

# ToneCarver

## Boids v1.0

## User Guide

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# Overview

## Overview

The Boids plugin is a hybrid Granular + Delay plugin that features a 2D “Boid” swarm as a modulator for the grain and delay parameters. This plugin grew out of an interest to accomplish two different goals:

- Finding a way to manage grain swarms visually.
- Creating delay-based ambience that has subtle, not quite random, variations.



Figure 1 - Boids Screen View

Although the original goal for the plugin was to be able to produce subtle effects, the ranges of the controls are not limited to just that and the plugin is capable of producing a range of effects from subtle to extreme.

## Boids

The Boid Swarm represents a set of flocking boids (a boid is a "Bird Android" - see Craig Reynolds work: <http://www.red3d.com/cwr/boids/>). There are a few simple rules that each boid uses to determine

where it will fly to on the next swarm advance. These include rules for how fast to fly, how near to fly to other boids, how strongly to move to the center of the flock, how strongly to follow a leader boid, and how strongly to match the position and direction of nearby boids.

## Using Boids to Control Effects

The swarm space that the boids fly in is treated as a 2D coordinate system where the X (horizontal) and Y (vertical) position of each boid can be used to modulate plugin controls.

The plugin supports multiple grain streams and multiple delay taps. Each grain stream or delay tap is automatically associated with one of the boids in the swarm. The X position, Y position, Radius position and ID number of the boid associated with a grain stream or tap can be assigned to modulate the controls that define how each specific grain or tap will be produced. I.e. each sound manipulating event is associated with one of the boids and the dynamic properties of that boid may be used to provide event-specific modulations.

For example, the X position of a boid can be assigned to control the pan value for the delay taps. For each delay tap, the X position of the boid associated with that delay tap will determine its pan position in the output stereo field. Different taps will have different pan values depending on the location of the boid associated with the tap. In this configuration delay tap signals will move through stereo positions as the boids move through the swarm space.

Similarly, the Y position of a boid can be assigned to control grain pitch so that grains in a grain stream alter pitch as the boid moves vertically. Each grain stream may have a different pitch value depending in the location of the boid that is associated with the grain stream.

Boids have 4 characteristics that are used to modulate controls:

- X position        - the horizontal position of the boid
- Y position        - the vertical position of the boid
- Radius position - the distance from the center of the swarm space
- Boid Number    - a sequential ID number

The X, Y and Radius values are determined from the boid's position in the swarm space. The Boid Number is a constant value that is assigned to the boid when it is created. The boid number can be used as a modulator to "spread out" a range of values evenly for all boids in the flock. This is useful for setting a Pan value, for example, to give each grain or tap an evenly divided percentage of the total range.

## Leader Boid

There is one boid, the first boid created in a swarm, that is designated as the "Leader Boid". This boid appears inside a small circle to easily identify its position. This boid serves two purposes: as a focal point for other boids to "follow" (to the degree set by the Follow control), and as a source of additional modulation values.



## Chasers

Chaser boids are provided to add some additional chaos to the swarm. They chase after regular boids and regular boids move away from them. A swarm may have zero or more chaser boids. Chaser boids are not associated with grains or taps and are not a modulation source. Their purpose is to add chaos and movement to the swarm.

## Control Zones

The plugin controls are grouped into zones where each zone controls a logical portion of the plugin.



Figure 2 – Control Zones

Each of these zones is covered in subsequent sections.

# Signal Flow

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## Signal Flow

Boids has 2 processing engines: a grain engine and a delay engine. Each engine may be independently switched on or off. The mixer section shows the signal flow through the plugin. (See the Mixer section for details on the controls). Input arrives from the host, and is directed to the engines that are enabled. Output from the grain engine may be sent to the host and also cascaded into the delay engine. Output from the delay engine may be sent to the host. Dry output may also be sent to the host.

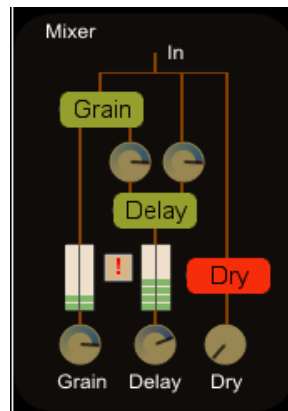


Figure 3 - Signal Flow

# Common Controls

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## Common Controls

This section introduces some common controls and control interactions.

## Status Display

Parameter values are displayed to the Status Display in the middle area of the plugin screen.

## Knobs

Left-click and drag on the knobs to rotate them. Hold down the Ctrl key for more accurate movement.

## Spinner

Spinner controls provide a list of items you may choose from. Right-clicking in the spinner box brings up a popup menu that you may select from. Left-clicking in the spinner box then mouse-wheeling or dragging cycles through the selections.

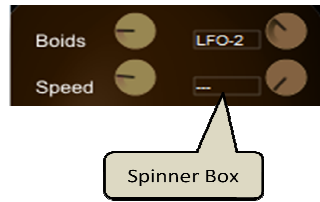


Figure 4 - Spinner Control

## Modulatable Parameters

Parameters that may be modulated are shown a parameter name, a value knob, a modulation source spinner and a modulation depth knob. A modulator source showing "---" indicates that no direct modulation source is associated with the parameter (although it could still be modulated if it is a target in one of the active modulation matrix modulators).

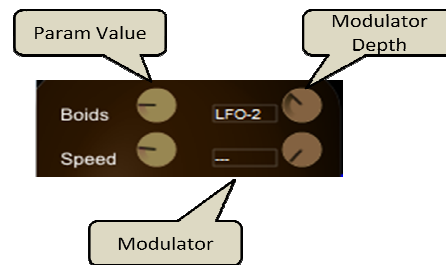


Figure 5 - Modulatable Parameter

## Modulator Sources

The following table describes the modulator sources.

Mod Source	Description
--	Indicates that modulation source is not assigned
LFO n	Modulation source is LFO
Random	Modulation source is a random number
Boid X	The X position of the Boid associated with the Grain Stream or Delay Tap is the modulation source. Values increase as Boid moves closer to left.
Boid Y	The Y position of the Boid associated with the Grain Stream or Delay Tap is the modulation source. Values increase as Boid moves closer to top.
Boid R	The Radius position (distance from center of swarm display) of the Boid associated with the Grain Stream or Delay Tap is the modulation source. Values increase as Boid moves away from center.
Boid X -	The X position of the Boid associated with the Grain Stream or Delay Tap is the modulation source. Values increase as Boid moves closer to right. (Opposite of Boid X)
Boid Y -	The Y position of the Boid associated with the Grain Stream or Delay Tap is the modulation source. Values increase as Boid moves closer to bottom. (Opposite of Boid Y)
Boid R -	The Radius position (distance from center of swarm display) of the Boid associated with the Grain Stream or Delay Tap is the modulation source. Values increase as Boid moves closer to center. (Opposite of Boid R)

Boid ##	The Boid number is modulation source. Each Boid is assigned an equal percentage of the range. The Lead Boid has the first (lowest valued) portion and the highest Boid number has the last. For example, if there are 4 Boids then the Boids are assigned modulation values 0, 25, 50, and 75.
Boid ## -	The Boid number is modulation source. Boids are placed in order Opposite of Boids ##.
Lead X	The X position of the Lead Boid is the modulation source. Values increase as Boid moves closer to left.
Lead Y	The Y position of the Lead Boid is the modulation source. Values increase as Boid moves closer to top.
Lead R	The Radius position of the Lead Boid (the distance from center of swarm display) is the modulation source. Values increase as the Boid moves away from center.
Lead X -	The X position of the Lead Boid is the modulation source. Values increase as the Boid moves closer to right. (Opposite of Lead X)
Lead Y -	The Y position of the Lead Boid is the modulation source. Values increase as the Boid moves closer to bottom. (Opposite of Lead Y)
Lead R -	The Radius position of the Lead Boid (the distance from center of swarm display) is the modulation source. Values increase as Boid moves closer to center. (Opposite of Lead R)

Table 1 - Modulation Sources

*Hint:* The “Boid ##” and “Boid ## -” sources can be particularly useful for spreading out parameter values, particularly for Pan, Delay Time, and Grain Pitch.

## Tempo Sync

Parameters and controls whose values are related to time (rates, delay times, grain length) have an additional widget to sync the time to the host tempo. Click the widget to toggle states. When the widget shows "s" the control is operating in "sync to host tempo" mode. When the widget shows "m" the control is operating in "millisecond" mode.

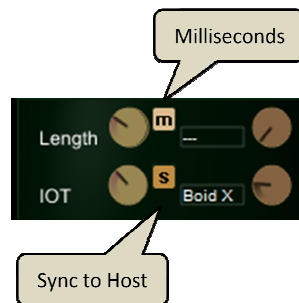


Figure 6 - Tempo Sync

# Swarm Display

## Swarm Display

The Swarm Display shows the Boids flying through the 2D swarm space. There is one "leader" Boid (the first Boid created) whose position is drawn with a circle to identify it as the leader. Boids are assigned random colors as they are created and begin their flight from random locations within the swarm space.

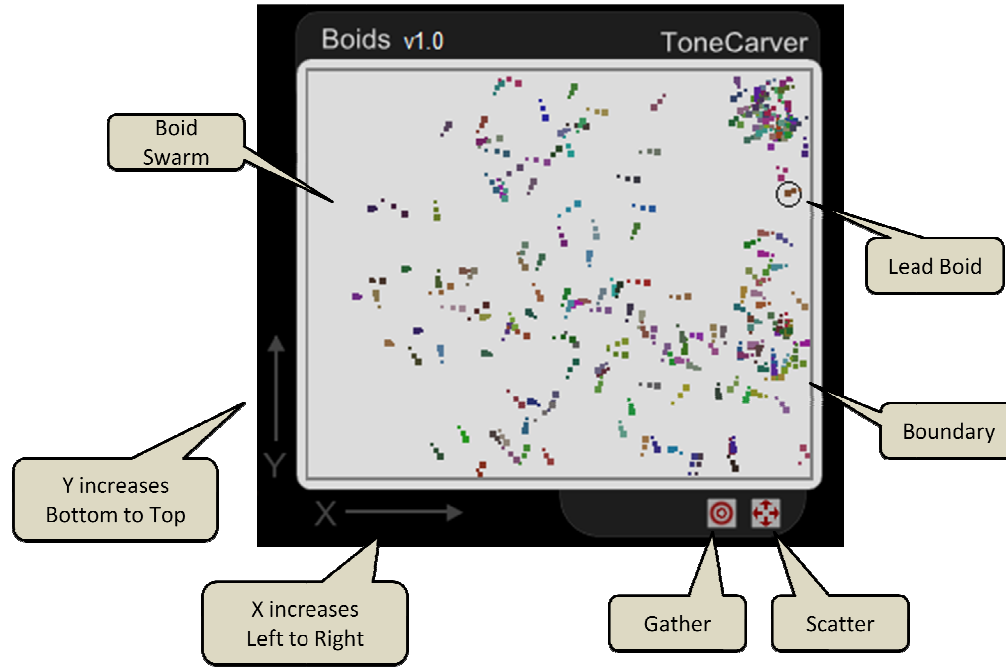


Figure 7 - Boids Swarm View

The display is laid out using X and Y coordinates which come into play later when using the Boid positions as modulator sources. The X coordinates grow horizontally from left to right. The Y coordinates grow vertically from bottom to top.

Chasers are drawn as large black squares to distinguish them from regular Boids.

Boids and Chasers are drawn with "tail" markers showing the last few positions of a Boid. The distance between the tail positions increases as the Boid speed increases.

## Boundary Box

The Boid Display shows a gray rectangle identifying the limits of the swarm space. Boids are generally limited to moving within the bounding box unless extreme settings force them outside. If the bounding box is moved away from the Boids they will move towards the bounding box in order to eventually find a flight path within the box.

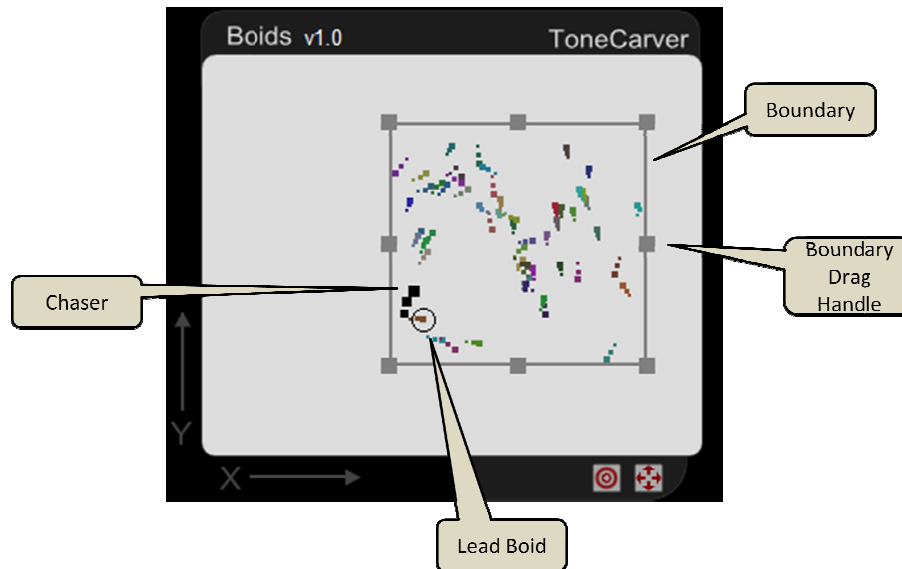


Figure 8- Boids Swarm View + Bounding Box

To select the boundary box, click on or inside the boundary box. Gray handles appear at the corners and the middle of the line segments. Dragging the handles resizes the bounding box. Clicking and dragging within the bounding box drags the entire box without resizing it. Click outside the box (or in the tool palette) to unselect the bounding box.

*Hint:* Narrowing the bounding box is a good way to force Boids to have a higher/lower occurrence of specific X or Y values in order to manage the effect of modulators assigned to Boid X or Y.

## Tool Palette

The tool palette is under the lower right side of the Swarm Display. There are two tools in the tool palette (so far...), the Gather tool and the Scatter tool.

### Gather

Left-click on the Gather tool and drag it over the Boid Display to cause the Boids to follow the mouse position.

### Scatter

Left-click on the Scatter tool and drag it over the Boid Display to cause the Boids to avoid the mouse position.

# Boids

## Boids

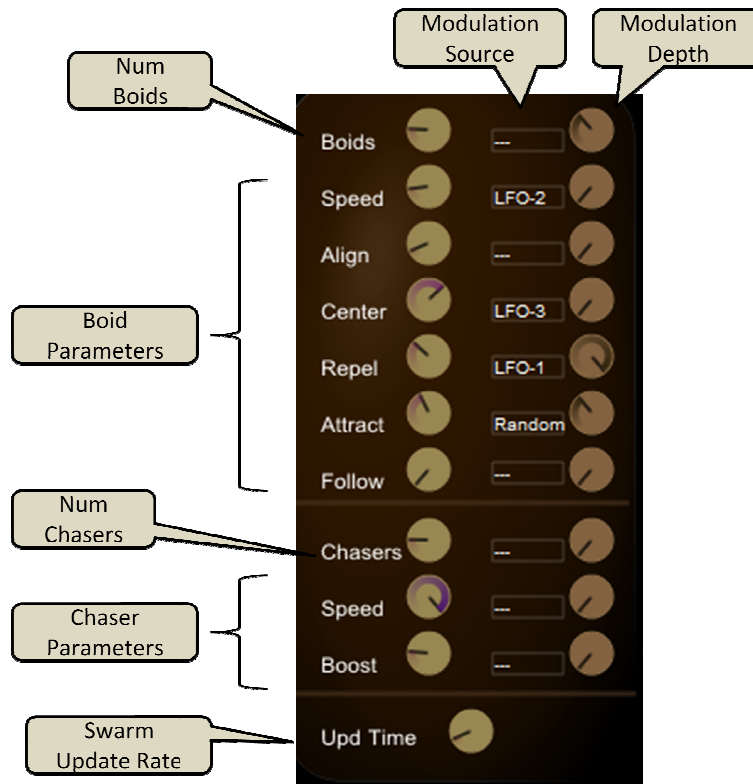


Figure 9 - Boids Controls

**Boids** - controls the number of boids in the swarm.

**Speed** - controls how fast the boids fly, i.e., the distance a boid travels each time the swarm distribution is computed.

**Align** - the tendency of boids to line up (match speed and direction) with neighboring boids.

**Center** - the tendency of boids to move towards the center of the flock.

**Repel** - the tendency of boids to avoid being near other boids.

**Attract** - the tendency of boids to be comfortable being near other boids.

**Follow** - the tendency of boids to follow the leader boid.

## Chaser Controls

**Chasers** - controls the number of Chasers in the swarm.

**Speed** - controls the speed of the Chasers.

**Boost** - controls the tendency for Chasers to speed up as they near their target.

## Swarm Controls

**Upd Time** - controls how often the new boid positions are computed.

*Hint:* Balance the use of the Speed control and the Upd Time control. Higher value of Upd Time increase CPU usage, higher values for Speed do not. But, higher values for Speed make the boids tend to stay separated (harder for them to turn and stay close).



# Grain Streams

## Grain Streams

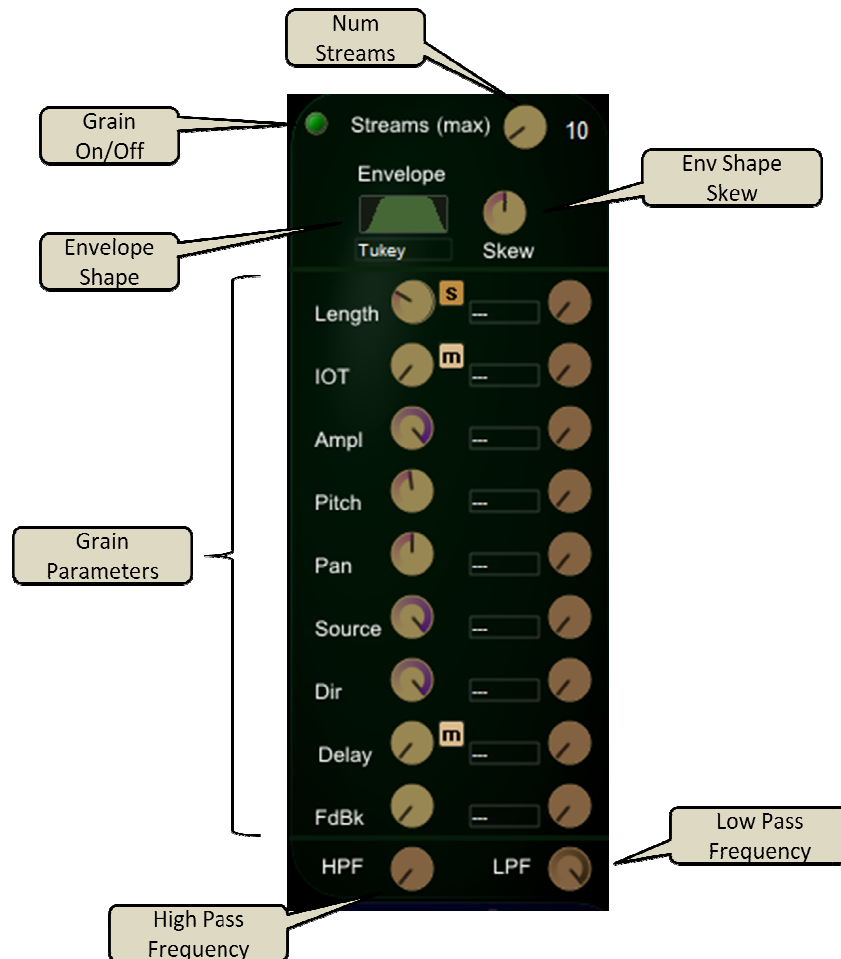


Figure 10 - Grain Stream Controls

**On/Off** - green indicates that the granular engine is active, red indicates that it not.

**Streams (max)** - sets the maximum number of Grain Streams. Each Grain Stream is assigned to one of the Boids so the total number of Grain Streams is limited to the number of Boids. If Streams (max) is set larger than the number of Boids then the number of Grain Streams is equal to the number of Boids. If the Streams (max) is less than the number of Boids then the number of Grain Streams is equal to Streams (max).

**Envelope** - controls the shape of the grain envelope. Experimentation pays off here by selecting different envelope types (and skews) to control the spectral content of the Grain Streams. Envelopes with corners tend to be more noisy than smooth envelopes. Envelopes with narrow peaks tend to have

less low frequency content than those with wider peaks. Use the spinner below the envelope image to select the envelope type.

**Skew** - modifies the envelope shape.

**Length** - the length of the grains.

**IOT** - Inter Onset Time, the time gap between grains.

**Ampl** - controls the grain amplitude.

**Pitch** - controls the pitch (playback speed) of the grains.

**Pan** - sets the L/R pan of the grain output.

**Source** - selects grain source as L or R.

**Dir** - controls the playback direction of the grain. Use 0 for forward playback, 1 for reverse.

**Delay** - controls playback delay time.

**FdBk** - controls the amount of feedback on the grain delay lines. Depending on the settings of the other parameters this control can be sensitive and can cause runaway feedback quite quickly in some cases. The HPF is handy here to cut out the low end which tends to buildup very rapidly. Also, turning down the Ampl reduces the input levels to the delay line. Use the Panic Button (see the Mixer section) to temporarily interrupt the delay line if necessary.

**HPF** – sets the cutoff frequency for the high pass filter for the grain output.

**LPF** – sets the cutoff frequency for the low pass filter for the grain output.

# Delay

## Delay Taps

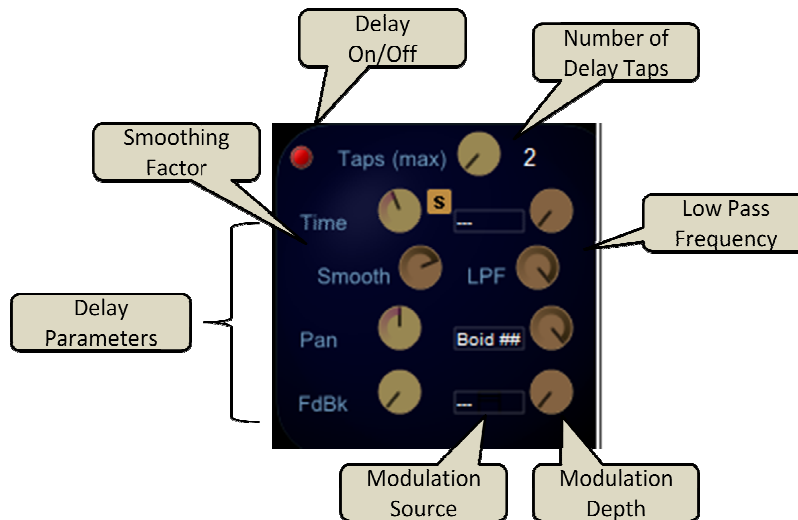


Figure 11 - Delay Controls

**On/Off** - green indicates that the delay is active, red indicates that it not.

**Taps (max)** - sets the maximum number of Delay Taps. Each Delay Tap is assigned to one of the Boids so the total number of Delay Taps is limited to the number of Boids. If Taps (max) is set larger than the number of Boids then the number of Delay Taps is equal to the number of Boids. If Taps (max) is less than the number of Boids then the number of Delay Taps is equal to Taps (max).

**Time** - controls the delay time.

**Smooth** - a smoothing factor to manage artifacts (clicks) resulting from large jumps in delay times. Lower smooth values will leave delay jump artifacts in. Higher smooth values will dampen them out. Selecting the appropriate value is a matter of experimentation and personal preference.

**LPF** – sets the cutoff frequency for the low pass filter applied to the feedback loop.

**Pan** - controls the L/R pan of the delay output.

**FdBk** - controls the delay feedback. Depending on the settings of the other parameters this control can be sensitive and can cause runaway feedback quite quickly in some cases. Use the Panic Button (see the Mixer section) to temporarily interrupt the delay line if necessary.

# LFOs

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## LFOs

Boids has 4 low frequency oscillators that can be used as modulation sources.

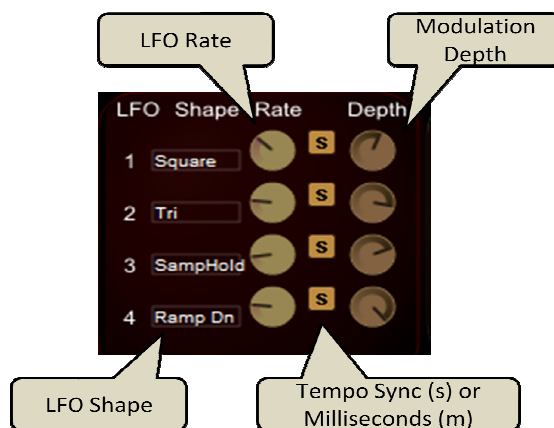


Figure 12 - LFO Controls

**LFO** -the LFO number

**Shape** - controls the shape of the LFO.

**Rate** - controls the speed of the LFO.

**Depth** - controls the depth of the LFO.

# Modulation Matrix

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## Modulation Matrix

Boids has a modulation matrix that assigns modulators to parameters. Multiple modulators can be assigned to the same parameter.

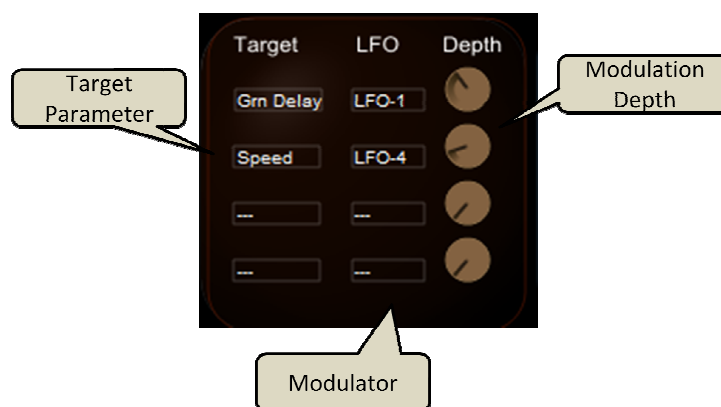


Figure 13 - Modulation Matrix

**Target** - selects the modulation target, the parameter to be modulated.

**LFO** - selects the LFO that will modulate the target.

**Depth** - controls the depth of the modulation.

# Mixer

## Mixer

The Mixer shows the signal path through the plugin and provides controls to enable/disable the major signal paths and controls to apply gain adjustments along the way.

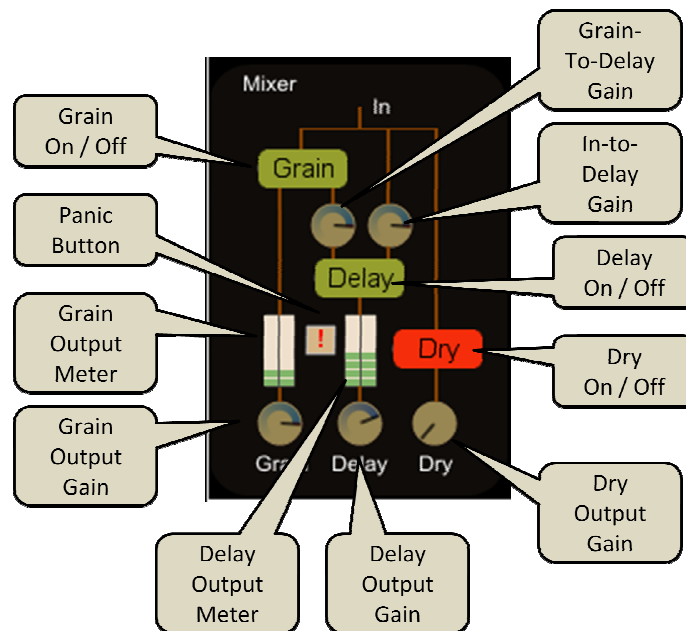


Figure 14 - Mixer Controls

**Grain (button)** - enables/disables the grain engine.

**Delay (button)** - enables/disables the delay engine.

**Dry (Button)** - enables/disables the Dry output.

**Grain-to-Delay Gain** - controls the amount of Grain output provided as input to the Delay Engine. This control has no effect when the Grain Engine or the Delay Engine is disabled.

**In-to-Delay Gain** - controls the amount of input signal processed by the Delay Engine. This control has no effect when the Delay Engine is disabled.

**Grain Meters** - show the output level of the Grain Engine.

**Delay Meters** - show the output level of the Delay Engine.

**Panic Button** - temporarily clears the delay buffers to interrupt runaway feedback conditions.

**Grain** - controls the output level of the Grain Engine. This control has no effect when the Grain Engine is disabled.

**Delay** - controls the output level of the Delay Engine. This control has no effect when the Delay Engine is disabled.

**Dry** - controls the output level of the Dry signal.

# Presets

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## Presets

Boids uses text files to store presets.

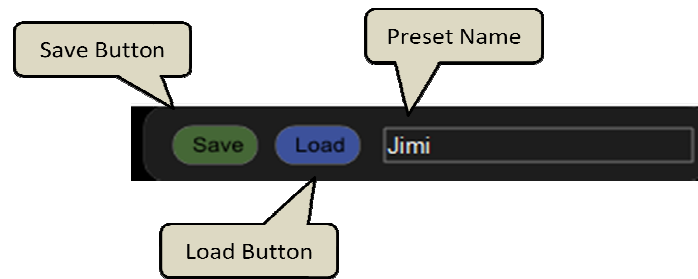


Figure 15 - Preset Controls

**Load** - opens a file dialog to load a preset from a file.

**Save** - opens a file dialog to save the current settings to a preset file.

The preset name box shows the name of the most recently loaded preset. An asterisk (\*) after the name indicates that one or more controls have been changed since the preset was loaded.

# Configuration File

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## Configuration File

On startup, Boids reads a text file describing some global configuration parameters. The file is named "Boids.ini" and should be placed in the same directory as the Boids DLL.

Blank lines and lines beginning with a ";" (semicolon) are ignored.

Items in the configuration file are listed as name and value pairs. Values that contain spaces (e.g., "\\Program Files\\") should be enclosed in quotes.

The only parameter that is in the configuration file for this version is the path to the folder of presets for Boids. The parameter name is "PresetFolder". The default value for the PresetFolder is the same directory as the DLL. If you have your preset folder somewhere else you can edit the configuration file to specify that folder as the default.

Here is an example configuration file:

```
; Boids initialization file
PresetFolder    c:\somefolder\otherfolder\Boids\Presets
```



# Installation

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## Installation

To install Boids:

1. Select the version that is compatible with your system and copy it to your VST DLL directory:  
Boids32.dll is a 32-bit version of Boids (no SSE)  
Boids64.dll is a 64-bit version of Boids (SSE2)
2. Copy the Boids.ini file to the same directory.
3. Copy the Presets folder to a directory of your choosing.
4. Edit the Boids.ini file in the Boids DLL directory and set the PresetFolder parameters to point to the directory where the Presets folder is located.

## Credits

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This plugin was written for the KvR Developer Challenge 2012.

## Credits

Craig Reynolds - <http://www.red3d.com/cwr/boids/>

Boids Applet - <http://www.cs.ioc.ee/~ando/boids.php>

Boids Pseudocode - <http://www.kfish.org/boids/pseudocode.html>

WDL/IPlug Framework - <http://www.cockos.com/wdl>

KnobMan - <http://www.g200kg.com/en/software/knobman.html>

SkinMan - <http://www.g200kg.com/en/software/skinman.html>

## Wish List

Possible future enhancements:

- Accept MIDI input for controlling the position of the Scatter and Gather cursors
- Transmit MIDI output from the Scatter and Gather cursor positions
- MIDI Learn for the controls
- Add Envelope Skew as a modulation target
- Add Delay Smoothing as a modulation target
- Simplify the main screen. Use panels (maybe tabbed panels) to organize the controls
- Input Trim
- Separate delay times for the Left and Right delay lines in the delay engine.
- option to invert swarm canvas background to black