

Autocatalysis

Guitar-into-amp feedback, played by MIDI.

MIDI notes pluck six virtual strings. Two virtual amps play them back into the room, and the room sound drives the strings again. Hold a note and it blooms into feedback on one of its harmonics. Which harmonic wins depends on how far the amps are, how the strings ring and how hard the amps are pushed, the way it does on stage.

The name is the dynamics. The feedback feeds itself until it runs out of supply: the amp's power supply sags under load, and a reaction term (a Brusselator, the textbook autocatalytic oscillator) modulates the power stage. Push Catalysis past its threshold and the amp breathes.

Original design: no sampled amps or impulse responses, and no claim to model a specific amp.

SIGNAL PATH

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MIDI -> 6 waveguide strings -> neck pickup -> amp L -> out L
      ^      ^      bridge pickup -> amp R -> out R
      |      '-- body (solid -> hollow) <-- air
      '----- air drive <-- air <----- amps
              (L at Distance, R at Distance + Offset, Stage reflections)
```

QUICK START

- 1 Load on a MIDI track and hold a low note.
- 2 Raise **Feedback** until it blooms. At the default Drive of 20 dB that happens around 25-35 %.
- 3 Sweep **Distance** to make it jump between harmonics. Sweeping toward the amp gives the classic stepping-closer sound.
- 4 Turn **Catalysis** past about 50 % with **Rate** at 0.5-2 Hz to make the amp breathe.
- 5 Switch **Seek** on and pick a Harmonic to have the device find the distance where that harmonic wins.

CONTROLS

STRINGS

CONTROL	RANGE	WHAT IT DOES
Sustain	0.2-60 s	Ring time (T60) of a held string.
Pick	0-100 %	Pluck brightness.
Damp	0-100 %	String loop loss. Higher pushes the feedback toward lower harmonics.
Body	0-100 %	Solid to hollow body. A hollow body can howl on its own.
Ring	toggle	Released strings keep ringing and stay coupled. Same as the sustain pedal.

CONTROL	RANGE	WHAT IT DOES
Mute	toggle	Damps every string and closes the loop in about 20 ms. The panic button.
AMP		
Drive	0-40 dB	Preamp gain. With Feedback, the main control for how easily it feeds back.
Bias	+/-100 %	Preamp asymmetry (even harmonics).
Tone	+/-100 %	Tilt EQ around 650 Hz, +/-8 dB.
Spread	0-100 %	Neck to L, bridge to R. At 0 % both amps get the mix.
Cab	1x12 / 2x12 / 4x12	Cabinet voicing (open 1x12, closed 2x12 and 4x12).
KINETICS		
Sag	0-100 %	How hard output power drains the amp supply.
Recover	10-3000 ms	Supply refill time.
Catalysis	0-100 %	Reaction strength. The amp breathes above about 40 % (quiet) to 65 % (loud).
Rate	0.05-8 Hz	Reaction speed, roughly cycles per second.
SPACE		
Distance	0.1-8 m	Guitar-to-amp distance. Sets the loop delay and level.
Offset	0-4 m	How much further back amp R stands.
Stage	0-100 %	Room reflections.
Seek	toggle	Moves the air delay to where the chosen harmonic wins.
Harmonic	Fund / Oct / 12th / 2 Oct	Seek target.
OUTPUT		
Feedback	0-100 %	Loop gain, squared taper.
Output	-70 to +6 dB	Level. A tanh ceiling sits at 0.97.

NOTES

Playing

- Notes take strings in this order: a string already on that pitch (re-pluck), then the free string released longest ago, then the oldest held string. Up to six notes sound at once.
- **Sustain pedal** (CC 64) acts as Ring while down. **Pitch bend** is +/-2 semitones. **All Notes Off** (CC 123, sent when the transport stops) releases everything.
- MIDI never writes a Live parameter, so playing leaves undo and automation alone.

Seek

Seek computes the open-loop response of the whole feedback path at the last note's harmonics 1-6 and glides the air delay (0.25 s) to the spot where the target harmonic is in phase. The strip shows Seeking / Locked / Weak and the offset in degrees. **Weak** means other harmonics out-gain the target even at its best spot; the low-E fundamental (under the amp and cab high-passes) and the 4th harmonic (nulled by the neck pickup) are typical.

Kinetics display

Plots the reaction state X (right) against Y (up) for each amp. A still dot is a steady amp; a loop is a breathing one. The two amps see different levels, so they drift out of step and the breathing goes stereo.

Banks (Live Push)

Play: Feedback, Drive, Distance, Offset, Sustain, Damp, Body, Output. **Kinetics:** Sag, Recover, Catalysis, Rate, Bias, Tone, Spread, Stage. **Switches:** Pick, Cab, Ring, Mute, Seek, Harmonic.

Known limits

- One string model for every note: no fret position or string-specific inharmonicity.
- The cabinet is four filters, not an impulse response; close-miked only.
- Both amps share the strings, so stereo width comes from pickups, distances and supply/reaction state, not from two independent pitches.
- With Feedback and Drive both near maximum, damped strings and the body can keep a squeal going after release, as a real amp does.

STATUS

Offline DSP and patch tests pass. In Live 12's bundled Max 9 the gen~ compiles cleanly and all native QA checks pass (silence before the first note, bloom, release, mute, breathing, Seek, mono/stereo). Not yet done: playing it from a MIDI track in a Live set and listening.