

DIGITAL AUDIO SYSTEMS FINAL REVIEW
PRODUCT WORKING TITLE
'UNREAL CONVOLUTION'

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1. 'PROBLEM DESCRIPTION

'Reverberation within acoustic spaces has been sonically shaping music since the Gregorian period. The long decay of sound, induced by the large reflective churches they were produced in, helped create Gregorian chant. The Large reverb time smeared pitch and gave the vocalists an ethereal, larger than life quality. In almost all aspects of music since this period, Reverberation has been just as relevant as the instrumentation and orchestration. As technology advanced so did the emulations of reverberation. First, analogue efforts were achieved by routing dry audio from loudspeakers into a reverberant echo chamber, recording the output with a specifically placed microphone. Then came mechanical inventions; Spring and Plate Reverberation, which utilize metal transducers whereupon vibrations are created through electromagnetism and later picked up and added to the dry audio signal.'

Convolution Reverb can not only recreate acoustic spaces but also mechanical and digital hardware units as well. The realistic recreation of spaces makes convolution reverb perfect for orchestral music mixing and film.

The biggest problems associated with musical usages of Convolution Reverb lies within a lack of modulation parameters over time. This product and the evolution of products to follow will aim to achieve musical results by coupling convolution reverb with spatial effects.

When mixing reverb in a musical context it is very common to utilize panning to create unexpected movement in the spatial soundstage. It is uncommon to see a stereo reverb plugin with automated panning incorporated. An all in one spatial reverb solution could be just as commercially viable as an all in one channel strip like the ssl g channel plugin.

This digital reverberation effect; 'unreal convolution' employs spatial effects to utilize convolution reverb in a more musically viable manner;
Providing a musical solution for the lack of modulation parameters in convolution reverb.

If convolution reverb is coveted for its realism in recreation and algorithmic reverbs such as the Lexicon 480L for its fantastical approach, the 'unreal convolution' product aims to create a soundscape of realistic fantasy.

The coupling of convolution reverb with spatial audio effects provides the ability to develop the reverb over time, something that only algorithmic reverb has benefitted from, until now.

2. SPECIFICATION

The programming of this digital effect has been executed in matlab. The background of this code has been referenced from other sources but implemented into it's own right. The signal processing toolbox within matlab has been utilized greatly in the final production of this function.

Convolution is performed (in the frequency domain) to the inputted mono audio signal with a given impulse response. FFT convolution proves to be a more efficient computational process than it's time domain counterpart. Keeping things light on the CPU load means the effect will work on all ranges of consumer DAW.

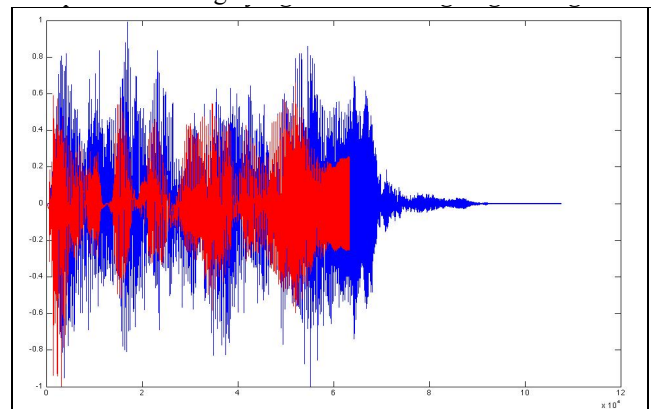


Figure 1. Input signal red vs convolved signal blue

The outputted stereo reverb is then fed to a panning function that bases its operation on amplitude variation. The initial and final angles are user definable variables

that control the convolution reverberation's width of movement.

A value 90 is equivalent to an 100% left signal where an angle of -90 is equivalent to 100% right. Any value can be selected within this range for both the initial and final angle resulting in an infinite possibility of movement within the stereo stage.

This user control makes this product the first all in one self panning convolution reverb of its kind.

The stereo signal utilizes an overlapping function and a zeros function to match the input and output signals sample duration. This provides an automatic adjustment to the panning function that matches the duration of movement from the initial to final angle to the length of the convolved reverberation signal.

The Wet/Dry ratio control is an amplitude variable multiplier; 1 gives a 1:1 ratio 0.5 gives a 1:0.5 ratio of dry to wet.

The function performs very quickly with minimal computational processing, outputting a rendered stereo signal with the mono input signal and panning stereo output signal (user defined variables) interleaved.

3. IMPLEMENTATION

The most obvious instantaneous effect of this function is that it turns a mono signal into a stereo one. It is, however, how this function utilizes the stereosonic medium that makes this product so commercially viable.

It is well documented and recorded that panning reverb is an effective tool in music production. The spatial motion provides an unexpected tension and release, which provides excitement for the listener. This excitement is what makes enjoyable musical recordings and in effect profitable ones.

A variety of mono instrumental audio signals have been tested as well as various impulse responses of various locations. This yielded pleasing results across a vast number of instruments and spaces.

The initial/final angle gives the user complete spatial control over the reverberation.

The results with initial angles of 0 and final angle of 0 (i.e. no panning function) yield a perfect recreation of the location of the impulse response.

With angles of 90 and -90 (i.e. the panning function in full effect) the focus becomes less on the sound of the reverb but more about the ethereal effect of the reverb tail decaying across the sound stage.

The Wet/Dry mix controls the ratio of panned reverb to the original mono signal. In basic terms this affects the subtlety of the panned reverberation effect. Depending on the decay time of the impulse response it is vital to roughly match the amplitude of the end of the impulse to the amplitude of the convolved signal. That way it becomes a subtle evolution into the panned reverb tail. Values of around 0.2-0.5 prove to yield the most musical results.

The parameter of wet/dry mix also allows controllable front to back depth. This is another spatial aspect that is often overlooked in spatial mixing. It is interesting to note that this could also be automated spatially. A variably moving front to back spatial effect could be explored in later development.

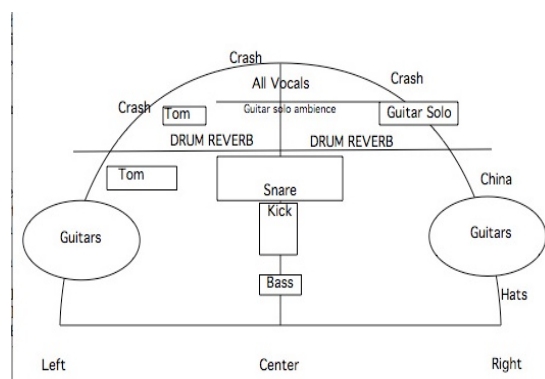


Figure 2. An example of a typical mix of a modern rock/pop band.

Moving the drum reverb or guitar solo ambience across the stereo field can greatly create excitement to an otherwise stagnant mix.

4. EVALUATION

There is an ongoing competition between algorithm and convolution reverb, with the argument for convolution being that it is the more realistic of the two but the argument against convolution reverb being the lack of modulation parameters of time being non existent, and thus less musical.

This product effectively and efficiently offers a new sonic take, mixing the psychoacoustic effects of both; Spatial modulation and realism.

As is seen in history 'new' effects in audio have always been on the forefront of what entails to be popular trends in the music industry. From the birth of reverb chambers,

to slapback echo in electric guitar sounds, and even to Autotune, the unheard and interesting has always appealed of the general public.

In Audio production there is no definition of what is musical or not, it is about what sells records and new and interesting digital audio effects tend to be on the forefront of what becomes commercial.

This Product could essentially be marketed as a Beginners product. With out the adequate knowledge of what makes up reverberation (such as early reflections, decay time etc.), the beginner consumer can simply pick a space and the spatial effect they want to add and be rewarded with a powerfully immersive, evolving soundscape. It could present itself as a 'fun' reverb, presenting over the top panning effects, leading into choruses or in a quiet section of a bridge.

This is simply an initial exploration into the uses of convolution in a musical sense. With beta testing upon the public (after development of a GUI) in a freeware release, this product will prove its usefulness through application.

Further development into spatial effects such as front to back panning through wet to dry automation can be easily implemented into matlab and can be developed before any serious final release of the product.

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