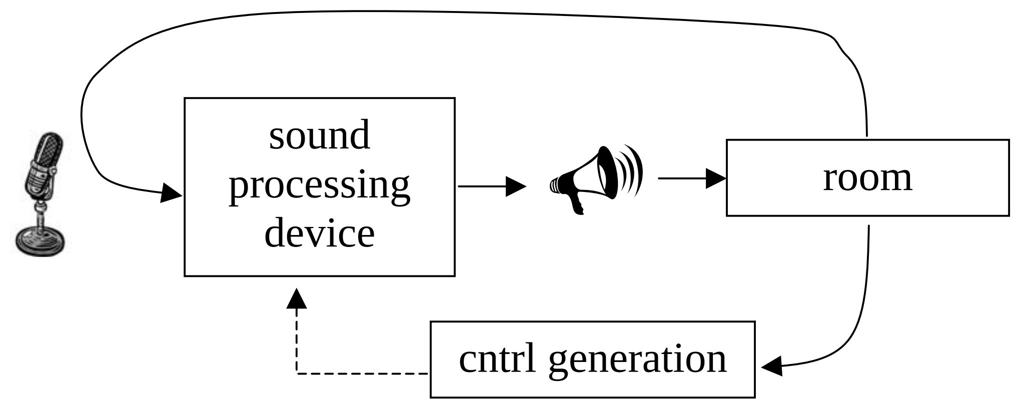
AUDIBLE ECOSYSTEMICS n.2a (FEEDBACK STUDY)
solo live electronics

***room-dependent* network of purely sonic interactions**



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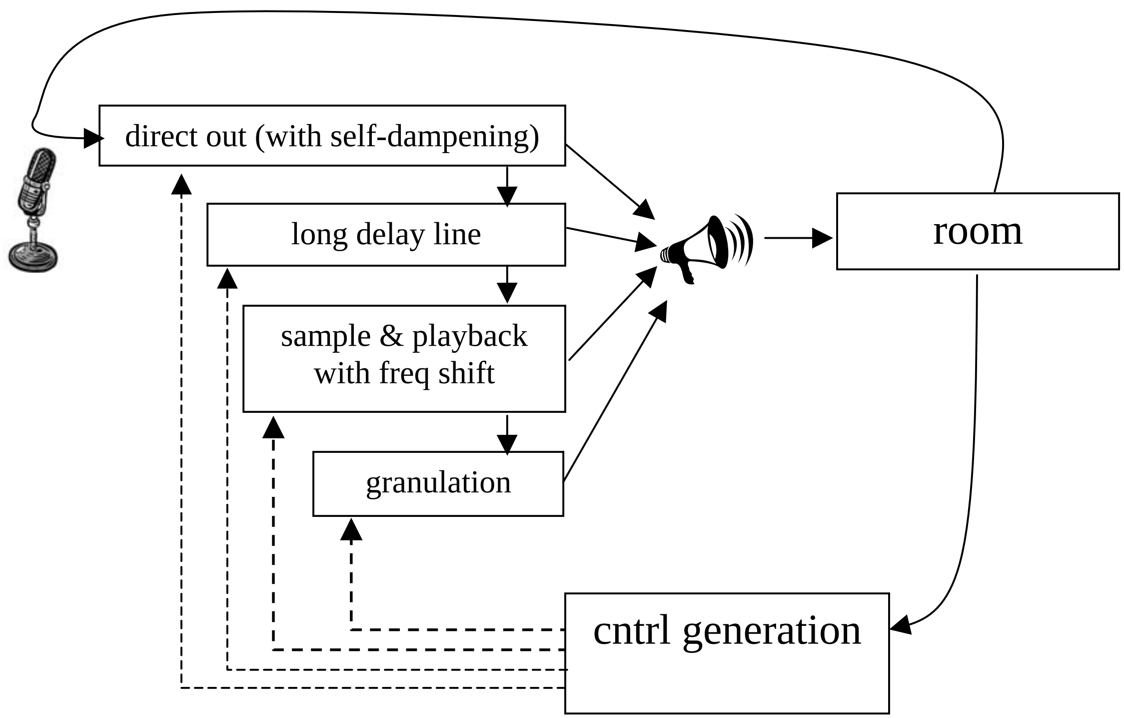
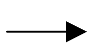
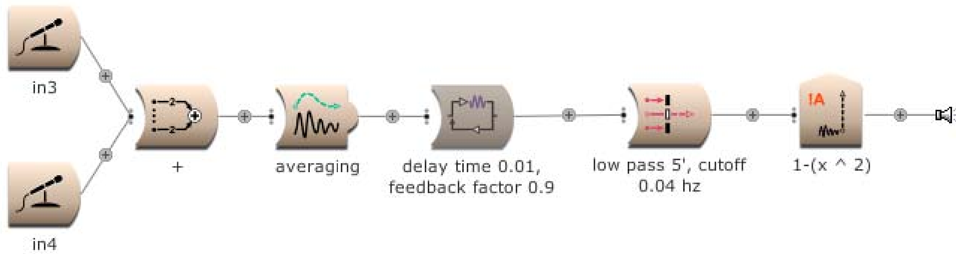
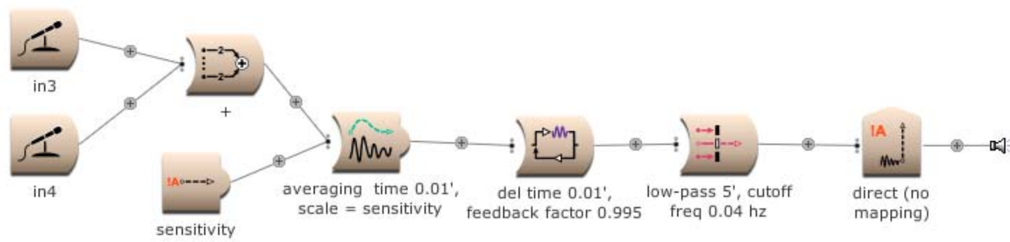




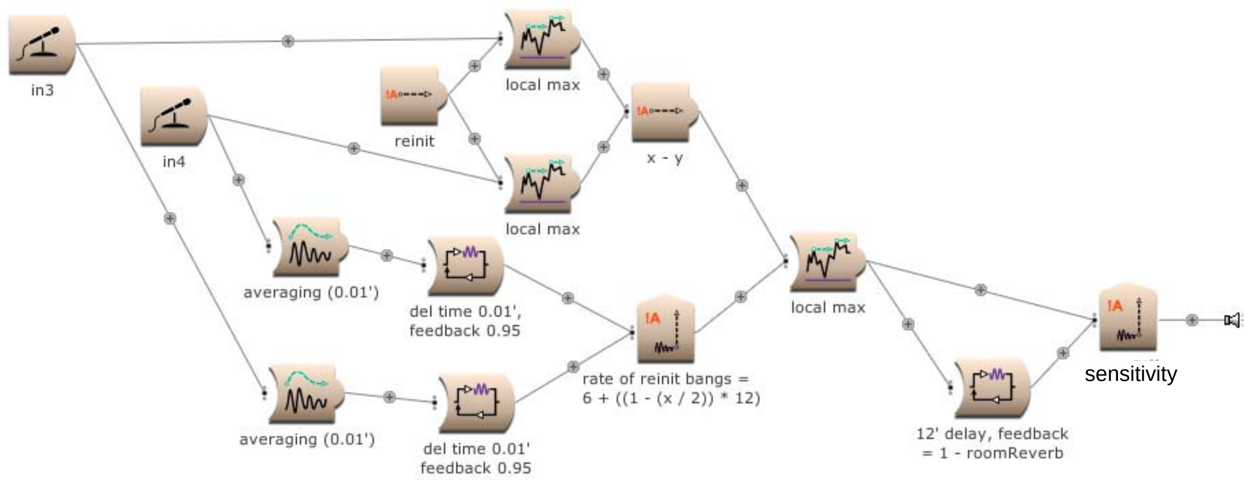
some of the cntrl-signals implemented for *Feedback Study*



This is an estimate of the current level of the total sound in the room. The signals from the two room mics are added together, averaged, and delayed. There is also a low-pass filter to smooth-out some ripples in the final signal. The final mapping is in the reverse range, but with an exponential transfer. The result drives the amount of input audio signal entering the RAM buffer: the louder the room sound, the smaller the input to the RAM buffer. As a consequence, in a short turn of time, the output sound to become sparser or weaker. There we see a principle of compensation, but one whose action indeed affects the sound texture only at a later time.

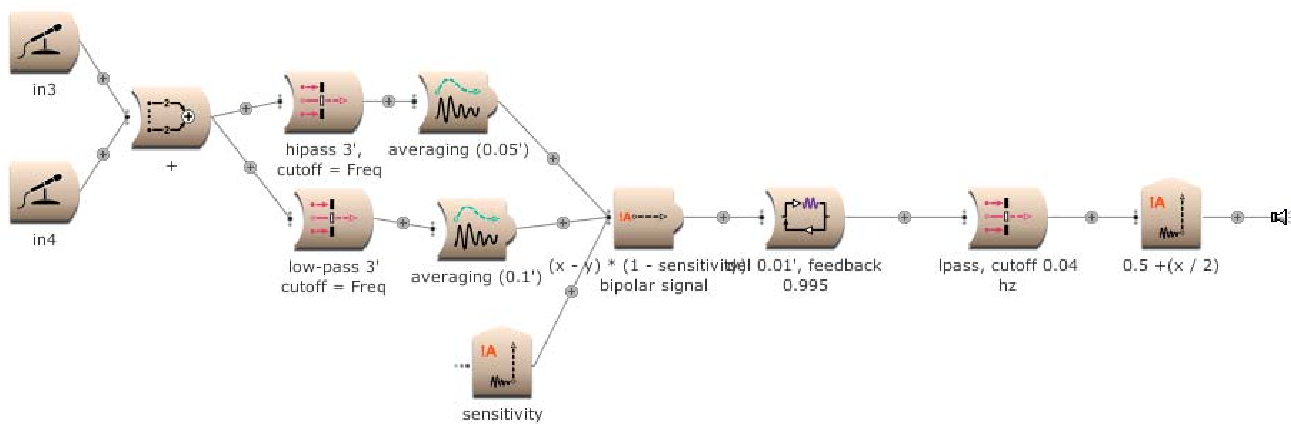


Just like the previous, this is an estimate of the current level of the total sound in the room. However, the amount of signal input to the sliding average (amp following) is driven by another cntrl-signal, "sensitivity". The final signal will be more or less active and responsive to external events, depending on that. Various mapping of the final signal are used in the audio signal transformations, so these latter will indirectly depend on "how sensitive" are these controls to the external events as detected by mic3 and mic4.



The final signal is a rough estimate of how varied or busy has been the overall sound in the room over the last 12' (average value, ranging 6' to 18'). Such an estimate is based upon a measure of the max difference (rightmost local max box) in recent amplitude peak values of the two room microphone (left local max boxes). The peaks themselves are updated every 12' or so, as the autoReinit button takes action.

The final signal will drive the input scale to the feature-extraction process in many of the patch branches generating control signals. That is, it will make the overall signal process more or less active and responsive to the external sound events. A very busy and varied output in the recent past, will make the process more prompt and ready (eventually able to compensate for excessive variety or excessive density of events). A less varied output in the recent past will make it more idle.



tracks down how much different are the energy peaks in the spectrum of the room sound, above and below the init value called "Freq". "Freq" is a value set before performance, in a situation of silence, in a way that the cntrl-sig thus generated shift to a value of 0.5. Therefore, "Freq" is an estimate of the mean frequency in the spectrum of the background noise of the room.

In performance, this will tell us how bright or dark the room sound is, as relative to the mean frequency. However, this estimate will vary as a function of the present "sensitivity to external conditions" in the network (see above).

The final signal is used to drive the playback frequency in real-time sampling&playback processes, to which the input audio is subjected. Some of the playback frequencies will be driven higher than original when this control signal is higher than 0.5, some will be driven lower when control signal is lower than 0.5 (an example of redundancy, in the frequency domain). Other playback frequencies will be driven in the opposite way (an example of compensation).

The performance takes place as a chain of causes and effects, in a network of (composed) low-level interactions of which we only hear higher-level, **emergent** properties (sound, music).

At any one time the current total sound in the environment is the result of all past interactions occurred (**philogenetic** development). Past interactions in the ecosystem (it's *history*) are part of the environment, and provide ineludible context to current operations, affecting present interactions and their future developments.

responsibility (ability to account for the consequences of one's own actions)

↓

..."interaction"...

Conceptual problem : in actual performance "sound" and "environment" are not separate entities (sound happens only in the room, and the room is only part of the performance with its acoustics and in its reponse to sound). There is no way to isolate one from the other, as the interaction is reciprocal and permanent. **Structural coupling**.

The range of system states actually achieved in performance is limited, and that limitation (captured in the particular low-level interactions composed) is the **identity** of the process enacted. **Organizational closure**.

A "good" performance is however one where several system states are achieved, within the limits of the organizational closure. That is heard as different sound events, a variety of textures or gestures of sound, a variety in timbre. Indeed, the sequence of sonic interactions actually taking place in a performance, is one of innumerable different configurations consistent with the system organization. **Structural openess**.

autonomy
autonomous systems (as opposed to allonomous, heteronomous)
are always **ECO↔SYSTEMS**,
however reduced and specific their organization can be

Conceptual problem : in **actual performance** "sound" and "environment" are not separate entities (sound happens only in the room, and the room is only part of the performance with its acoustics and in its reponse to sound). There is no way to isolate one from the other, as the interaction is reciprocal and permanent.

↓

Noise breeds the process, does not corrupt it, as far as the dynamics of the composed interactions are able to turn it into a signal, into a resource, a source of self-organization. Noise is indeed capital, existential: the audio feedback loop itself (the minimal sound-producing device in the present work) is but an accumulation of backround noise (or thermal turbulence). Accidental events (unexpected sounds in the environment, too violent interactions or else) become part of the resources available in the room, affecting the ecosystemic process, and let it shift into extreme, rare regions in the array of all possible system states.

The range of system states is the same as the variety of shapes of sound emerging in the total process, i.e. is heard as the **timbre** of the network of interactions taking place in the particular room. **Timbre** is in fact (another word for) **Form**, an array of invariants as manifested upon contact with given external conditions : identity is preserved under circumstances putting it at risk (noise, again, is crucial).

Space is the medium by and through which the system process comes into existence and express its identity. But it acts as a dialectical force : the room response constantly forces the process to reorganize itself and secure conditions upon which it can preserve its existence while also changing in time. Space puts the sonic identity (timbre) into question, while giving it a chance to manifest itself : there's no individual, separate sound - there's no sound except in conjunction with a space (a more general instance of structural coupling).

Conceptual problem : in **actual performance** "sound" and "environment" are not separate entities (sound happens only in the room, and the room is only part of the performance with its acoustics and in its reponse to sound). There is no way to isolate one from the other, as the interaction is reciprocal and permanent.

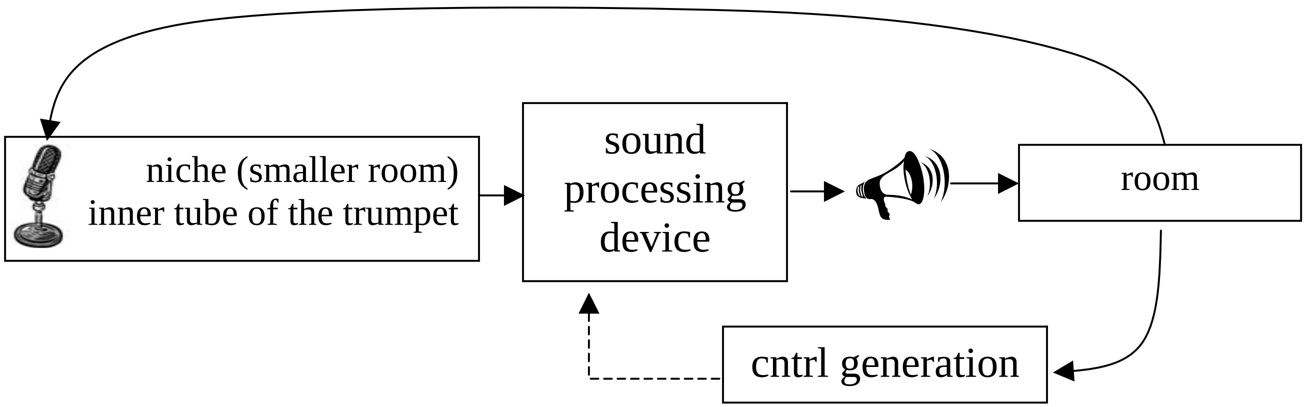
FORM is identity, closure, distinction, perception of invariants and separation from context or background. In systemic terms: organizational closure. "Timbre" = audible Gestalt of the system invariants, which takes place at performance time - it emerges, out of place and time.

PerFORMance is when closure (form) takes place, i.e. the *con-clusion* that means getting *close with* the particular, real space, in the particular, real time. To that aim, actually performance exploits the system structural openess, it leans on the residual ambiguity which resists identity.

FORMance (formability) is the implementation of the factual conditions (social, technological) enabling the systemic closure and making it audible.

MODES OF INTERFERENCE / 1

audio feedback system with trumpet and electronics



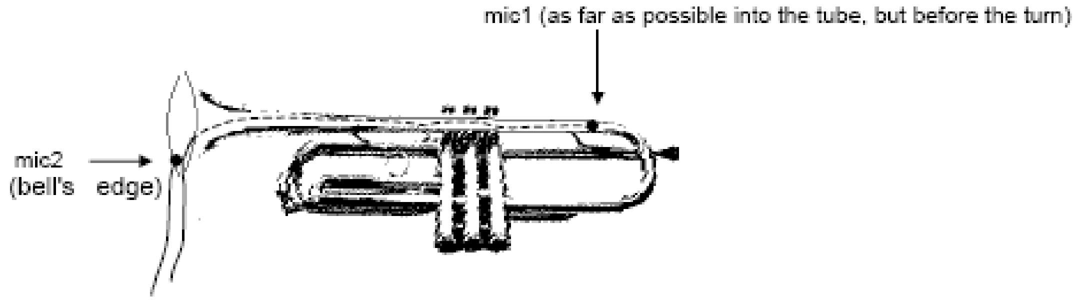
Actions on the trumpet (valves, tapping) as well as into the trumpet (blowing, tongue pulses, etc.) interfere with the audio feedback loop, altering the length of the loop (valves) or articulating noise into it.

(score excerpts)

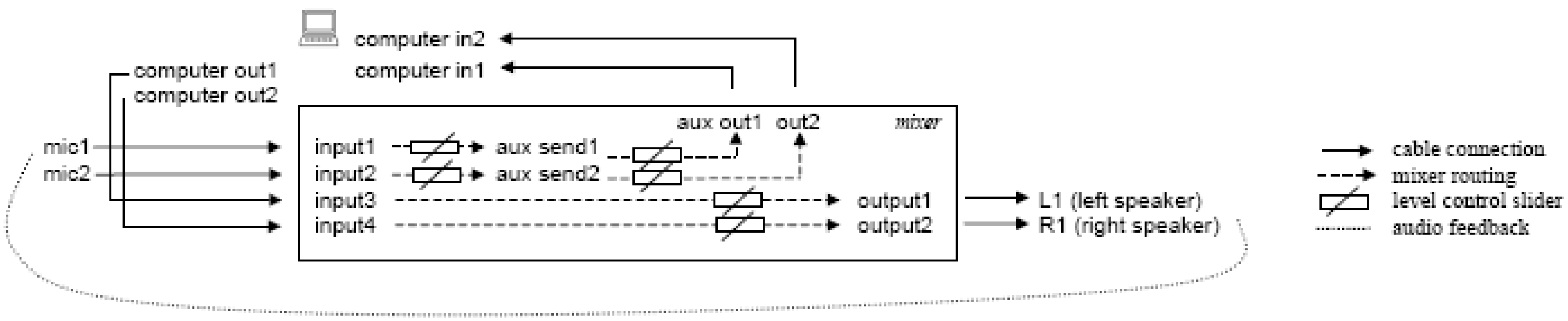
TECHNICAL SET-UP

Microphones

Two miniature microphones must be utilized, placed as illustrated.[1] Use tape to firmly stick the cables onto the bell's inner surface.



Audio Connections

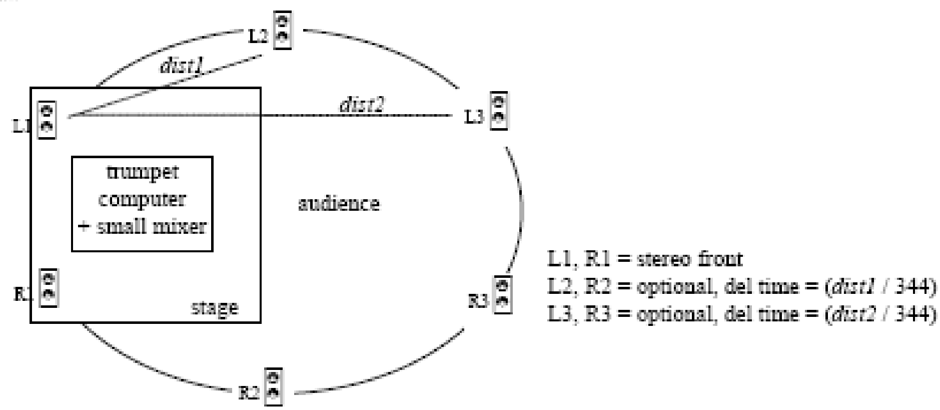


Sound Diffusion

This work is meant for <u>frontal stereo diffusion</u>.

If multiple pairs of speakers are available, positioned around the audience, they can be used to replicate the front stereo pair, with time delays directly proportional to the distance from the stereo pair (delay time = distance / 344). See illustration.

In any case, <u>only the front speakers should be effectively involved in the audio feedback loop</u>.



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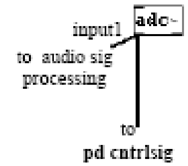
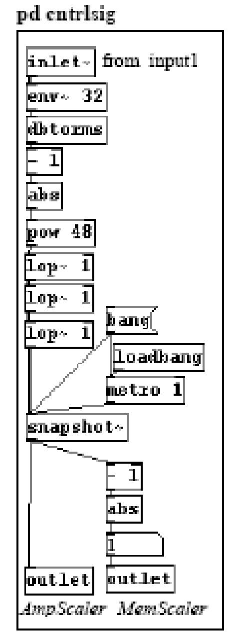
[1] microphones tested so far by the composer include DPA (the 4060 and 4061 series) and Beyerdynamic MCE5 and MCE55.

(score excerpts)





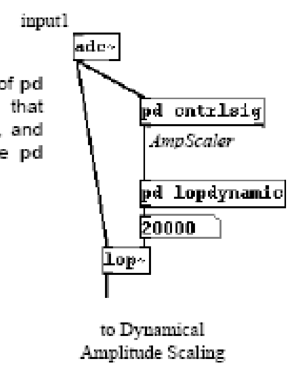
Control Signal Extraction

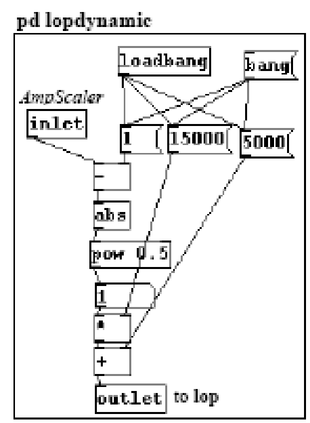
Control signal extraction (as implemented in the **pd cntrlsig** sub-patch) requires these main operations:

- amplitude following (env)
- subtraction (- 1)
- absolute value operator (abs)
- power operator (pow), with an exponent of 48
- one-pole low pass filter (lop), with a cut-off frequency of 1 hz. This is to smooth-out ripples and other quick amplitude fluctuations

The result is a low-frequency signal, that is utilized as a control signal in other parts of the patch, referred to here with the name *AmpScaler*. Notice that *AmpScaler* varies exponentially. Also, it varies between 1 (= no input amplitude) and 0 (= input amplitude is maximum). In other words, it gets closer to 1 as input gets weaker, and moves closer to 0 as input gets louder.

The complement value (abs of *AmpScaler* - 1) is used in other parts of the patch, and is referred to here with the name *MemScaler*.





Dynamical Low-pass filtering

A low-pass filter is used, whose cutoff-frequency is driven by the *AmpScaler* control signal (left outlet of **pd cntrlsig**). The range for cutoff-frequency is 5000-20000. The mapping function is inverse, such that *AmpScaler* [0, 1] ⇒ *hz* [20000, 5000]. In other words, the softer the input, the larger the spectrum, and viceversa - the louder the input, the narrower the spectrum. This mapping is implemented in the **pd lopdynamic** sub-patch.

This process includes the following main operations:

- power operator (pow), with an exponent of 0.5 (making the mapping logarithmic)
- one-pole low pass filter (lop) with variable cutoff-frequency
- absolute value operator (abs)
- other simple math (multiply, sum, subtraction)

For more on featured methods of feature-extraction and control-signal generation, see the score and the Pure Data example patches posted on the web.