

TECH 101

Quiz Review (overview)

DSP Effects (different types of effects + how they can be used)

(Ambient Music / Soundscape Composition / Process Music)

Synthesis Theory (a bit of its history, sources, processors, controllers)

Theremin (how it works)

MIDI (what it is and how it can be used)

FX

Audio Effects I:

Echo/Delay

Definition: *Adding delayed copies of a signal to itself*

Typical Parameters: delay length, feedback, filtering, wet/dry

Example REAPER plug-in: *ReaDelay*



Stereo Imaging

Def.: *Changing the perceived width of a stereo signal*

Params.: width, delay, mid/side, wet/dry

Ex. Plug-in: *Stereo Enhancer*



Reverb

Def.: *Emulating the reverberance of a room*

(using many delays or a special room recording ('impulse'))

Params.: length, size, dampening, stereo width, wet/dry

Ex. Plug-in: *ReaVerbate* (*ReaVerb* more advanced version)



Modulation Effects

Def.: *All involve using a control signal, called a low frequency oscillator (LFO), to modulate parameters of the signal*

Tremolo – changing **amplitude** over time with an LFO

Vibrato – changing **pitch/speed** over time with an LFO

Flanger and **Chorus** operate similarly: a delayed, modulated copy of a signal, with the delay and modulation changed over time by an LFO, is added to the input signal.

Depending on the length of the delay (in ms) different perceptual effects will occur.

Phasers operate differently, using a phase-shifting delay (called an all-pass filter), and their parameters often allow you to control the frequency range effected.

Phaser – alters phase relationship between incoming signal and its copy, perceived not as a delayed signal but rather a shimmer-y, sweeping effect.

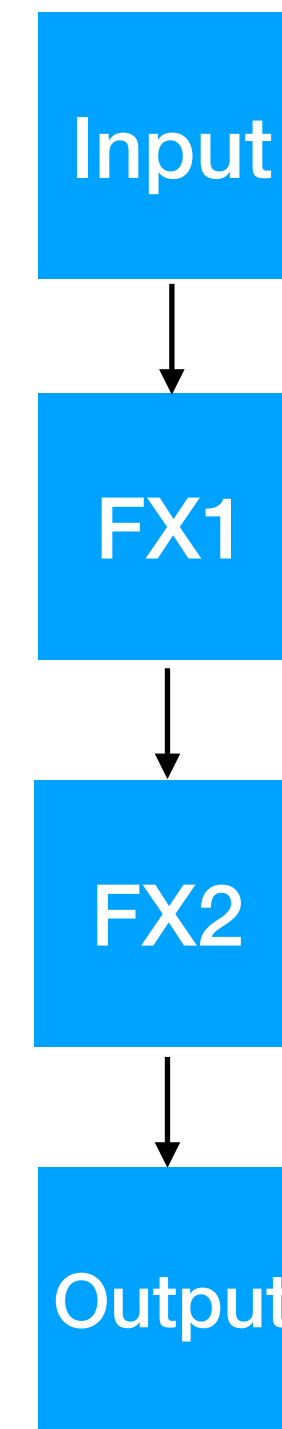
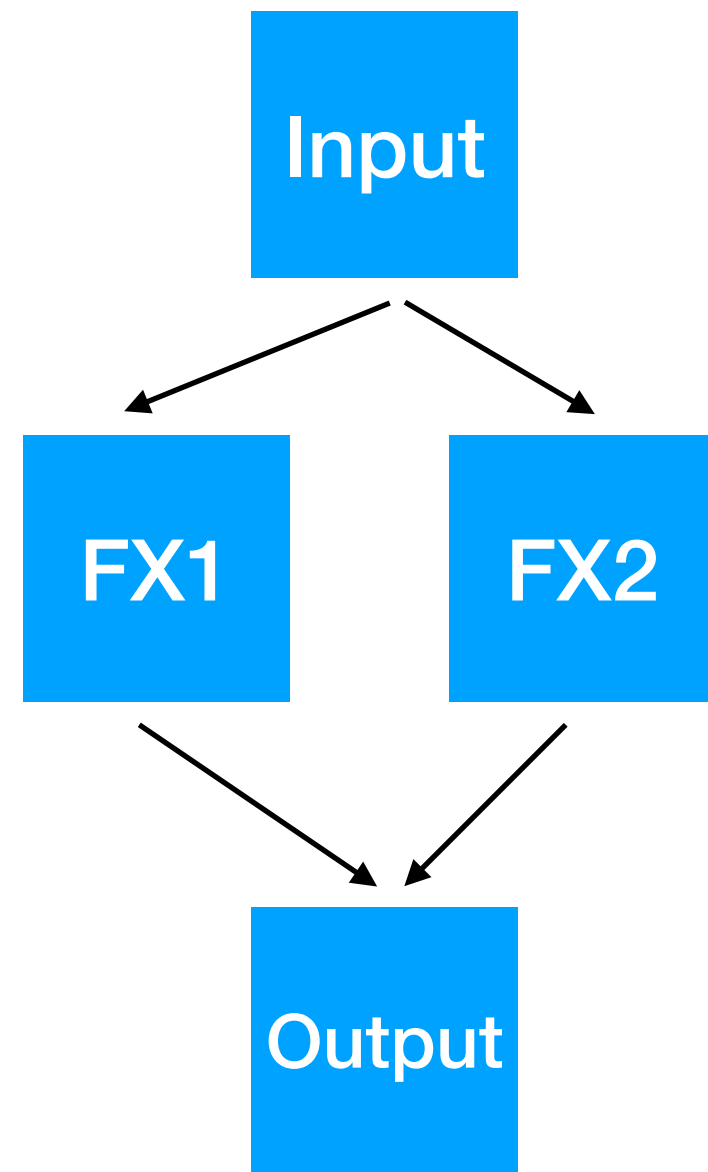
Flanger – longer delay times than phaser (1ms – 10ms), perceived as a water-y, swirling effect.

Chorus – longest delay times (10ms – 100ms+), perceived as multiple copies of the input signal.

Params.: depth, length, feedback, rate, low/high range (Phaser), wet/dry

Ex. Plug-ins: *Tremolo*, *Chorus*, *Flanger* (is broken...), *4-Tap Phaser*, *Ring Modulator*

Parallel vs. Series



Differences?

Reverb:

Algorithmic vs.

Convolution

LFO

(low frequency oscillator):

***signal below 20 Hertz (often periodic)
used as a CONTROL signal
rather than an AUDIO signal***

Modulation

Tremolo vs. Vibrato

Volume

Pitch

Modulation

Phaser vs. Flanger
vs. Chorus

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Audio Effects II:

Dynamics

Def.: *Automatically changing the amplitude of a signal based on its amplitude*

Compressor – turns down amplitude by a particular value (ratio) when it goes **above** a certain level (threshold)

Limiter – Compressor with infinite ratio, preventing signal from going above threshold

Expander – in downward version, turns down amplitude by a particular value (ratio) when it goes **below** a certain level (threshold)

Gate – Expander with infinite ratio, silencing a signal below threshold

Params.: threshold, ratio, knee, attack, release, makeup gain

Ex. Plug-ins: *ReaComp*, *ReaGate*

Equalization/Filtering

Def.: *Changing the amplitudes of particular portions of the frequency range*



High-pass filter – pass frequencies **above** a cutoff frequency, attenuate others (same as **Low-cut filter**)



Low-pass filter – pass frequencies **below** a cutoff frequency, attenuate others (same as **High-cut filter**)



Band-pass filter – pass frequencies **around** a center frequency, attenuate others



Notch filter – inverse of Band-pass filter: attenuate frequencies **around** a center frequency, pass others



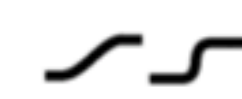
High-shelf filter – boost or attenuate frequencies **above** a center frequency



Low-shelf filter – boost or attenuate frequencies **below** a center frequency



Peak (also called "Band" or "Bell") **filter** – boost or attenuate frequencies **around** a center frequency



Params:

Slope – the intensity of attenuation across frequencies

Resonance or Q ('quality factor') – the sharpness or focus of the filter.

Params.: frequency, gain, slope, 'Q'/resonance

Ex. Plug-in: *ReaEQ*

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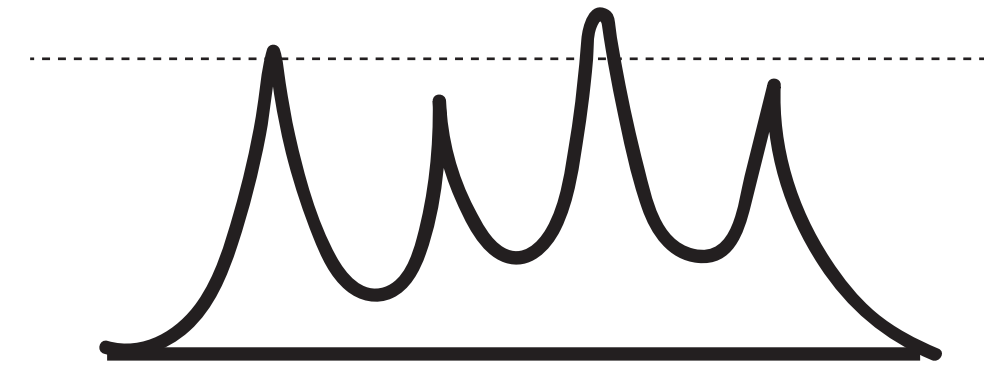
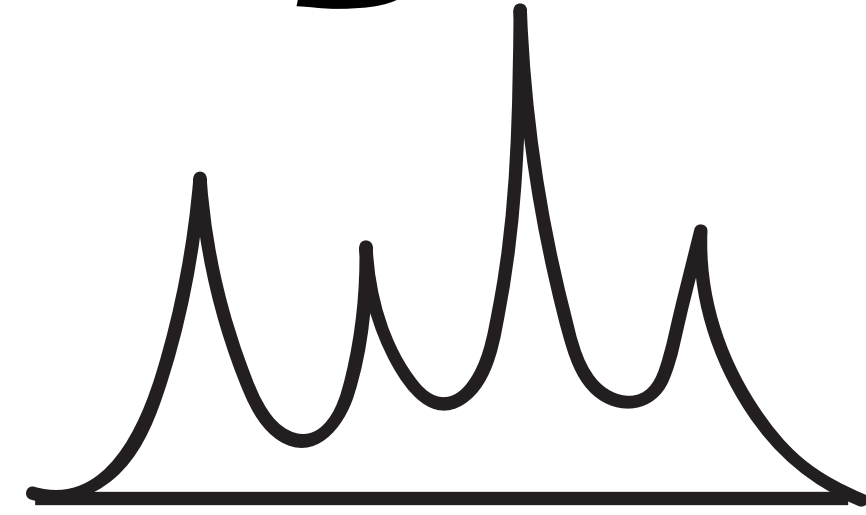
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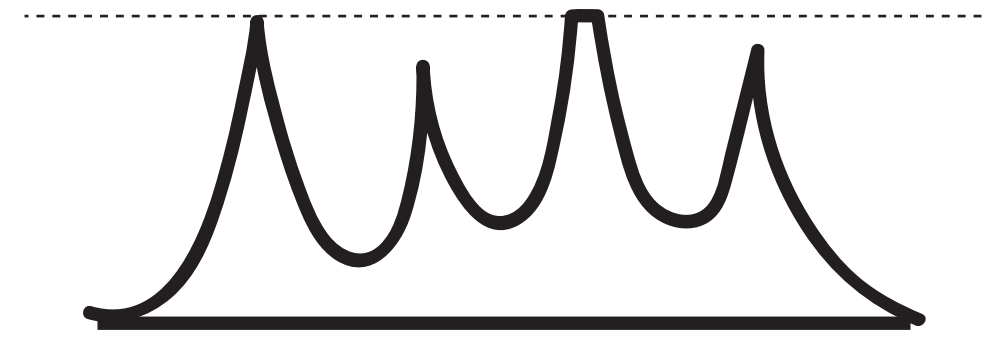
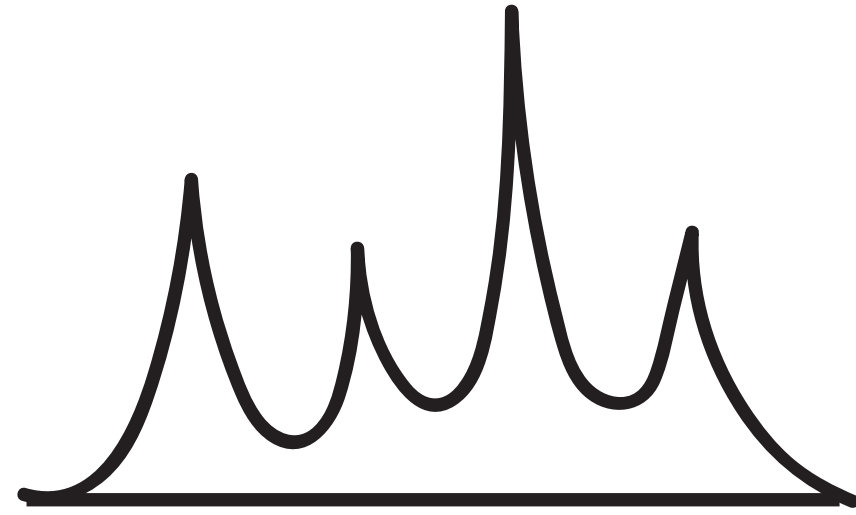
Dynamics

Compression:



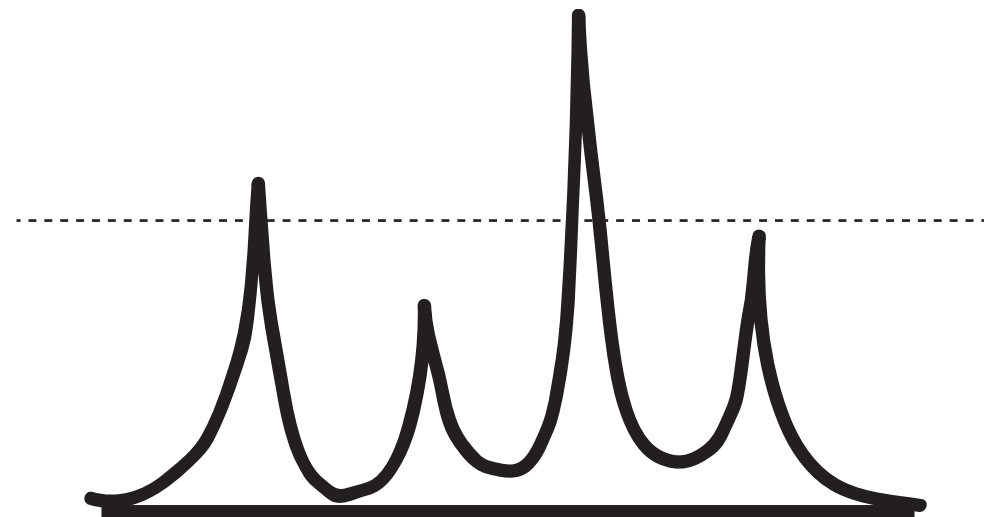
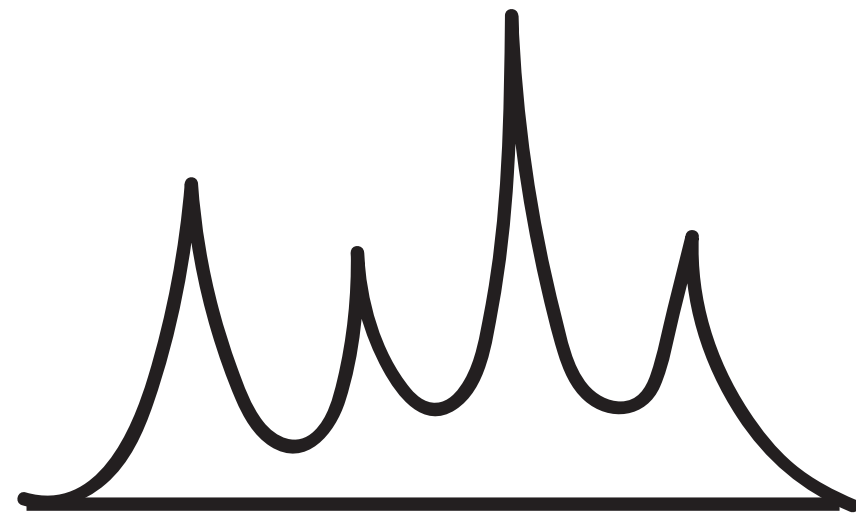
Smooth out peaks

Limiting:



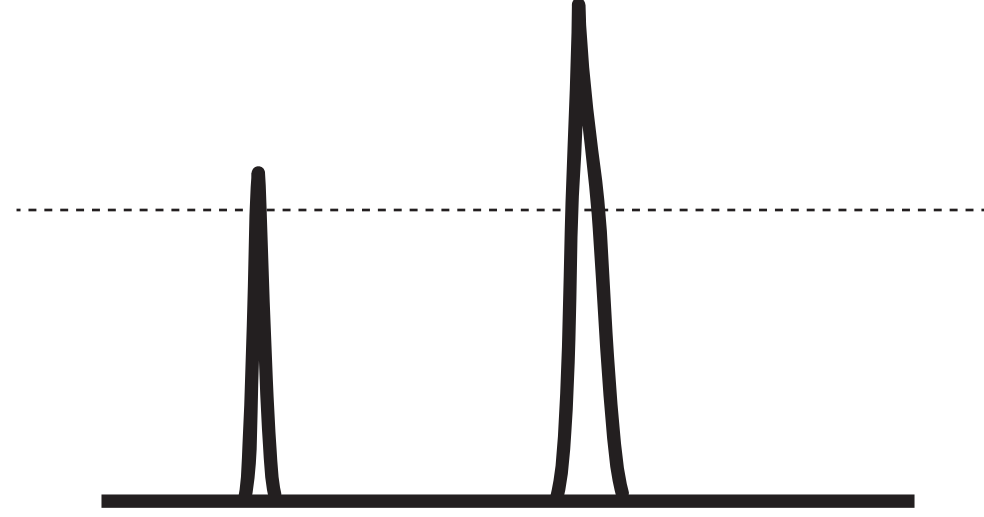
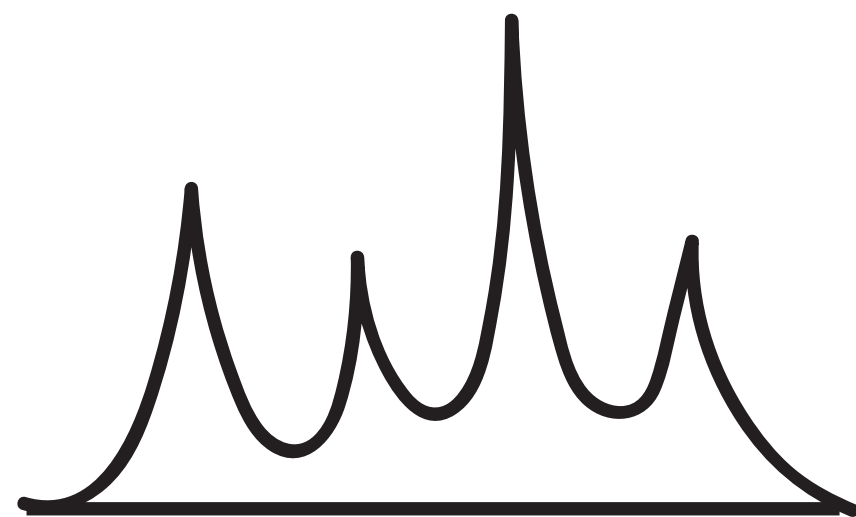
Chop off peaks

Expansion:



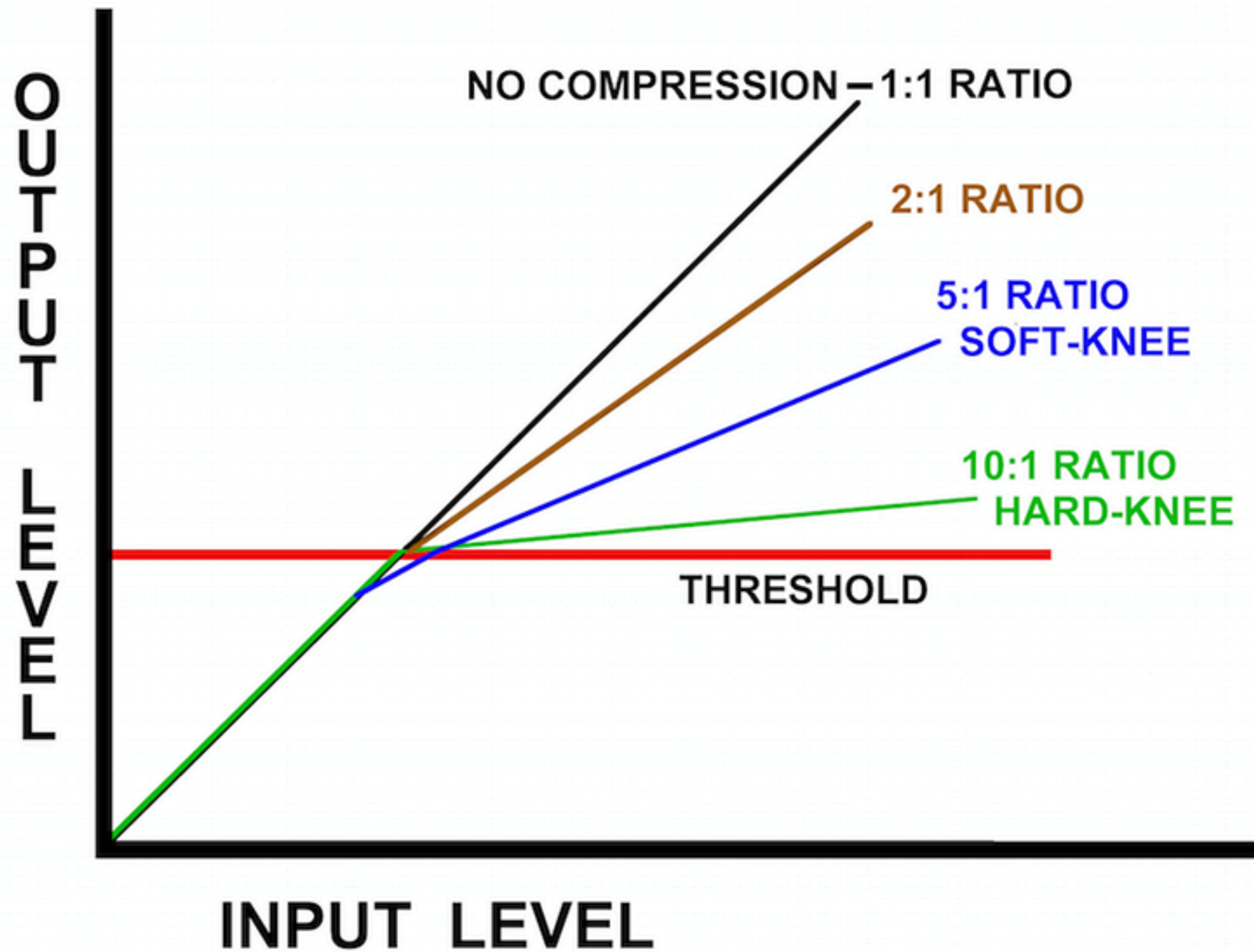
*Enhance peaks
(make everything else quieter)*

Gating:



Only peaks

Dynamics



Threshold:

Amplitude level above (or below) which the amplitude-changing is done

Ratio:

Intensity of the amplitude change (10:1 means the signal is made to 10 times as quiet, in a compressor, for example)

Attack + Release:

The time it takes for the dynamics processing to start (attack) and stop (release)

Makeup Gain:

Post process that boosts the signal after being compressed/limited

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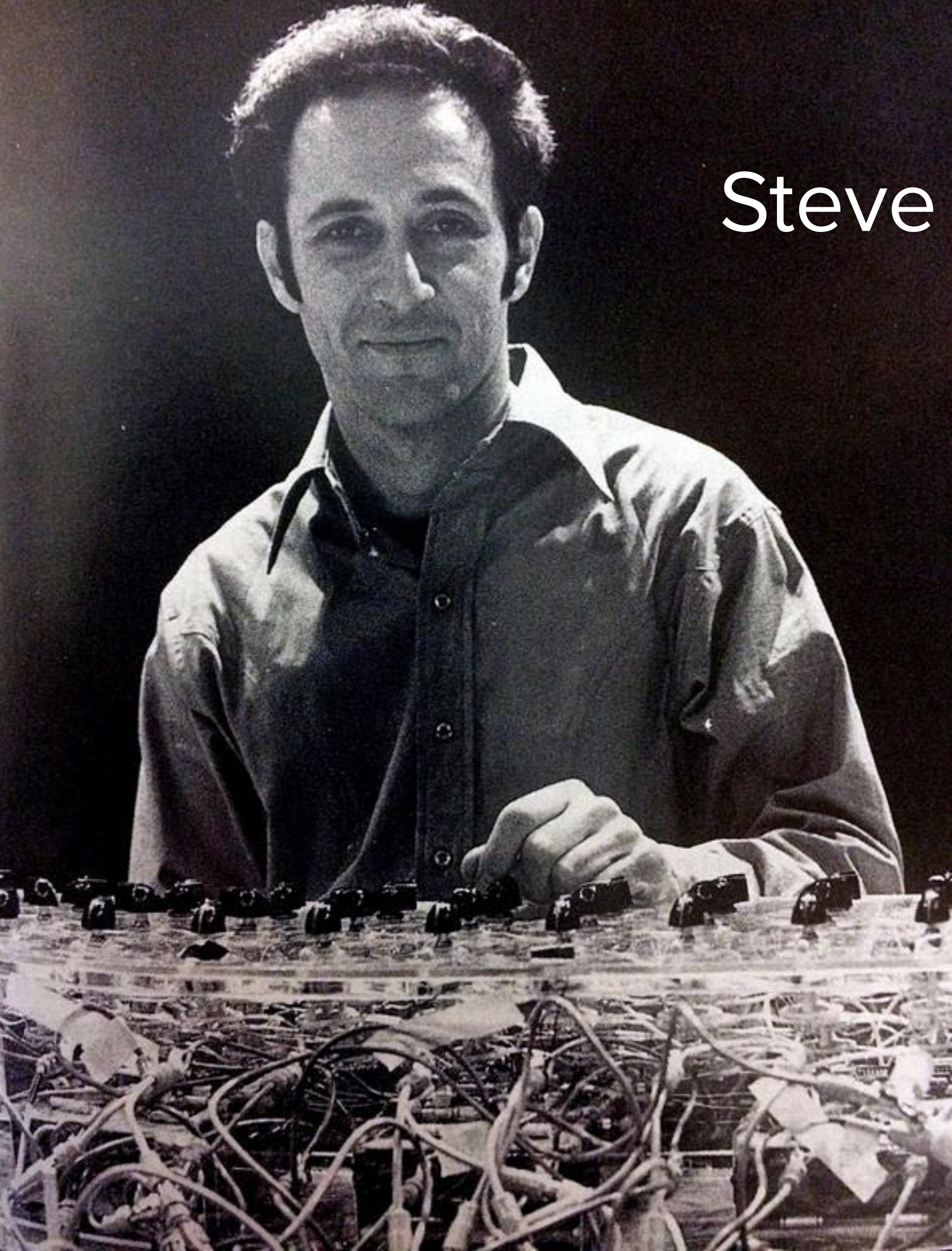
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Resonance or Q (‘quality factor’) – the sharpness or focus of the filter.

Params.: frequency, gain, slope, ‘Q’/resonance

Ex. Plug-in: *ReaEQ*

Steve Reich





BRIAN ENO

Eno's Ideas about Ambient Music

Eno contrasts canned music (or “muzak”), which tries to cover up surrounding sounds, with ambient music, which is intended to enhance the sounds of the environment.

Muzak

Blankets with sound, covers up the space

Strips away all sense of doubt and uncertainty

Brightens the environment, stimulating

Ambient Music

Invites you into the space, incorporates the space

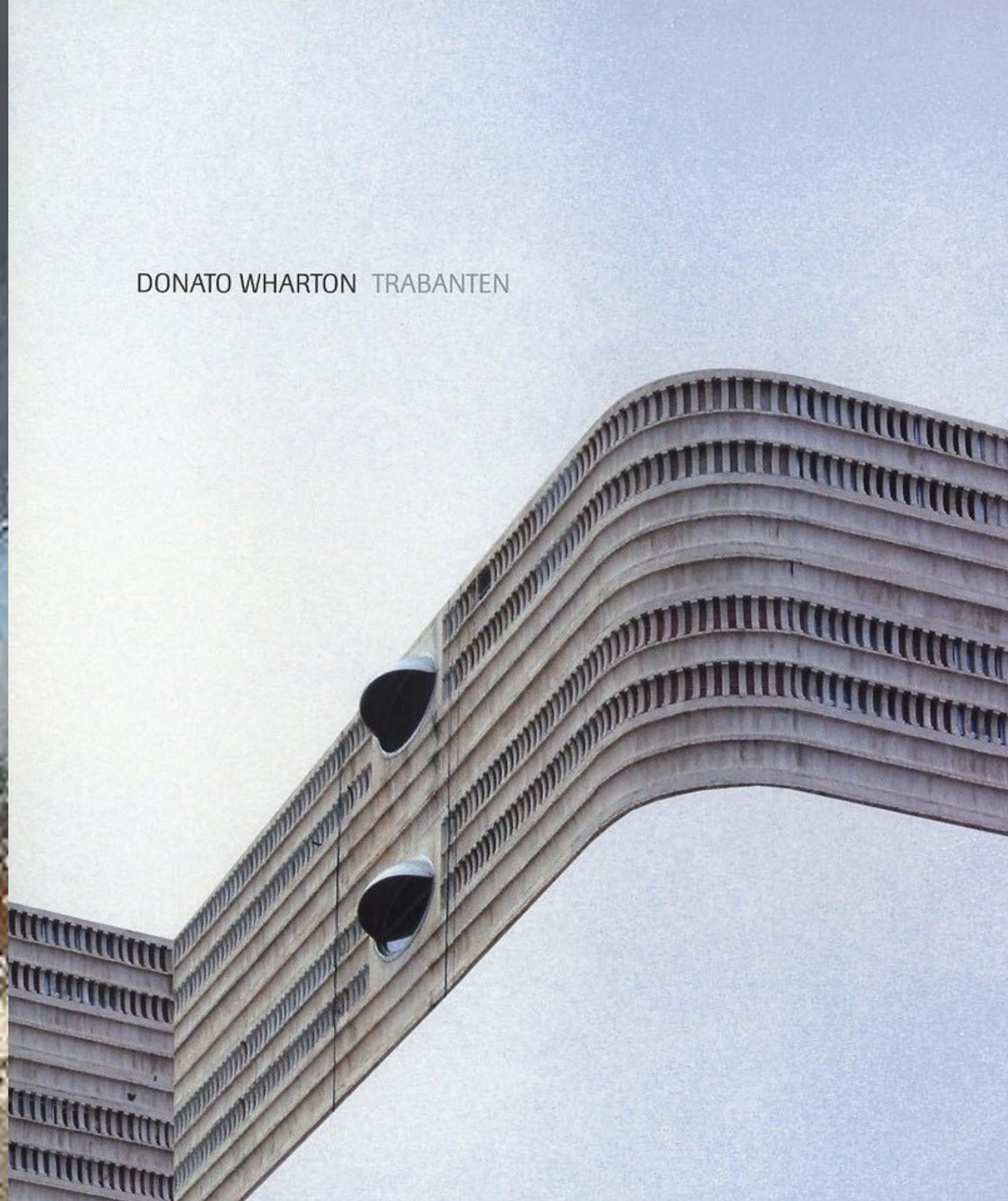
Mysterious, uncertain

Induces calm and a space to think

VS.



DONATO WHARTON TRABANTEN



Soundscape Composition + Acoustic Ecology





Luc Ferrari

French-Italian composer, pioneered use of barely-edited environmental recordings as electronic music

Notable Work: *Presque rien No. 1* (1970)



Presque Rien N° 1

LUC FERRARI

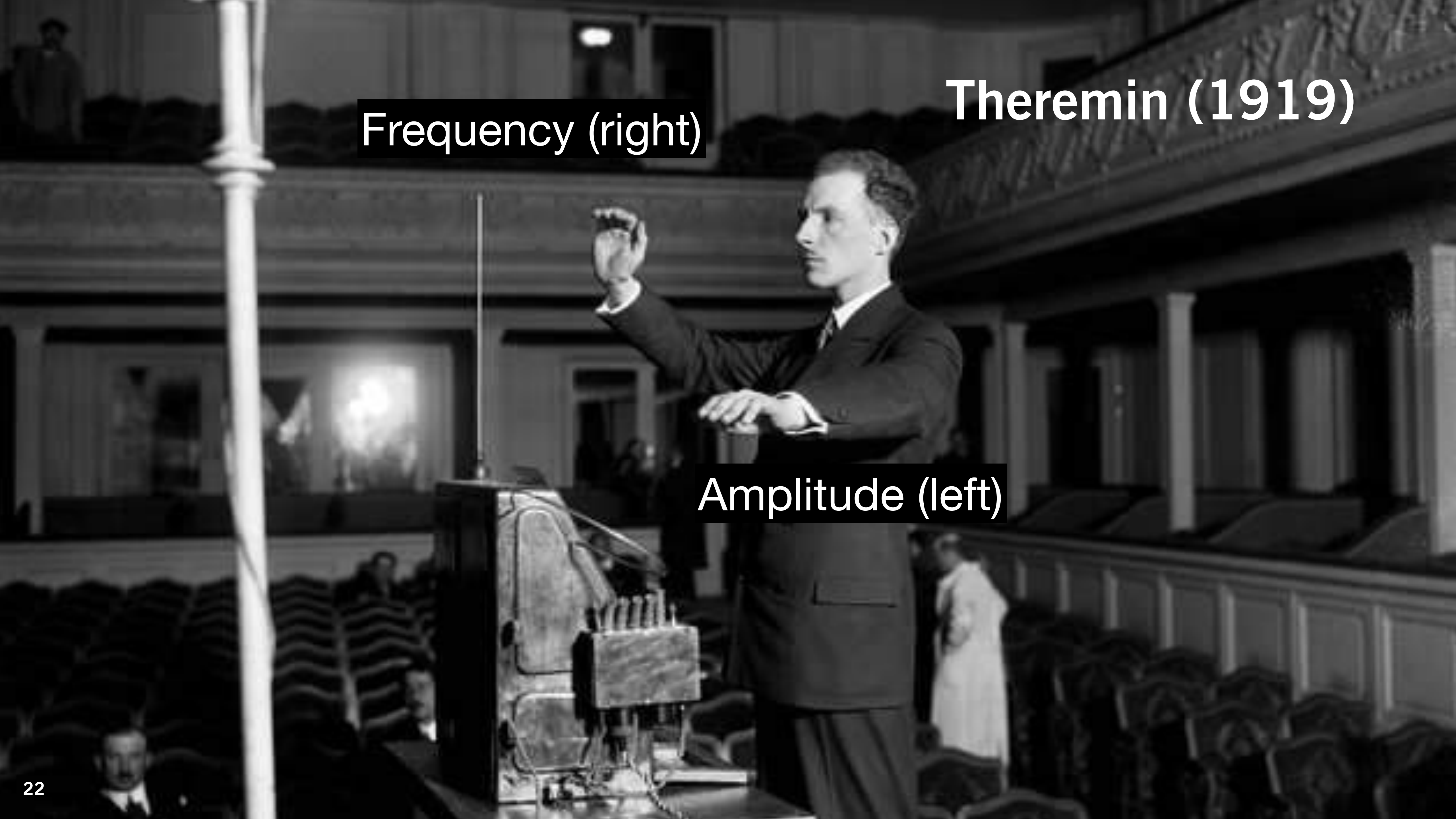


[Tape III
1.2. Cicadas]

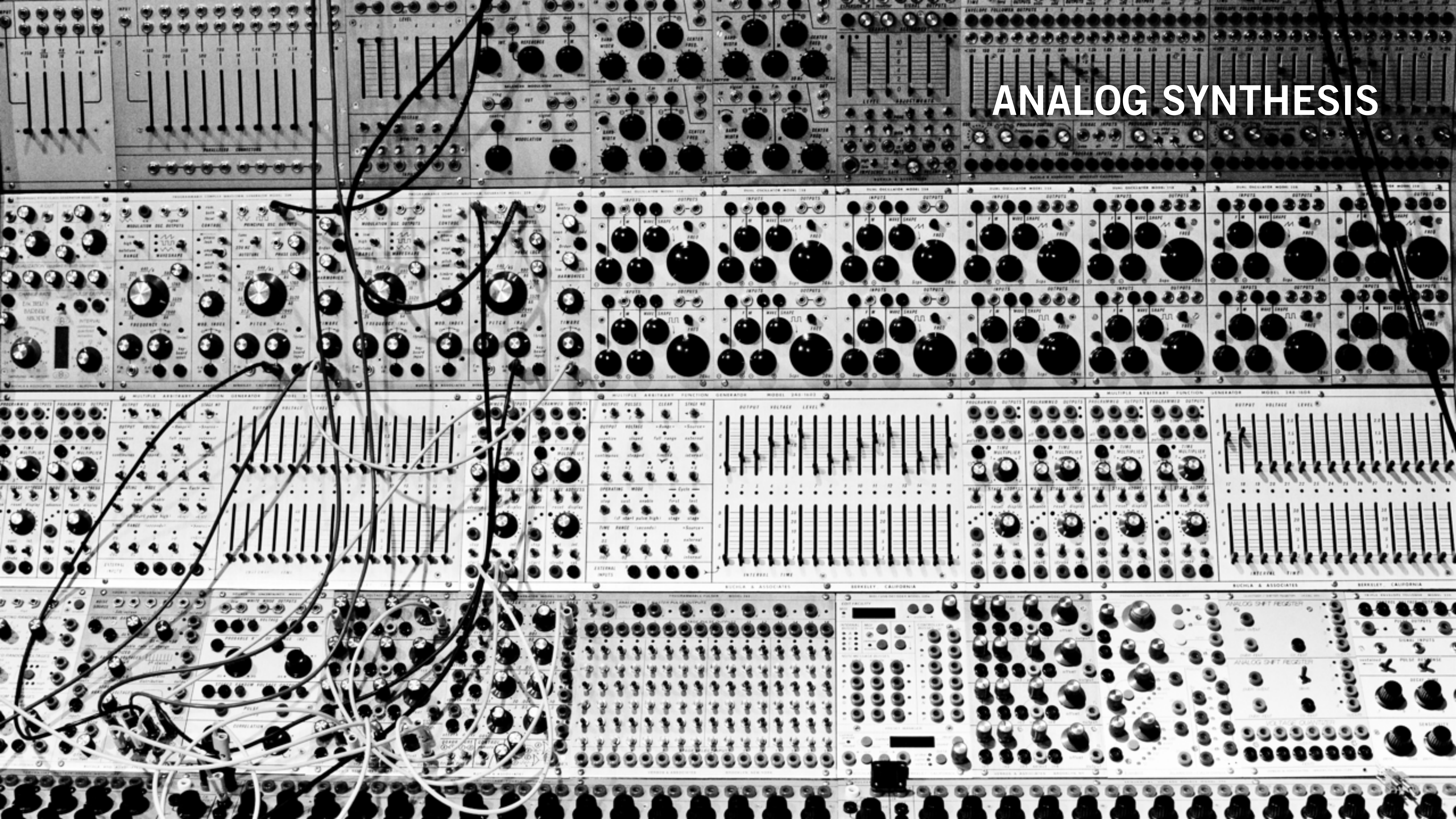
Theremin (1919)

Frequency (right)

Amplitude (left)



ANALOG SYNTHESIS



Synthesizer Functions

1. Sources: produce or generate a signal

Oscillators, noise generators, input sounds

2. Processors: modify a signal

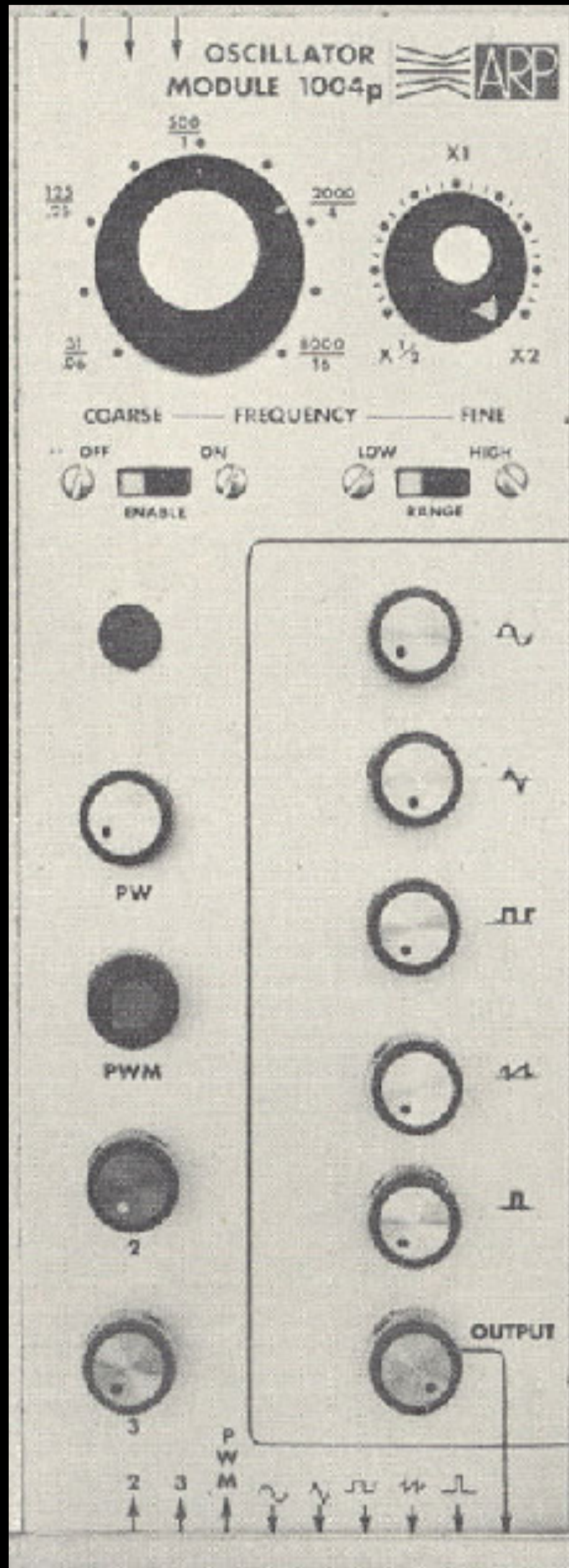
Filters, envelope generators (ADSR), effects.

3. Controllers: control the behavior of another function (module)

Physical input devices: keyboard, joystick, pedal

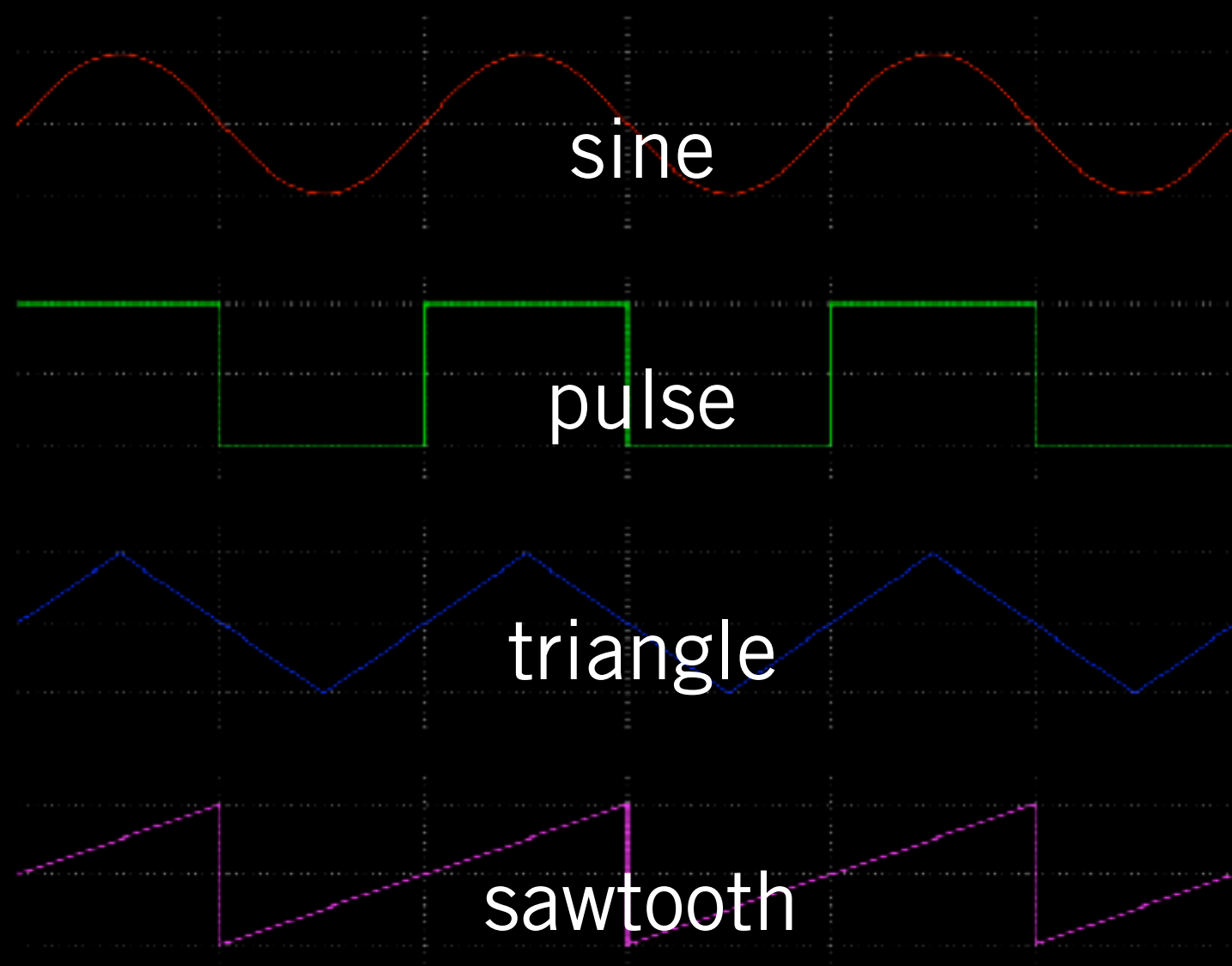
Automated controls: sequencer, LFO





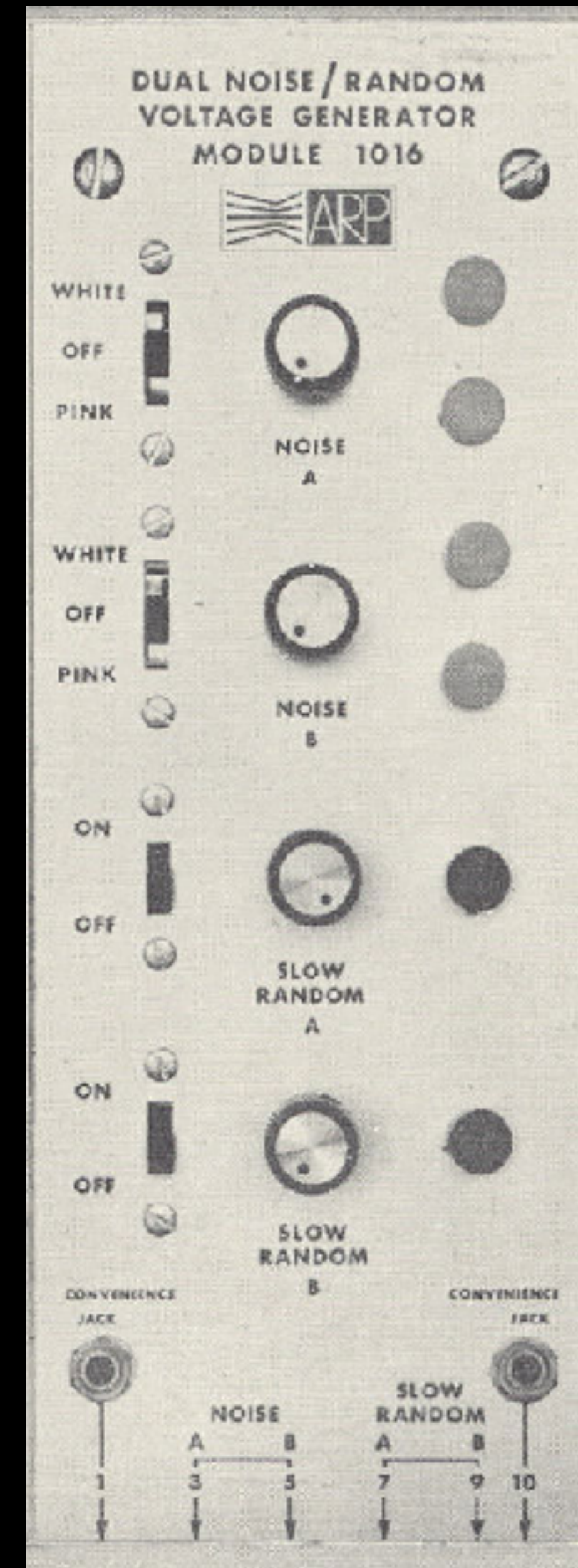
SOURCES

OSCILLATORS (VCO)

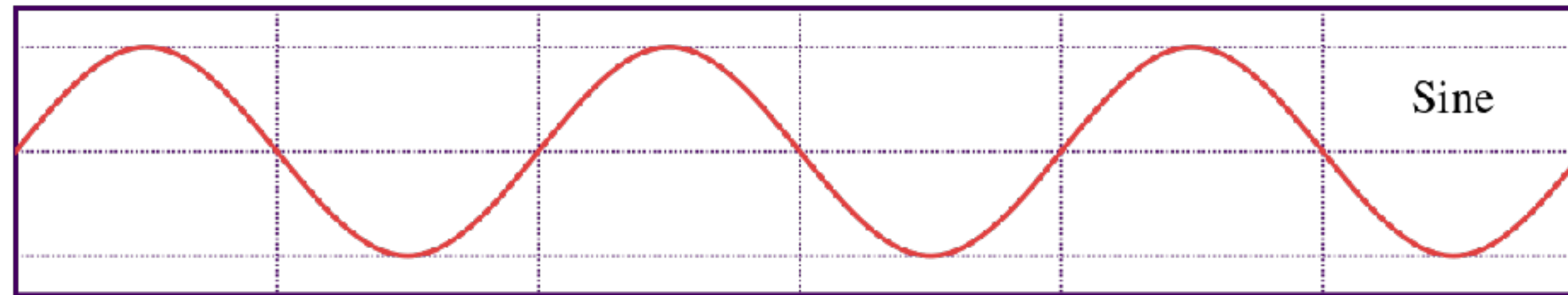


NOISE GENERATORS

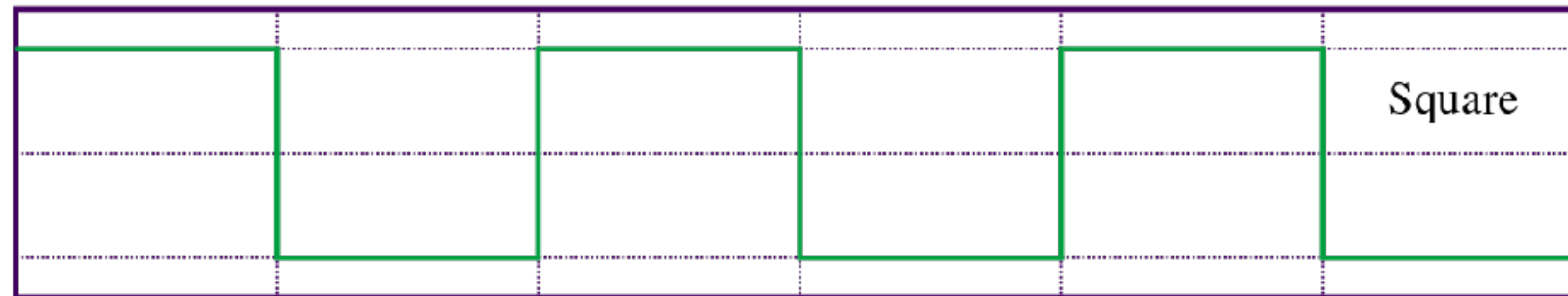
Often the simplest module on the machine. There may be a choice of white or pink noise, or even a species of low frequency noise for random control voltages.



Different Synthetic Waveforms



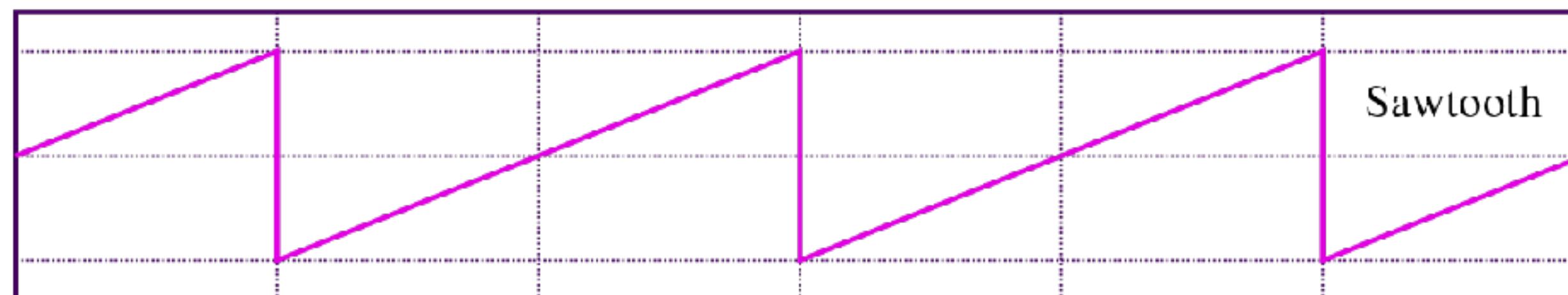
= pure, one frequency



= odd integer harmonics

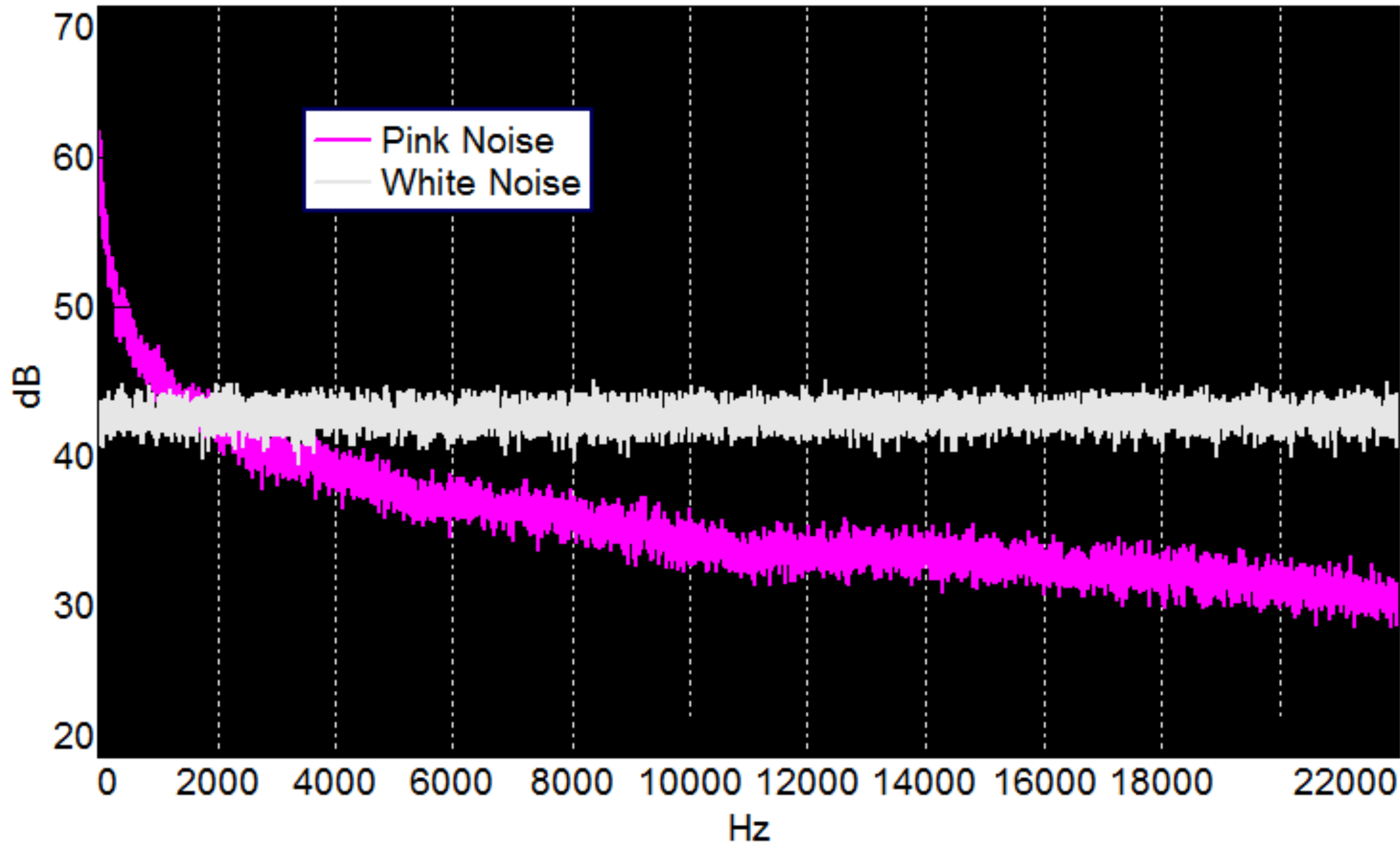


= odd integer harmonics,
but some inverted



= all integer harmonics

Colors of Noise

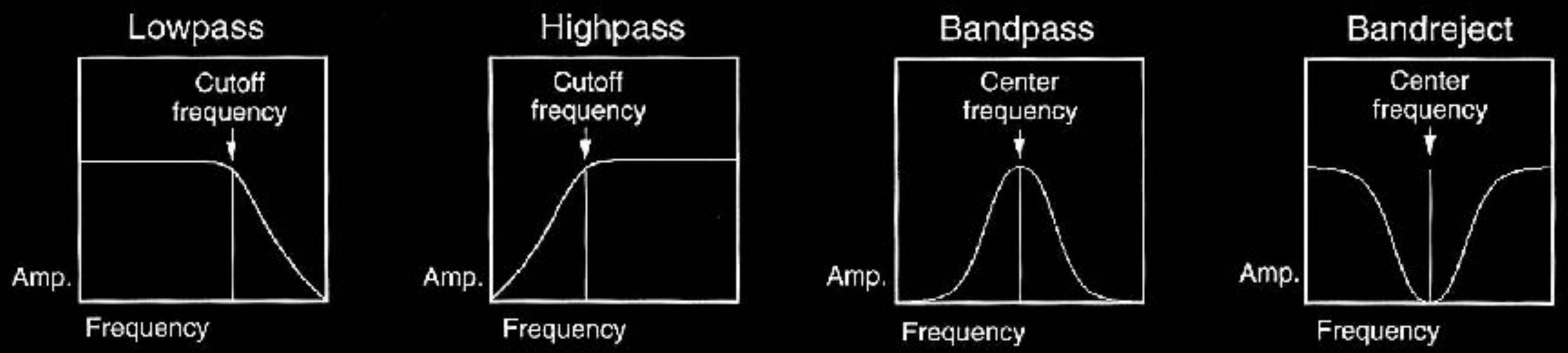


equal energy per frequency

equal energy per octave

FILTERS

signal processing module, Voltage-controlled filter (VCF)
much of the timbral flexibility of a synthesizer comes from the filters
Boost or cut the amplitude of spectral components
Common varieties: low pass (LPF), high pass (HPF), band pass (BP), notch

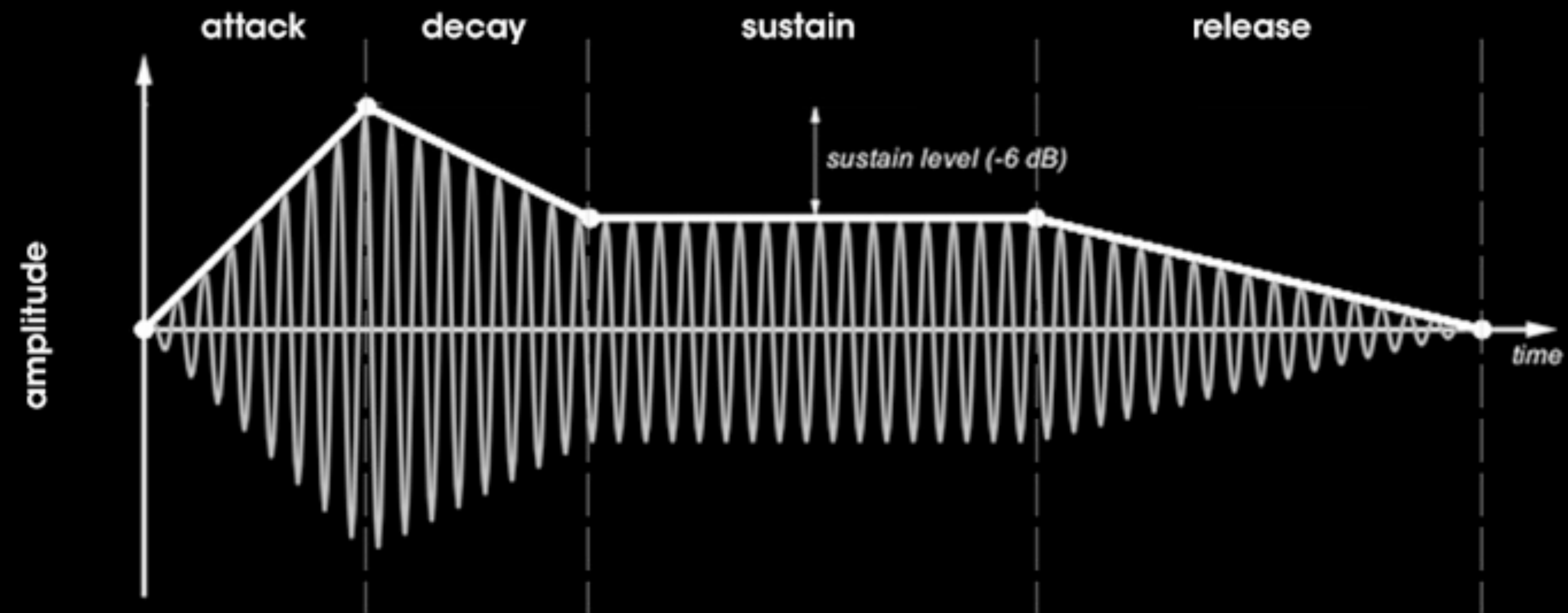


“Q” characterizes a resonator's bandwidth relative to its center frequency. Higher the Q, narrower the filter

ENVELOPES

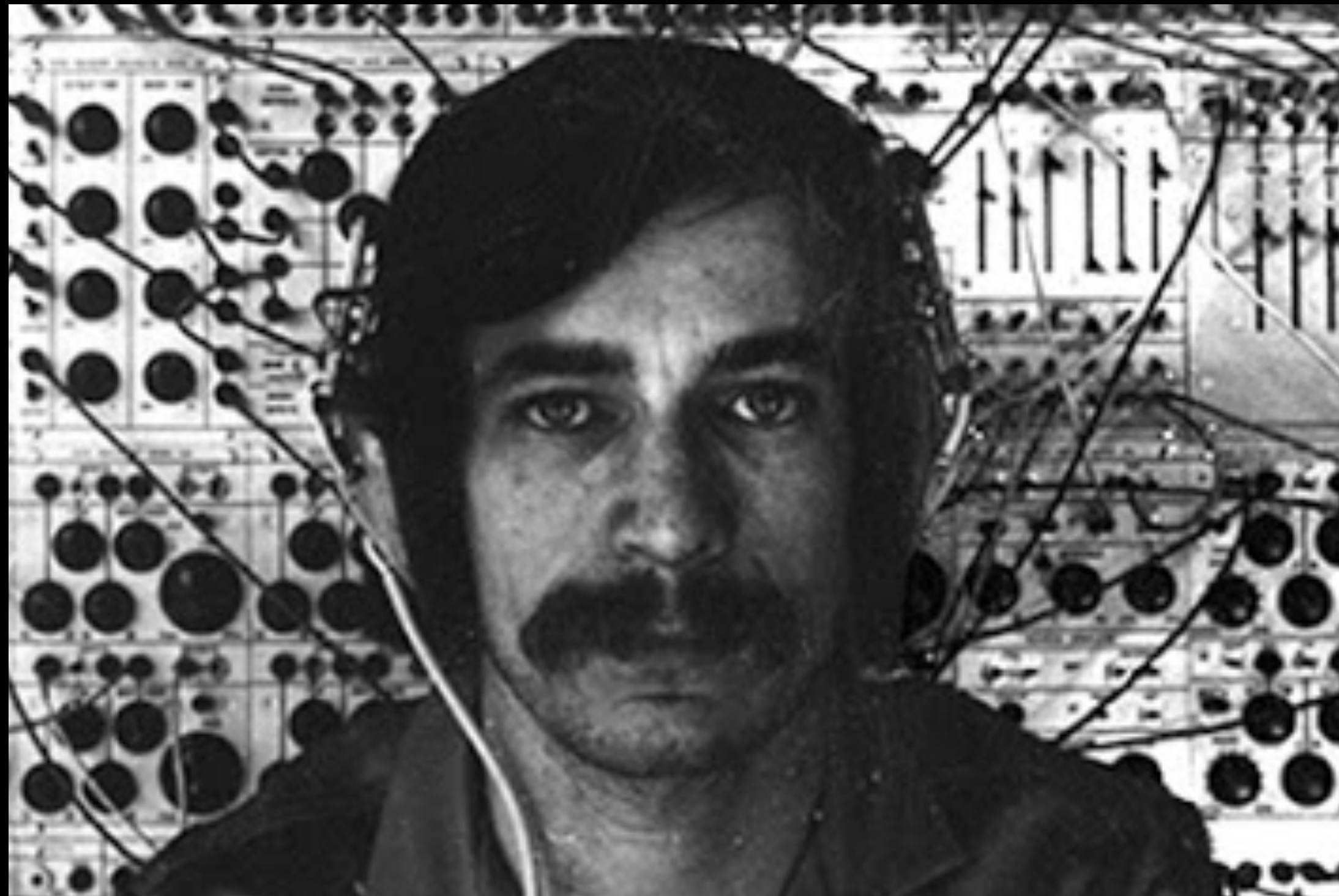
An envelope generator produces a control voltage that rises and falls once, according to a voltage command. The output rises to full on (ATTACK) and then falls over some time (DECAY) to an intermediate value (SUSTAIN) remains there before continuing to zero (RELEASE), often when the key is released.

ADSR design built by Moog at request of Ussachavesky



Donald Buchla

West Coast



Robert Moog

East Coast



Modules

Independent modules connected by patch cables

Moog developed general standards for synthesizer voltages including logarithmic 1-volt-per-octave pitch control and a standard for triggering pulses.

Generally (at least initially) monophonic



MOOG MODULAR

Voltage Control

an electronic communication paradigm

automation

musical system more than an instrument



Buchla 200



MIDI

MUSICAL INSTRUMENT DIGITAL INTERFACE

The MIDI protocol provides a way to specify music as instructions.

Each MIDI instruction (“event”) specifies:

- timestamp
- action, for example: NoteOn, NoteOff
- note, for example: 59 is B, 63 is D#
- velocity (volume)

Some Clarification:

- MIDI doesn't directly describe musical sound
- MIDI is not a language
- It is a data communications protocol

Extending MIDI

MIDI CC (continuous controller)

Most well-known: pitch bend, modulation, 'expression'

Player Piano

