order to appear to be coming from the centre point between the two loudspeakers. With this plugin you can investigate some of the things that Franssen and others reported, as well as using the effects in your audio productions.

### How do I install and access the plugin?

All you need to do is place the FranPan.dll file in the VST plugins folder of your host program (e.g. *Cubase*). If you're not sure where this folder is, check the documentation for your host software. Once you have installed the file, it should be accessible within the channel strip of the mixer in the host. Again, if you're not sure how to load effects in your host software have a look at the documentation that came with it. The user interface for the plugin when used in the host program *Wavelab 4* is shown below:



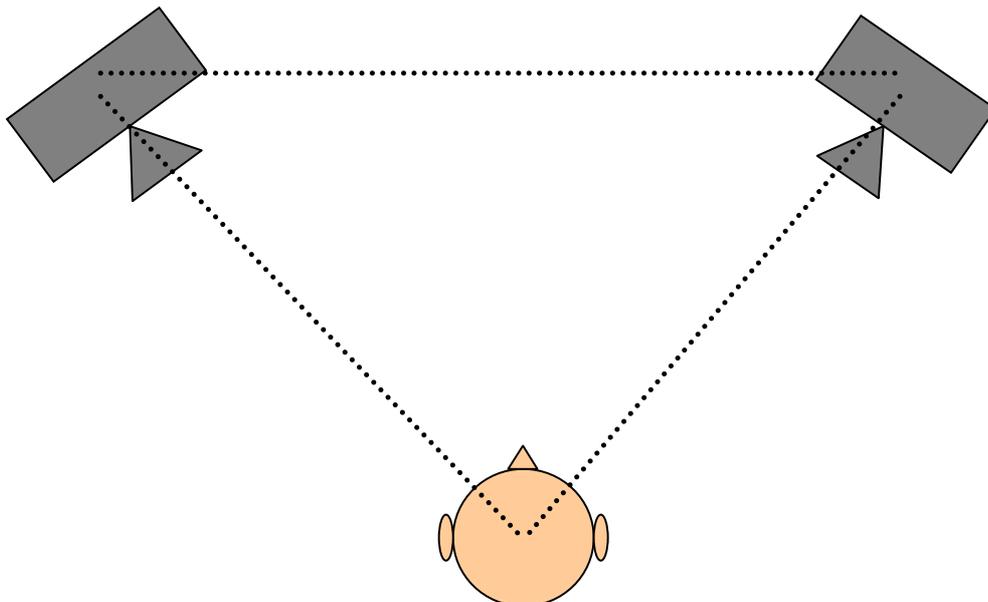
## Using FranPan

As this is a panner it is designed to be used as an *insert* effect. Using it by inserting it into a channel means that it processes all of the sound, rather than just a part of it (as would be the case if using it with an auxiliary bus, which would be more appropriate for effects such as reverberation or delay). Some plugin hosts (such as early versions of *Cubase*) cannot use this plugin correctly as an insert on a mono track. In this case use an auxiliary (effects) send and then use the plugin as the send effect – if you set the auxiliary send to be ‘pre fade’ and then pull the fader right down for the track the only signal that you will hear will be what passes through the plugin, and this will be equivalent to using it as an insert.

Once it has been inserted the plugin’s interface will open (as seen in the figure on the previous page) and you will see two parameters. The **R/L level difference** controls the difference in amplitude between the signals sent to the left and right loudspeakers. A positive value means that the signal is higher in level in the right speaker, a negative value means it is higher in the left. The **R/L time difference** controls the time difference between the two loudspeakers. A positive value means that the signal is earlier in the right speaker, a negative value means that it is earlier in the left speaker.

### What kind of things can be done with the panner?

Just using the level difference control will cause it to act in the same way as a standard pan control – mono sounds can be positioned between the speakers. Using just the time difference control also positions the sound between the speakers but in a different way, and with a different spatial quality to the sound. The best way to hear these differences in panning method is to sit in the stereo ‘sweet spot’. Position yourself midway between the speakers, at one point of an equilateral triangle with the speakers at the other two points as shown below, and move sounds using the two different sliders.



Some people report that using the level difference control gives a more precise positioning of the sound and that the time difference gives a more blurred position but with a greater sense of depth, as if the sound is happening behind the speakers. What do you think? Is there a difference? What positions of the sliders are necessary to move the sound to fully left or right? If one control is used to move sound fully into one speaker, how much does the other control have to be moved in the opposite direction in order to move the sound back to the central position between the two speakers? How does this compare with the kind of results that Franssen described (discussed on the previous page)? Does the type of sound being panned have an effect on the spatial effect achieved? For example, how does the spatial quality change if an impulsive sound (i.e. one which is sudden and short) is used rather than a smooth and sustained sound (i.e. one which lasts for a long time and has a very slow attack)?

One way of setting up an experiment is to have two identical tracks, with identical audio on them running through two instances of the plug-in. Use one of the plugins to do amplitude panning and the other to do time panning, switch between the two using the channel mute or solo buttons. Switch between the two and find out what time settings need to be made to produce the same perceived pan position for a particular amplitude setting and vice versa. This kind of psychoacoustic testing is known as ‘reproduction’: you are finding out the time settings required on the second panner to reproduce the panning position caused by the level settings on the first panner (and vice versa). Another kind of psychoacoustic testing is called ‘estimation’: here you would use either of the two panning methods and then estimate the position (as an angle) from which you perceive the panned sound as coming from.

### **Who made FranPan?**

This plugin was produced by Jez Wells at the Audio Lab in the Department of Electronics at the University of York. It is designed for creative use but also so that the ‘science in the studio’ that recording engineers use in their everyday work can be investigated, explored and, ultimately, understood in the same in-depth way that engineers themselves do. Jez is currently supported by a Public Engagement Scholarship from the Royal Academy of Engineering. If you have any questions, comments or bug reports please email them (along with details of how you are using the plugin and the host application) to [jez\[dot\]wells\[at\]york\[dot\]ac\[dot\]uk](mailto:jez.wells@york.ac.uk) – thanks!