# Waves IR-1

**Users like the sound of convolution reverbs but they also like the variability and finer control offered by more traditionally derived electronic space simulators. Waves has done what someone was bound to do and combined the best of both worlds into a single powerful package. ROB JAMES says you only have to listen.**

**A FEW YEARS AGO** a rash of commercials appeared, mostly for beer as I recall, using clips from classic movies with contemporary actors appearing to interact with the originals. The process of matting one image into another is relatively straightforward, but to convince, the new material had to be given all the characteristics of the old. The lighting, grain and contrast. A classic convolution reverb attempts to perform a similar trick with audio by taking dry source material and seamlessly slotting it into a sampled acoustic environment.

Convolution is a mathematical construct, applicable to many areas of engineering, images and sound. Although I, and many others, quickly glaze over when maths rears its head, a very approximate explanation of the process goes something like this: 'A convolution is an integral which expresses the amount of overlap of one function as it is shifted over another function.' The functions are therefore 'blended' or perhaps a better expression might be 'folded up'. An echo or reverberation is the convolution of the original sound with a function representing the various objects that are reflecting it.

In a convolution reverb an input signal is folded together with another type of audio signal called an impulse response. At the simplest, an impulse response is the difference between a source signal and the resultant signal after it has been passed through the subject system. The system can be an audio processor of some sort or a loudspeaker(s) and microphone(s) in a real space.

Audio convolution tools have followed a familiar development path. The first commercially available hardware examples were heavyweight (literally and metaphorically) dedicated digital processing engines with a high price tag. More or less concurrently, non-real time, software only plug-ins and applications arrived at much lower cost followed by real-time examples as processing capacity increased.

Any convolution reverb is only as good as the impulse response samples it is provided with. Waves has gone about the process with an astonishing level of dedication and academic rigour. Enter Professor Angelo Farina of the University of Parma. Farina was inspired by Michael Gerzon's 1975 proposal to begin a systematic collection of 3D impulse responses from theatres and concert halls to study their properties and preserve them for posterity. Building on the previous body of work, Farina, collaborating with Waves, has developed a sampling method incorporating all the previously known measurement techniques.

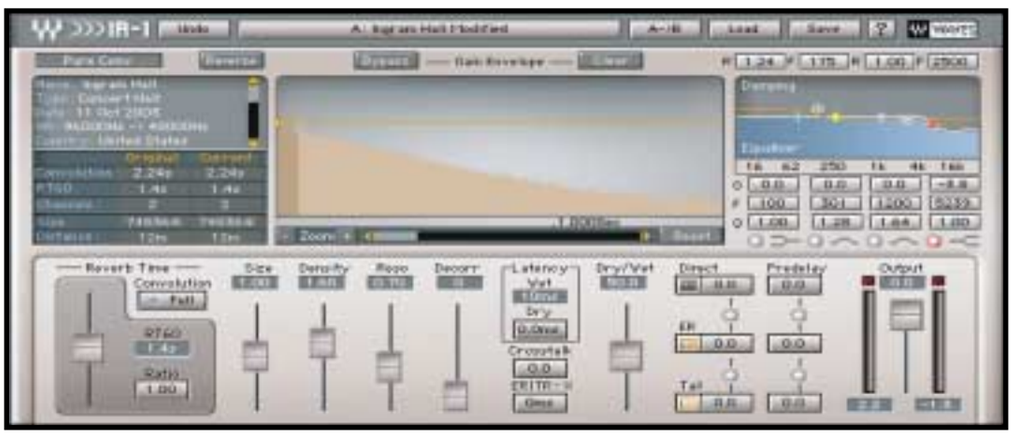
Three different microphones are mounted on a rotating boom (a binaural dummy head, a pair of cardioids in ORTF configuration, and a Soundfield microphone). The sound source is a specially constructed dodecahedron loudspeaker with 12 full-range drivers and a subwoofer as an omnidirectional source, or a Genelec S30D monitor as a directional source.

Using the indexed revolving mic array, a set of impulse responses are taken at 10 degree intervals. Recordings are made at 96kHz. The raw samples require sophisticated processing before they can be used in the IR-1 and I shall not attempt to describe how this is done. Suffice to say the explanation lost me after the first paragraph.

The classic purist approach suffers from significant limitations. A single set of impulse responses can, by definition, only produce one fixed reverb time (RT60) and one characteristic sound. Control is limited to after the fact filtering.

Conventional synthetic digital reverbs use early reflections generation, combined with a reverberation tail generator. A feedback loop adds greater complexity and reduces resonance. Conventional reverbs have the big advantage of a wide range of controls and relative efficiency, especially at producing long tails, although they generally lack the sense of reality that a top-class convolved sample can provide. However, in sound as in many fields of artistic endeavour a straight copy with no manipulation, no matter how accurate, often completely fails to convey the same message as the original. Waves IR-1 attempts to bridge the gap between the two technologies to provide a creative tool with real control to enable us to produce illusions of realities, not mere simulacra.

In the IR-1 the impulse response is used as the raw material, with similar user controls to a conventional





## The controls

**In the centre of the window lies the Impulse Response IR graph. The orange line and break points show any user-defined envelope. The display can be zoomed and/or scrolled using the sliders.**

**Reverse reverses the filter and flips the IR curve front to back. There are buttons to Clear or Bypass the envelope.**

**IR sample Information is shown to the left. Below the sample's original and current parameters are listed. Full CPU toggles the CPU mode between Full and Low — the Low setting saves up to 45% of the CPU cycles by using a simpler convolution.**

**The Reverb Time section allows you to adjust the reverb time ratio. The RT60 display does not update until the convolution has been recalculated. I initially found this odd and the explanation turns out to be somewhat complex. The slider sets the desired reverb time ratio between 0.25 and 4.00 times the original. However the actual RT60 is defined by the 'Shroeder' integral and by an ISO standard, and has to be computed over the whole IR. When the RT60 ratio is increased, a time-stretching algorithm is applied. The ratio in the display does not reflect the exact increase in RT60, simply because it is difficult to design an IR with a precise RT60 value. So Ratio reflects the requested increase, while RT60 shows the actual result obtained after computation.**

**Convolution allows the length of the process filter to be set anywhere from 0 to 6 seconds (or the overall length of the original sample, if shorter). Default is the full sample length.**

**Size uses acoustic modelling on the early reflections part of the IR to increase or decrease the size of the space while maintaining its characteristic signature.**

**Density also uses modelling. This time to control the original IR's reflections, resonances and randomness to make the space seem clearer (grainier) or denser (smoother).**

**Resonance looks at the IR frequency response to derive room modes enabling resonance to be extended or reduced.**

**Decorrelation increases or decreases correlation between channels. It can be used to create a stereo output from a mono IR sample.**

**For hosts with automatic delay compensation the IR-1 does not declare any latency because the dry signal goes to the output without any appreciable delay. However, the processed signal will be delayed by 5.6ms at 96kHz and 11.6ms at 48kHz. This is displayed as a pre-delay in the Wet path. Clicking on the Dry button allows up to 30ms of delay to be added to align the dry and wet signals (or even advance the dry).**

**ERTRX enables the early reflection/tail separation point to be moved 100ms earlier or later. Dry and Direct are not the same thing. Dry is the external input signal whereas Direct is the input signal convolved with the first reflection in the impulse response. In a speaker mic setup this will include the effects of air damping in the original room and the transfer function of speakers and microphones used. (For a purist application you would switch the Direct on and use 100% wet).**

**The Dry/Wet slider sets the ratio between dry and wet signal between 0 and 100%. The IR-1 analyses the impulse response, and separates from it the 'Direct' (if any), 'Early Reflections', and 'Reverb Tail' portions. The Direct, Early Reflection and Tail sections can be independently switched in or out, and their gain and predelay independently adjusted. The Damping section is based on a Renaissance 4-Band paragraphic EQ.**

digital reverb. Although the process is still power hungry, the manipulations to the impulse response resulting from the control settings are calculated off-line and applied as a straightforward convolution, so they don't consume CPU power when the reverb is running.

A broad range of impulse response samples is included with the IR-1, many recorded using the technique described above. Three basic samples, room, studio and plate are part of the software install and can be used on the demo version, the rest arrive on two more CDs. One of these is full of real acoustics ranging from Concert halls, including the Sydney Opera House, through theatres, churches, recording studios, amphitheatres, scoring stages, stadiums, caves, outside spaces, stairwells and rooms down to car interiors. The other CD, a selection of 'Virtual Acoustics' offers the, not very enigmatically titled, LX 48L with a vast number of presets and a range of synthetic effects such as 'Grain Rain', 'Hall of Fame', and 'Rotor'.

For ambitious and/or dedicated users it is possible to record, process and import IRs in .wav and Waves' native .wir formats (in 16 and 24 bit or 32-floating point, with sample rates between 44.1kHz and 192kHz). The plug-in automatically sample-rate converts the IR to the project sample rate (96kHz maximum).

IR-1 can be instantiated in a variety of channel configurations. A single convolution gives mono to mono, mono input to stereo output uses two convolutions, 'Efficient Stereo' also uses two convolutions for 'multi-mono' processing. Full stereo with left to stereo and right to stereo is the purist approach but also the most processing intensive with four convolutions.

The Native version lists at UK£595 and the TDM at UK£895 (both plus VAT). This is a steal for what you are getting. If you disagree, thinking of the convolution reverbs bundled with some DAW software, consider this. Just as with hardware reverberators, all plug-in convolution reverbs are not created equal. The same equally applies to other plug-ins. Simple algorithms may reduce the horsepower requirement but there is often a price to be paid in the sound. This is before considering the production costs of obtaining the kind of samples included here. Then there is the interface and stability to consider. The IR-1 interface follows Waves' familiar 'house style' and manages to make the large number of parameters comprehensible and easy to use. Stability is a given, I had absolutely no incidents of any kind with the IR-1 even on a fairly modest P4 system.

In an age obsessed by the transient it is refreshing to find a company prepared to invest time and money in doing something as well as it can be done, given the current state of knowledge, rather than settling for the quick and dirty fix. The sophisticated nature of the sampling techniques leaves wide open the possibility of a surround version. Not only in LCRS, 5.1 or 7.1, but any future surround format. Waves is not saying anything, but I will be astonished if it doesn't produce a surround version.

The combination of Farina's purist approach with Waves parametric processing expertise and engineering excellence in the real world makes the IR-1 the most usable convolution reverb yet.

All of the foregoing would be supremely irrelevant if the IR-1 did not deliver. It does. Superlatives are futile. I can only suggest you take the time to listen to the IR-1 in a good environment with material you know well. For my money, and at any price, these are some of the most natural and desirable reverbs around — period. ■

**PROS** **Just listen to it; best of both worlds; produces something greater than the sum of its parts.**

**CONS** **No surround version – yet; you have to wait (not long) for recalculation before you can hear the result of control changes.**

**EXTRAS** **Every *Resolution* reader in the UK and Eire who buys the IR-1 before the 30 April 2004 will receive an iLok (RRP UK£49) free of charge and a 10% discount on the IR bundle from Sonic Distribution through your local Waves reseller.**

**The IR-1 is included on the covermount Waves CD that comes with this issue along with all the other Waves plug-ins as a full working version 2-week time out demo. If the CD is missing or damaged readers can apply for a replacement free of charge through Sonic.**

**Sonic Distribution is also offering various time-limited discounts exclusively to *Resolution* readers during this period on other Waves software products. For more info contact Sonic at resolution@sonic-distribution.com or phone +44 (0)1525 840 400 and quote 'Resolution offer'**

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