Understanding Sound

Since moving the controllers on the JP-8000's front panel will modify the sound, it's easy to make new sounds. However if you have a certain sound in mind, moving the controllers at random will not get you any closer to the desired sound. In order to create the sound you want, you will need a basic understanding of sound. This section will provide the basic understanding of "sound" that you need. Reading and understanding it will help you create the sounds you want.

The Basics of Sound

In our lives we are surrounded by all types of sound. These sounds exist as "waves," or vibrations in the air. When these vibrations reach our ear and are conveyed to the brain, they are interpreted as "sound." The shape of these "waves" determines the type of sound that they are perceived as.

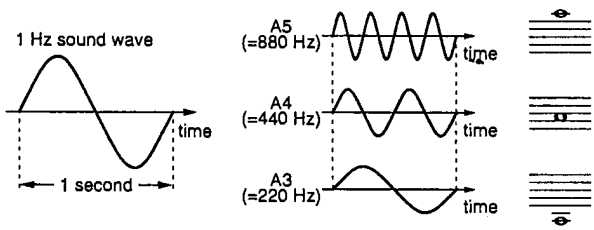
The three elements of sound

The three elements of sound are "pitch," "brightness," and "volume."

■ Pitch

Pitch is determined by the speed at which the wave repeats. A wave which repeats at a frequency of once each second is refereed to as a "1 Hz" (Hertz) wave.

As the frequency increases, the pitch will rise. As the frequency decreases, the pitch will be lower. For example, A4 (middle A) has a frequency of 440.0 Hz, but if this is raised an octave the frequency will be doubled (A5 = 880.0 Hz), and if it is lowered an octave the frequency will be halved (A3 = 220.00).

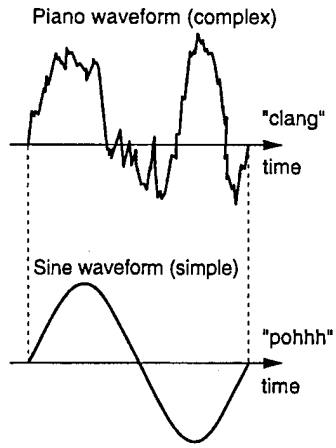


→ KEY BOARD OSC SHIFT [-OCT]/[+OCT] (p.71)

■ Brightness

Brightness is determined by the form (shape) of the wave. For example if you compare a piano waveform with a sine waveform, you will see that the piano waveform is much more complex than the sine waveform. Such differences in complexity are interpreted by our ears as the "brightness" of the sound.

Brightness is also closely related to the "partials" (overtones) that will be discussed later.

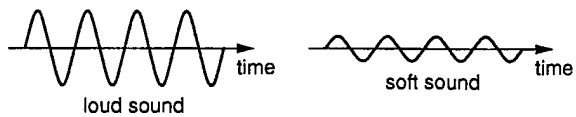


→ OSC 1 [WAVEFORM] (p.55)

→ OSC 2 [WAVEFORM] (p.57)

■ Volume

Volume is determined by the amplitude (size) of the waveform. Greater amplitude means louder volume, and lesser amplitude means softer volume.



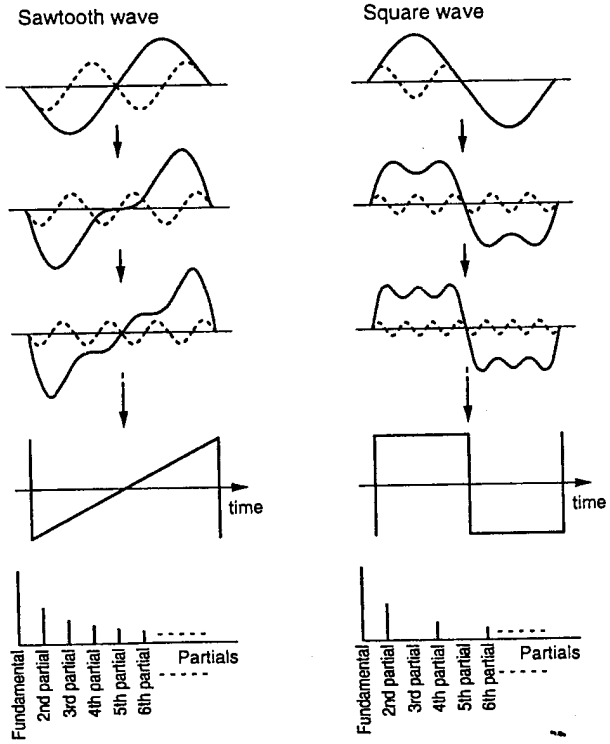
→ AMP [LEVEL] (p.62)

Partials

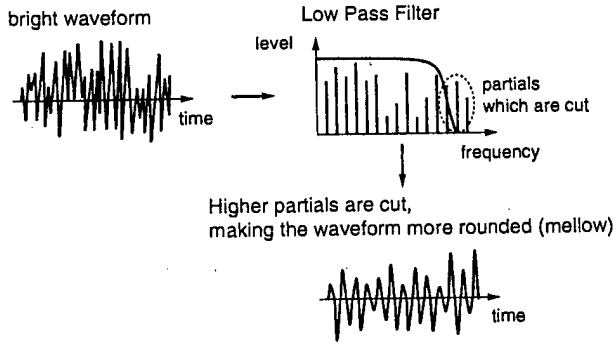
We have mentioned that the brightness is determined by the shape of the waveform, but how is the shape of the waveform determined?

It is generally known that waveforms are made up of multiple sine waves. For example, sawtooth waves or square waves consist of a fundamental (the "basic" frequency) plus integer multiples of the fundamental frequency such as 2x, 3x, ... and so on. These multiples of the fundamental frequency are referred to as "overtones" or "partials."

Partials which are integer multiples of the fundamental are referred to as "harmonic partials," and partials which are not integer multiples of the fundamental are referred to as "inharmonic partials." By combining these partials, an infinite range of sounds can be created.



The more high-frequency partials are included in a sound, the brighter it will appear. The more low-frequency partials are included in a sound, the mellower (darker) it will appear. The technique of cutting these partials to modify the brightness (= waveform) of the sound is known as "subtractive synthesis," and is one of the most common methods of synthesis. This means that synthesizers which use this method of synthesis need to contain waveforms which include a rich assortment of partials. By using a filter to selectively cut these partials, the brightness of the sound can be modified.



→ FILTER [TYPE] / [CUTOFF FREQ]/[RESONANCE]/ [-12dB/-24dB]/[KEY FOLLOW] (p.59)

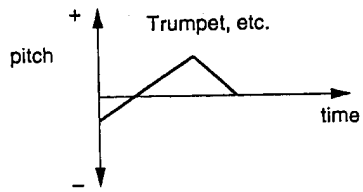
In addition to the filter, the waveform can be modified by Sync, Ring Modulator, or Cross Modulation to modify the waveform in various ways.

Time-variant changes in the sound (Envelope)

On any acoustic instrument, the waveform goes through various changes between the beginning and the end of the note. This is because each of the three elements of sound (pitch, brightness and volume) change as time passes.

These time-variant changes are referred to as the "envelope," and every natural instrument has its own characteristic envelope.

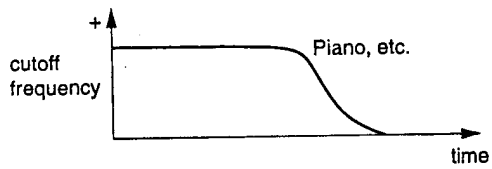
■ Pitch envelope



Brass instruments such as the trumpet often have a slight variance in pitch when the musician first begins to blow. On a synthesizer, this "time-variant pitch change" is created by the Pitch Envelope.

→ OSC COMMON [A]/[D] (p.59)

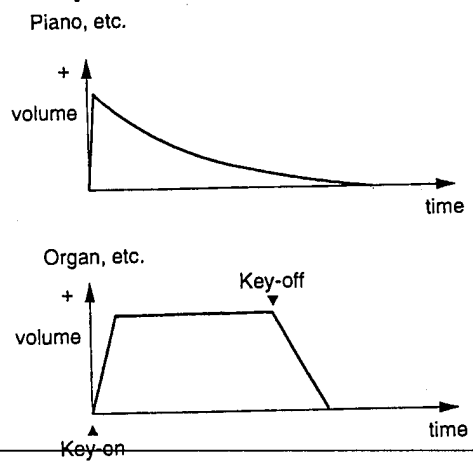
■ Filter envelope



Notes on a piano etc. contain the most partials (i.e., are brightest) when the note begins, and as the sound decays, the upper partials gradually diminish, causing the tone to become more mellow (darker). On a synthesizer, this "time-variant change in brightness" is created by the Filter Envelope.

→ FILTER [A]/[D]/[S]/[R] (p.61)

■ Amplifier envelope



On a piano, the sound begins the instant that the key is pressed, and gradually diminishes in volume. However on an organ, the same volume is maintained as long as the key is pressed. On a synthesizer, this type of "time-variant change in volume" is created by the Amplifier Envelope.

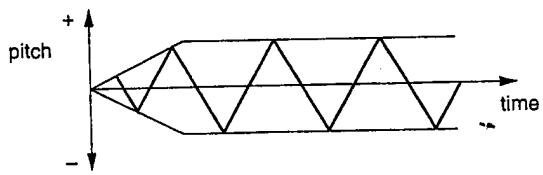
→ AMP [A]/[D]/[S]/[R] (p.62)

Adding Expression to Sound

In addition to the "three elements of sound," there are many ways in which expression can be added. This section explains some of these ways.

Using the LFO

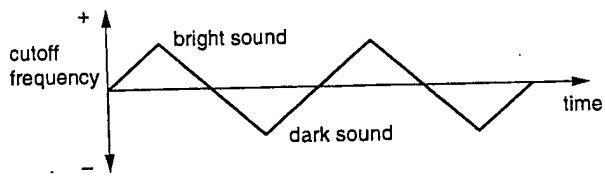
■ Vibrato

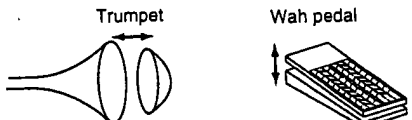


Vibrato is a cyclic modulation of the pitch. This is a performance technique often used by vocalists and on violin or flute to add expression to the sound.

→ LFO 1 [RATE] (p.63) +OSC COMMON [LFO 1 DEPTH] (p.58) etc.

■ Wah

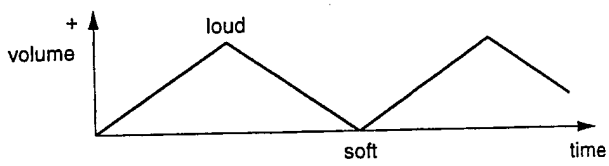




Wah is a cyclic modulation of the brightness. This is a performance technique that can be heard when a cup mute is used on a brass instrument, or when a wah pedal is used on an electric guitar.

→ LFO 1 [RATE] (p.63) +FILTER [LFO 1 DEPTH/PAN] (p.61) etc.

■ Tremolo



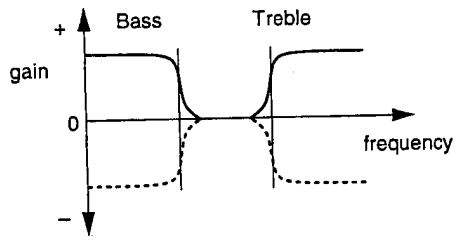
Tremolo is a cyclic modulation of the volume. This is an effect that is frequently used on electric pianos.

→ LFO 1 [RATE] (p.63) + AMP [LFO 1 DEPTH] (p.62) etc.

Effects

Effects can be categorized into two types: those which modify the overtone (partial) structure to modify the original sound itself, and those which add sound to the original sound.

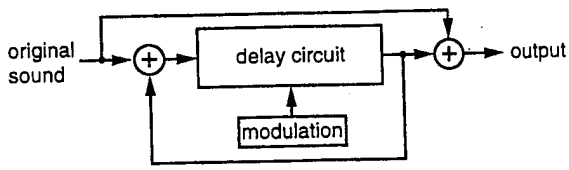
■ Tone Control



This effect adjusts the balance between the high and low frequencies by emphasizing/attenuating the high/low frequency ranges.

→ TONE CONTROL [BASS]/[TREBLE] (p.64)

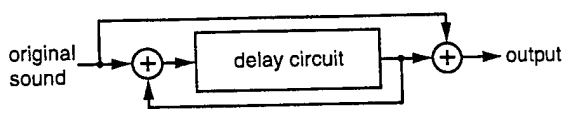
■ Chorus



This effect adds a slightly time-delayed sound to the original sound, making the sound depth and spaciousness.

→ CHORUS [LEVEL] (p.64)

■ Delay



This effect adds a time-delayed sound to the original sound, creating an echo-like effect.

→ DELAY [TIME]/[FEEDBACK]/[LEVEL] (p.65)