FINAL REVIEW

Structure

12/4 at 11am (last class period)

3 Sections, all multiple choice

Designed to take about 35 minutes

Questions draw primarily on lecture content, although the readings are fair game.

If you've been attending the lectures you are in good shape.

Part I - Listening (not cumulative) // Part II - Multiple choice (concepts & people, cumulative)

Alternate Testing Site

For students who have provisions for extra time or a distraction free environment

same time — 11am

Old Cabell Hall, Room B011 — also known as the VCCM

please email me by Friday night if you plan on taking the test in the B011

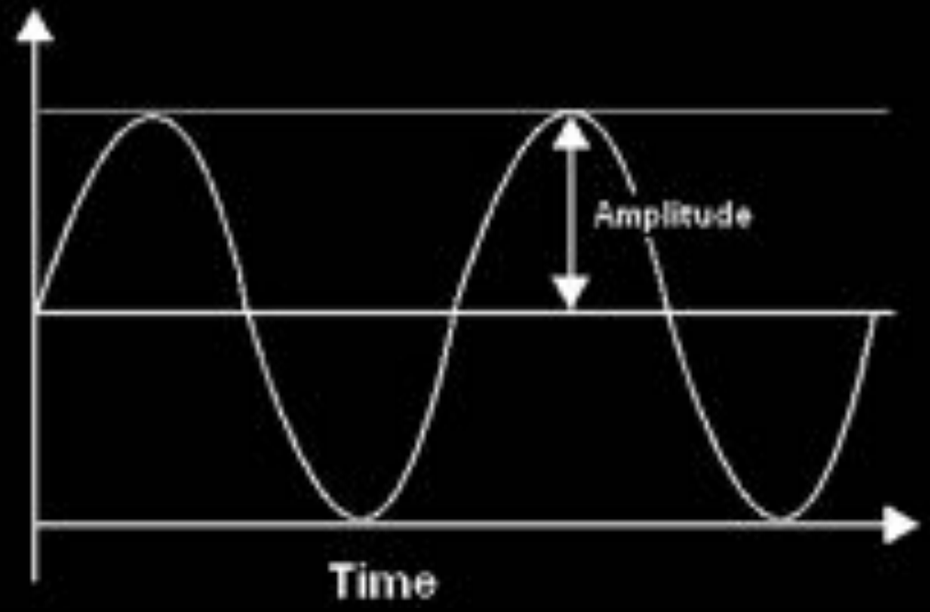
TERMS & PEOPLE

PSYCHOACOUSTICS		ACOUSTICS	
LOUDNESS	⟷	AMPLITUDE	Decibels (Db)
PITCH	⟷	FREQUENCY	Hertz (Hz)
QUALITY	⟷	TIMBRE	Spectra + Envelope

Amplitude

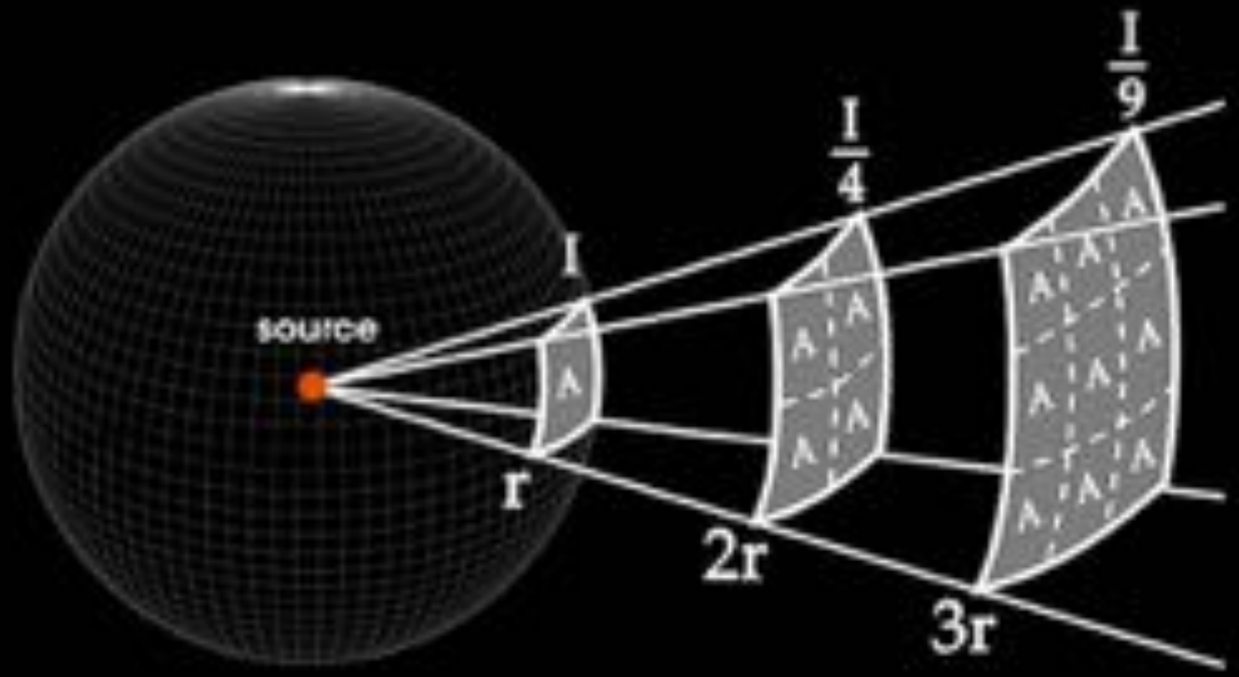
the intensity or perceived loudness of a sound

commonly measured in decibels (dB) - logarithmic unit

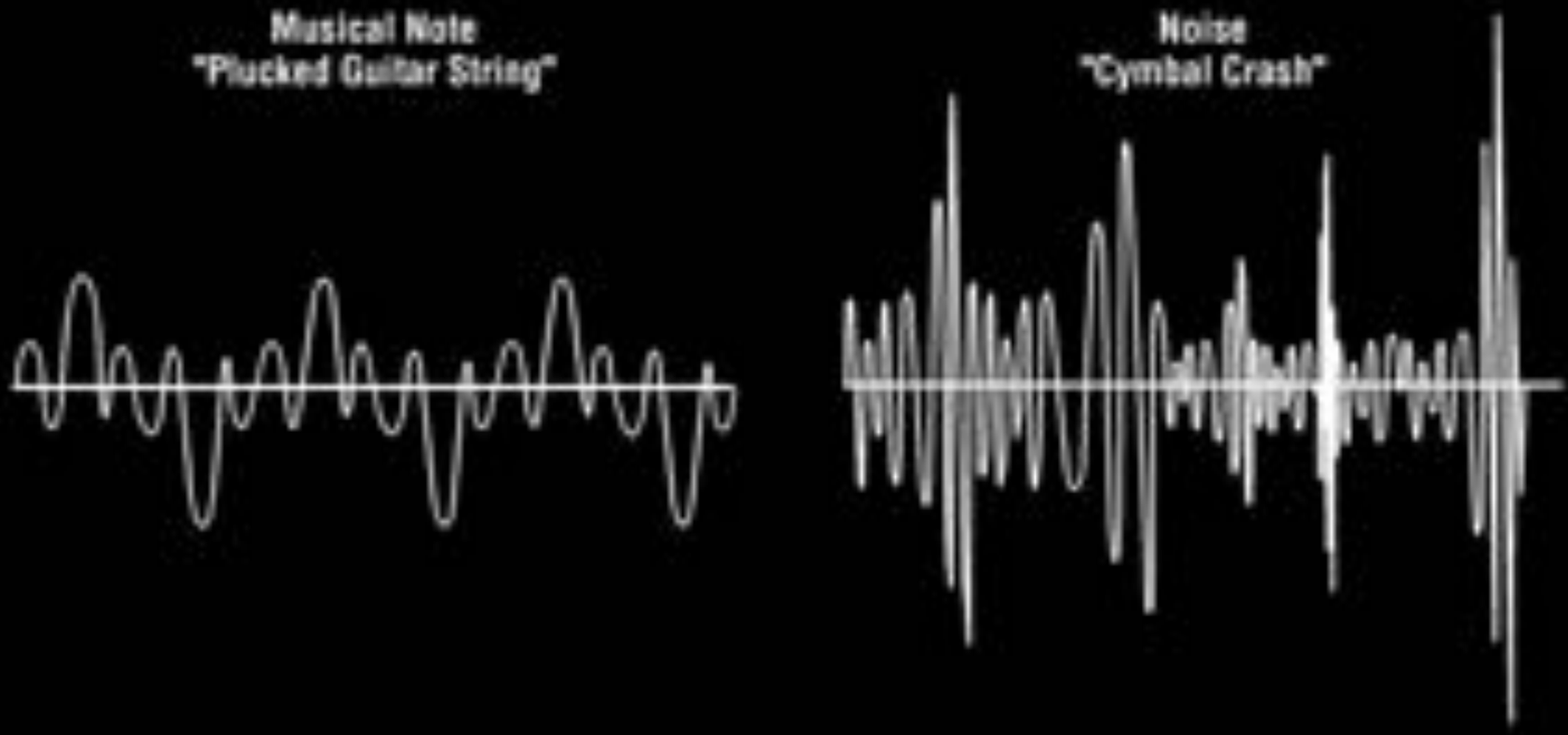


Amplitude - inverse square law

sound intensity is inversely proportional to the square of the distance from the source



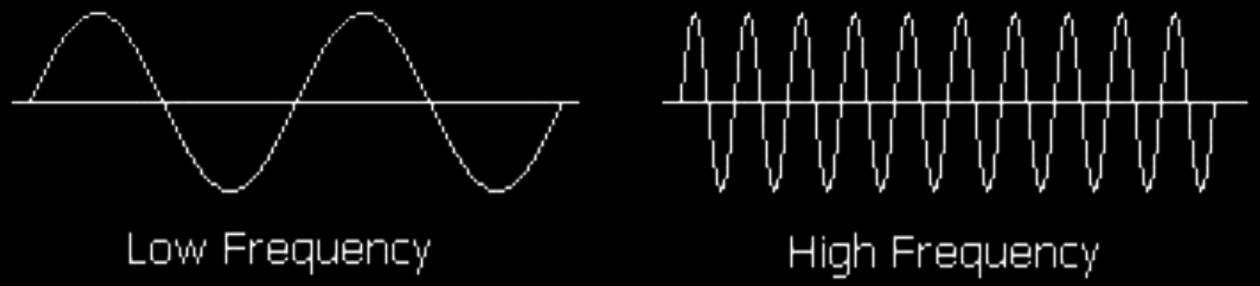
Periodic vs Aperiodic



Frequency

rate at which the air pressure fluctuates is the frequency of the sound wave

Cycles per second, Hertz (Hz)



Frequency & Pitch

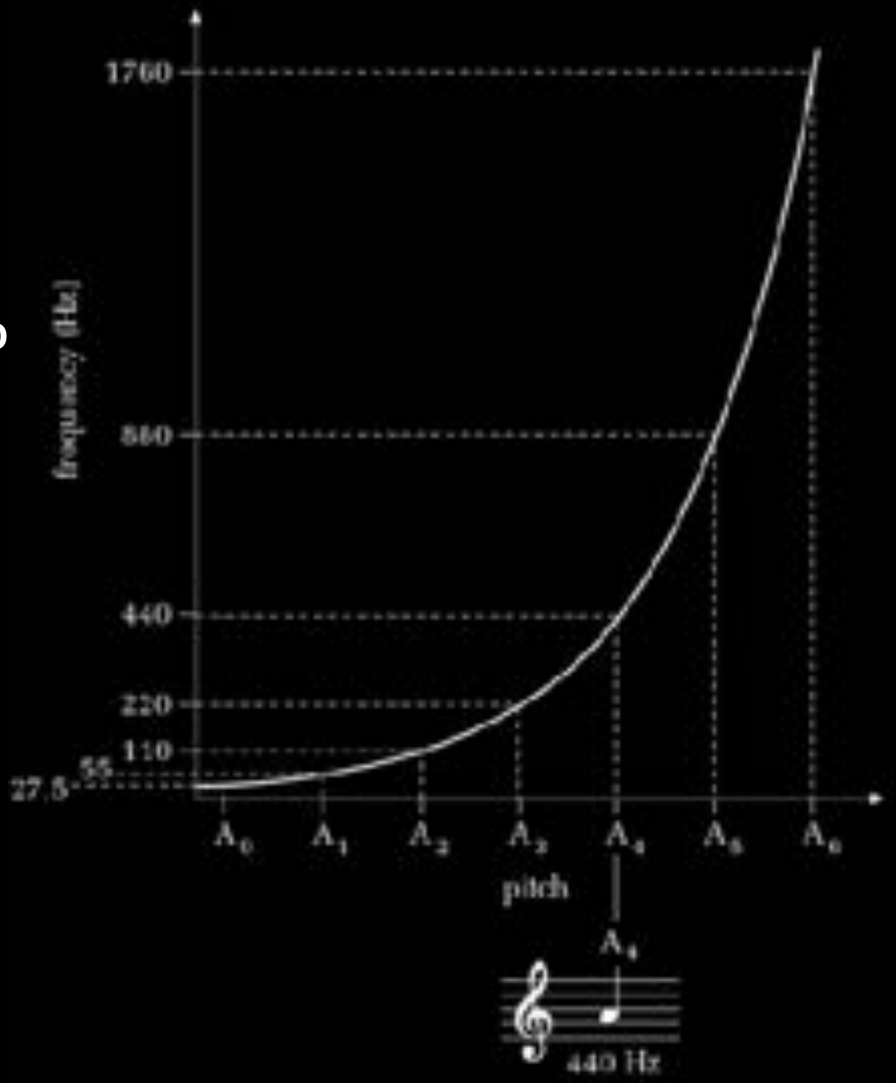
We experience pitch logarithmically as well

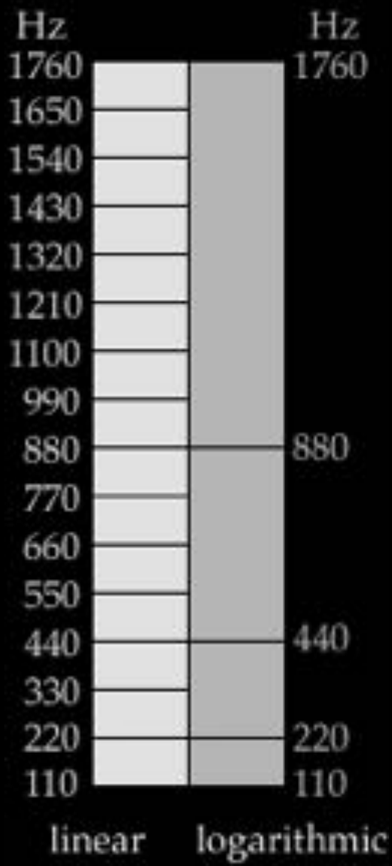
Octave - 2:1 frequency ratio

Octaves 1, 2, 3

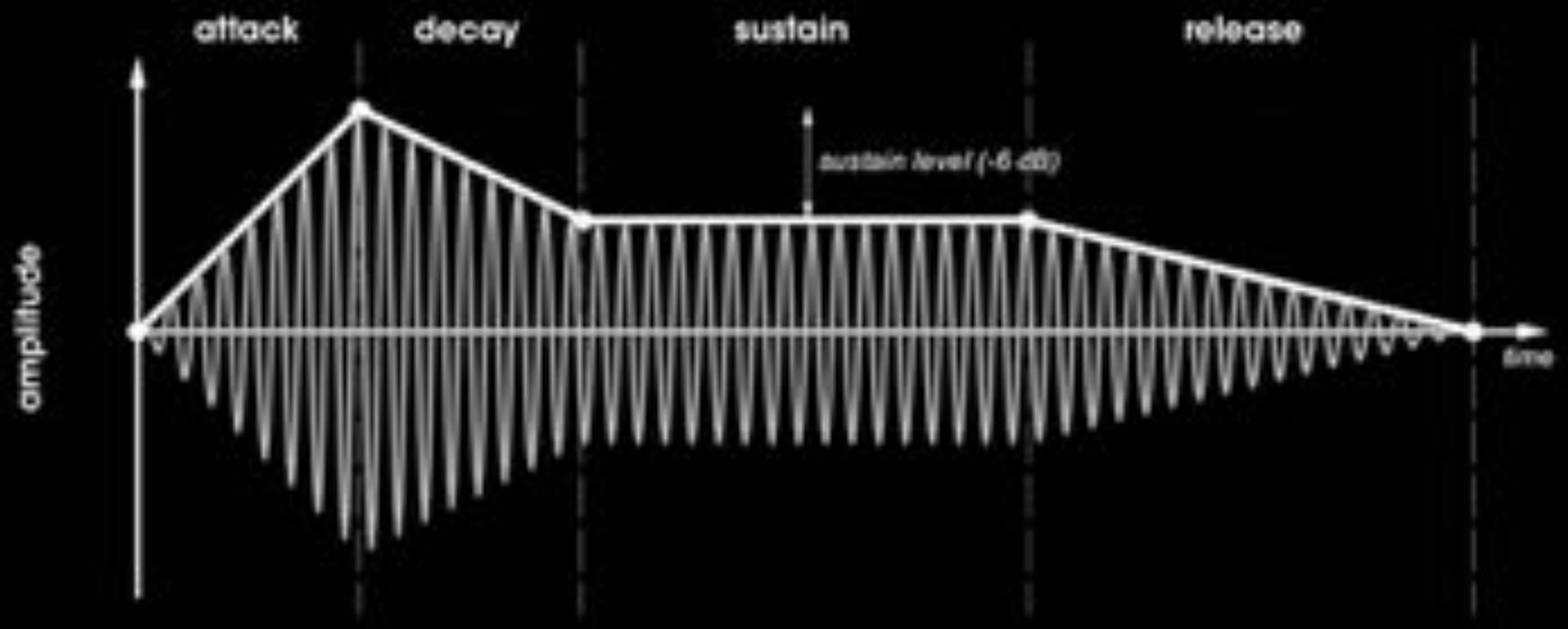
440 Hz
880Hz
1760Hz

440
880

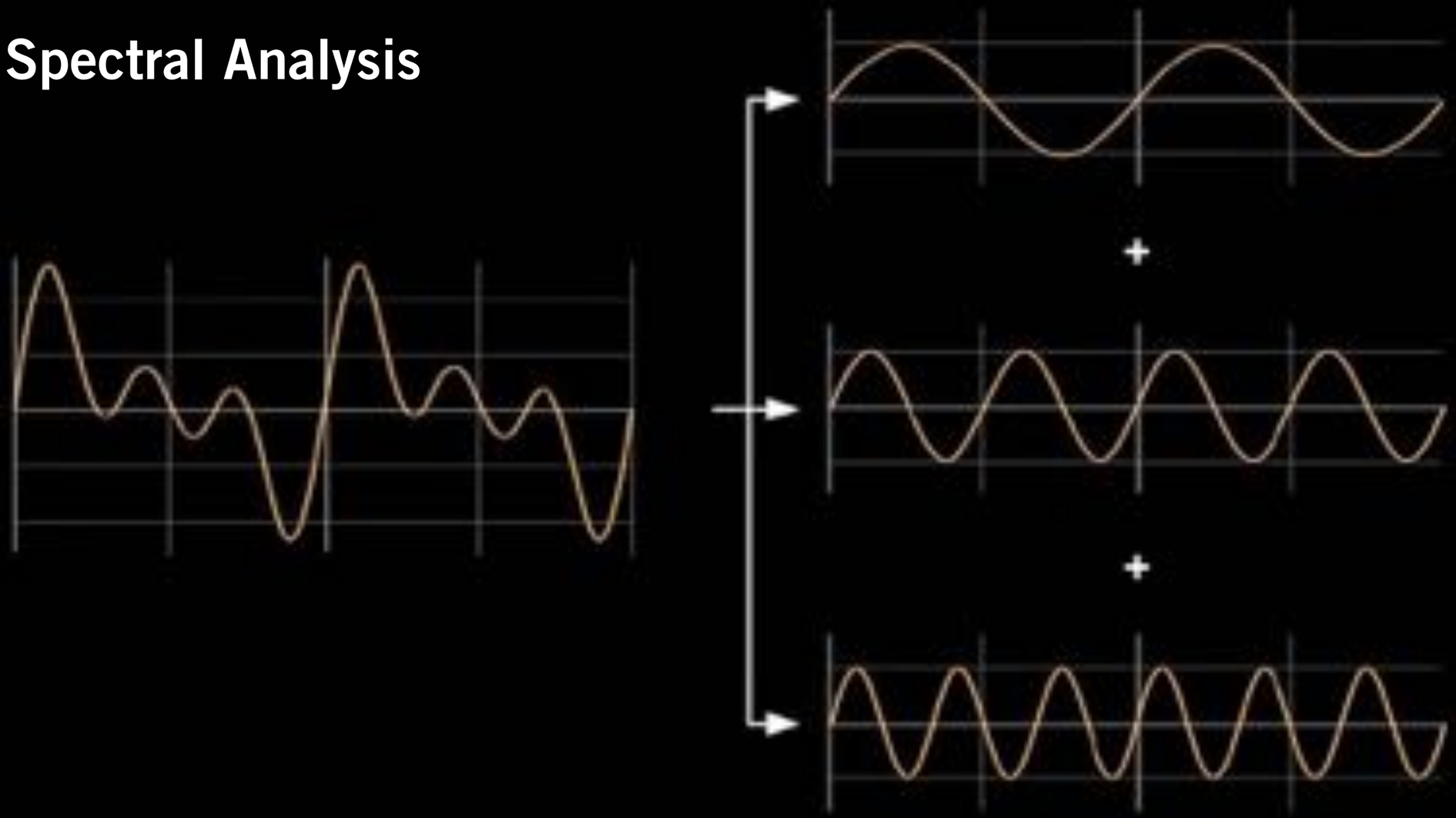




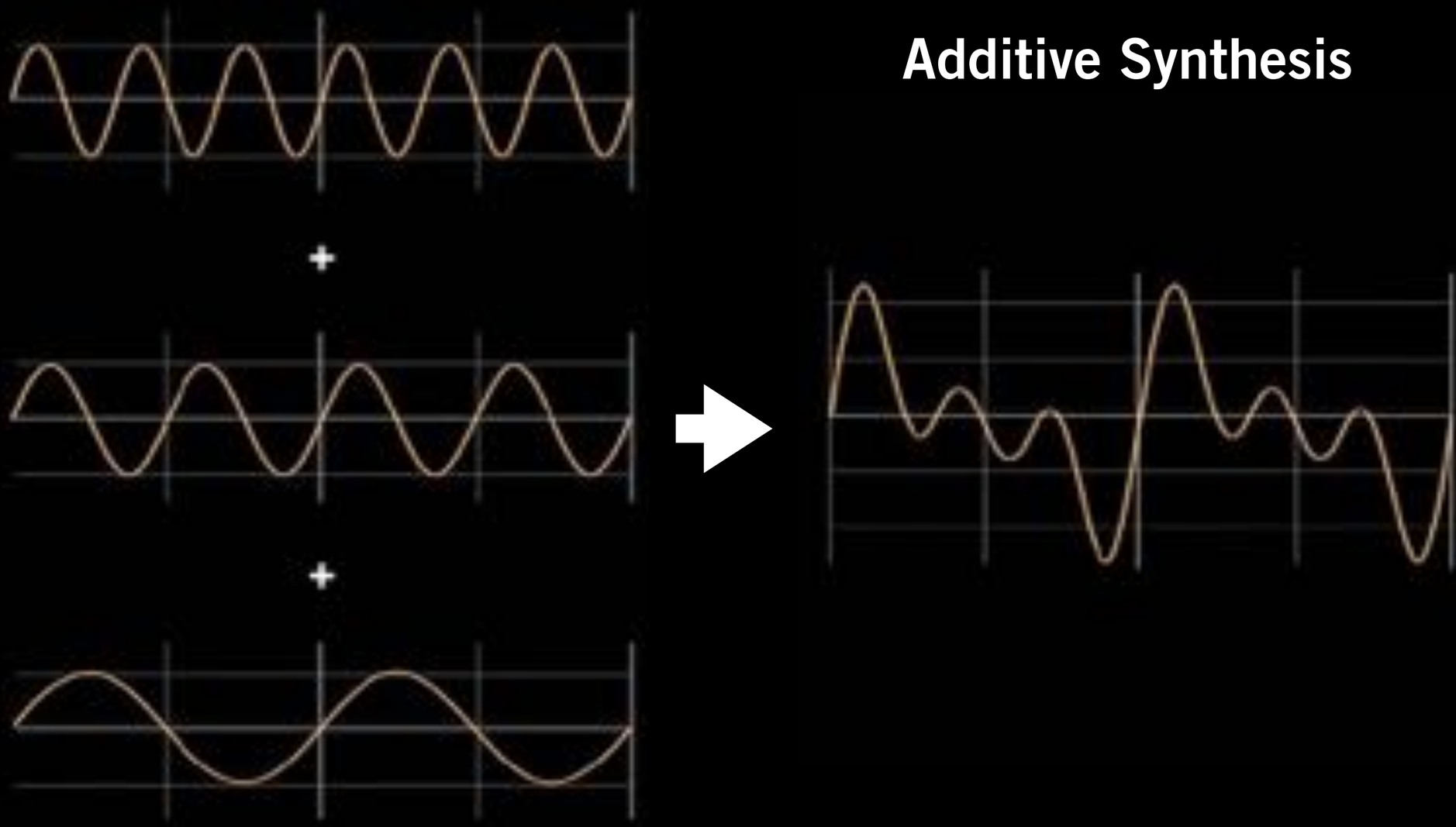
ADSR Envelope



Spectral Analysis



Additive Synthesis



harmonic / overtone series

the fundamental is the lowest partial - perceived pitch

A harmonic partial conforms to the overtone series which are whole number multiples of the fundamental frequency(f)

(f)1, (f)2, (f)3, (f)4, etc.

if f=110

110, 220, 330, 440

doubling = 1 octave

An inharmonic partial is outside of the overtone series, it does not have a whole number multiple relationship with the fundamental.

Basic Waveforms

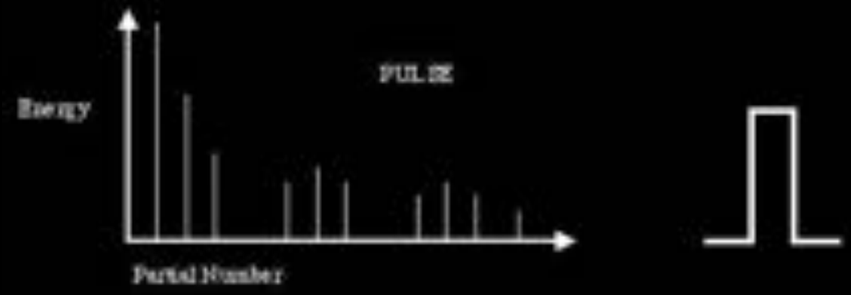
fundamental only, no additional harmonics

odd partials only (1,3,5,7...)

1 / p^2 (3rd partial has 1/9 the energy of the fundamental)

all partials

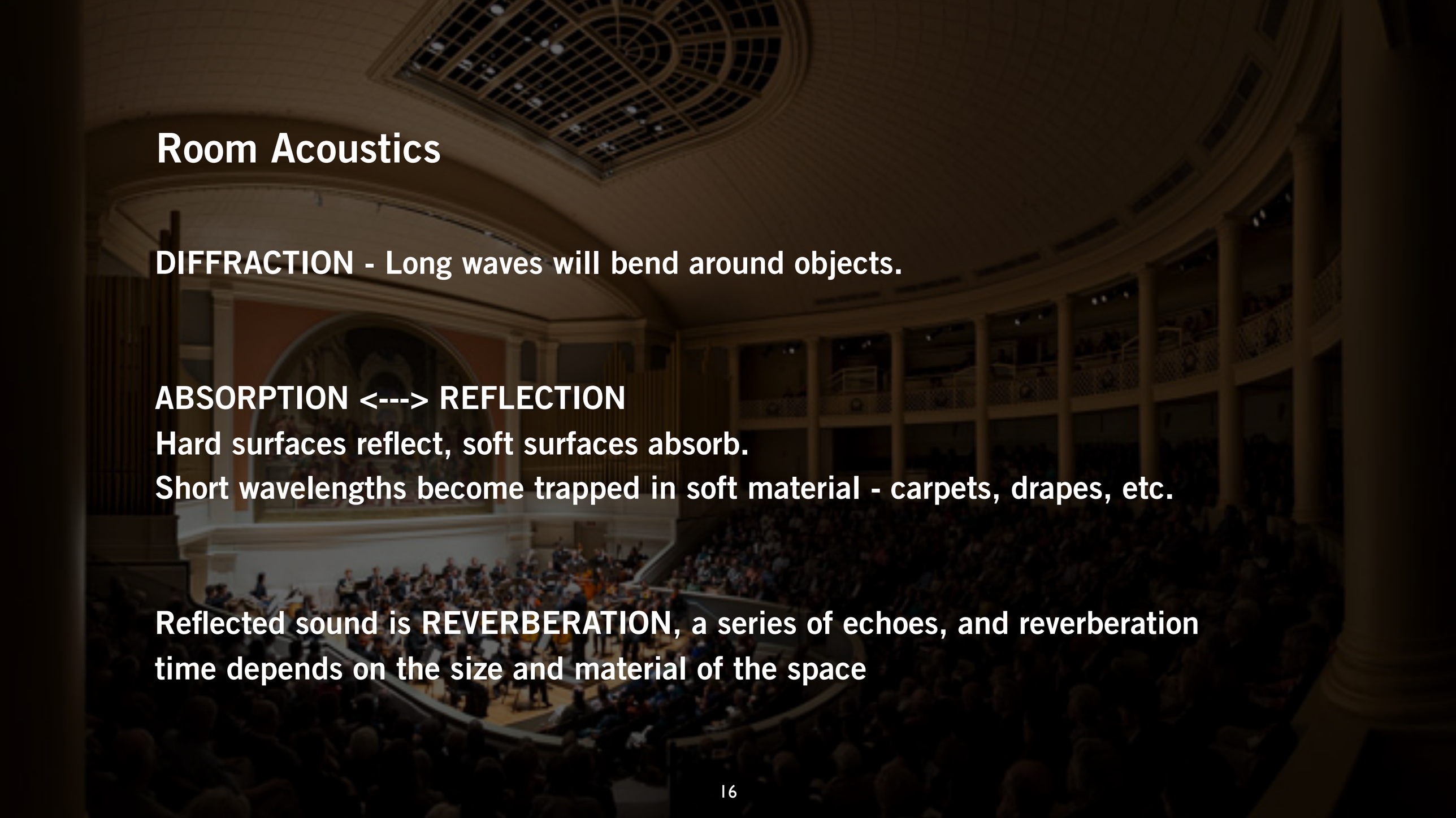
1 / p (3rd partial has 1/3 the energy of the fundamental)



only odd-numbered partials

1 / p (3rd partial has 1/3 the energy of the fundamental)

(max patch)



Room Acoustics

DIFFRACTION - Long waves will bend around objects.

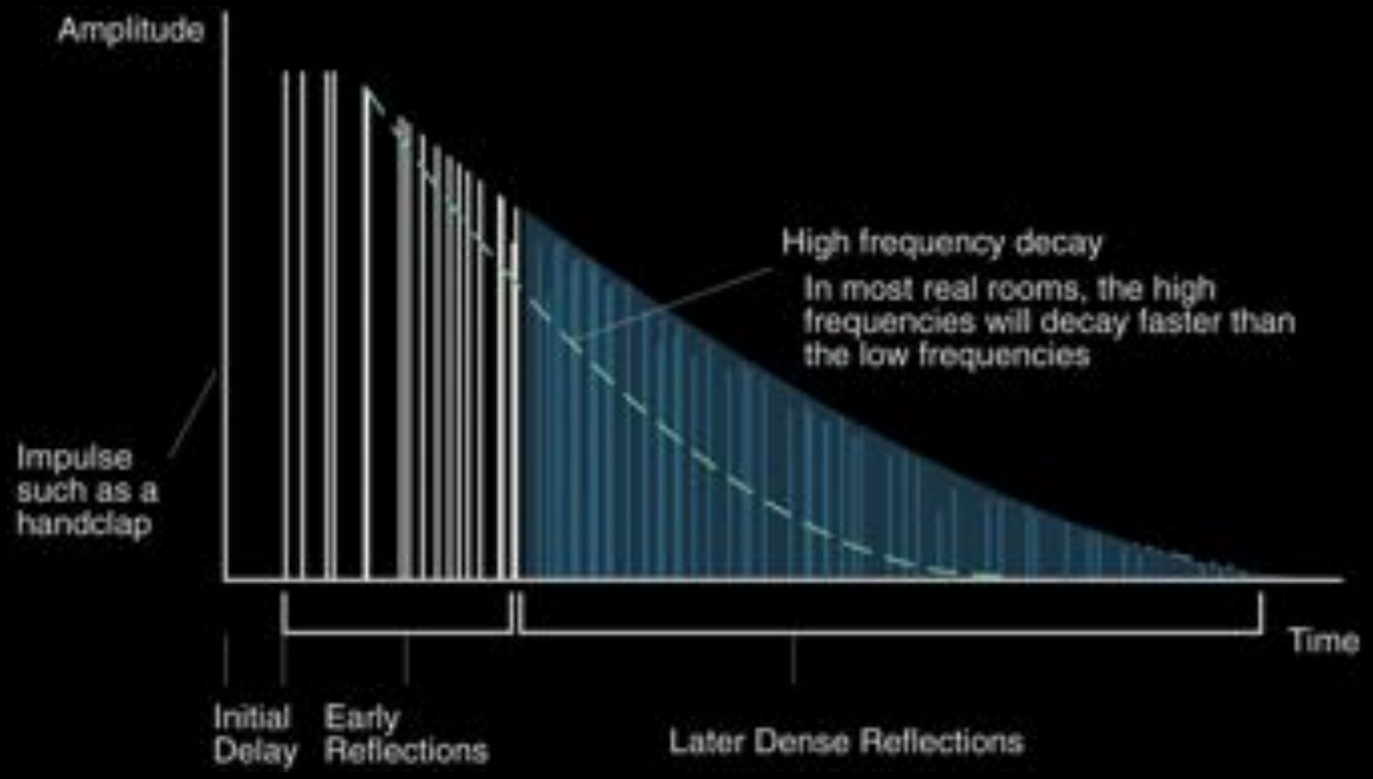
ABSORPTION <---> REFLECTION
Hard surfaces reflect, soft surfaces absorb.
Short wavelengths become trapped in soft material - carpets, drapes, etc.

Reflected sound is REVERBERATION, a series of echoes, and reverberation time depends on the size and material of the space

Reverberation

Natural - reflections caused by the resonant qualities of a space

Artificial - simulated digitally or through an analog system




Luigi Russolo
“The Art of Noise”
Intonorumori - noise orchestra

Electricity

Recording systems

Electronic Instruments

PHONOGRAPH

Invented 1877 by Thomas Edison

could record *and* playback sound

sound is no longer strictly a live event. It can be captured and replayed.

sound is represented as a physical medium (Cylinder, Record, Tape, etc), material that can be manipulated.

listen: “I am the Edison Phonograph” (1906)

GRAMOPHONE

Emile Berliner in 1887

rotating disc, harder material, louder. Patent 1894.

1897-1901 Introduced commercially

spiral not a helix, lateral rather than vertical cuts

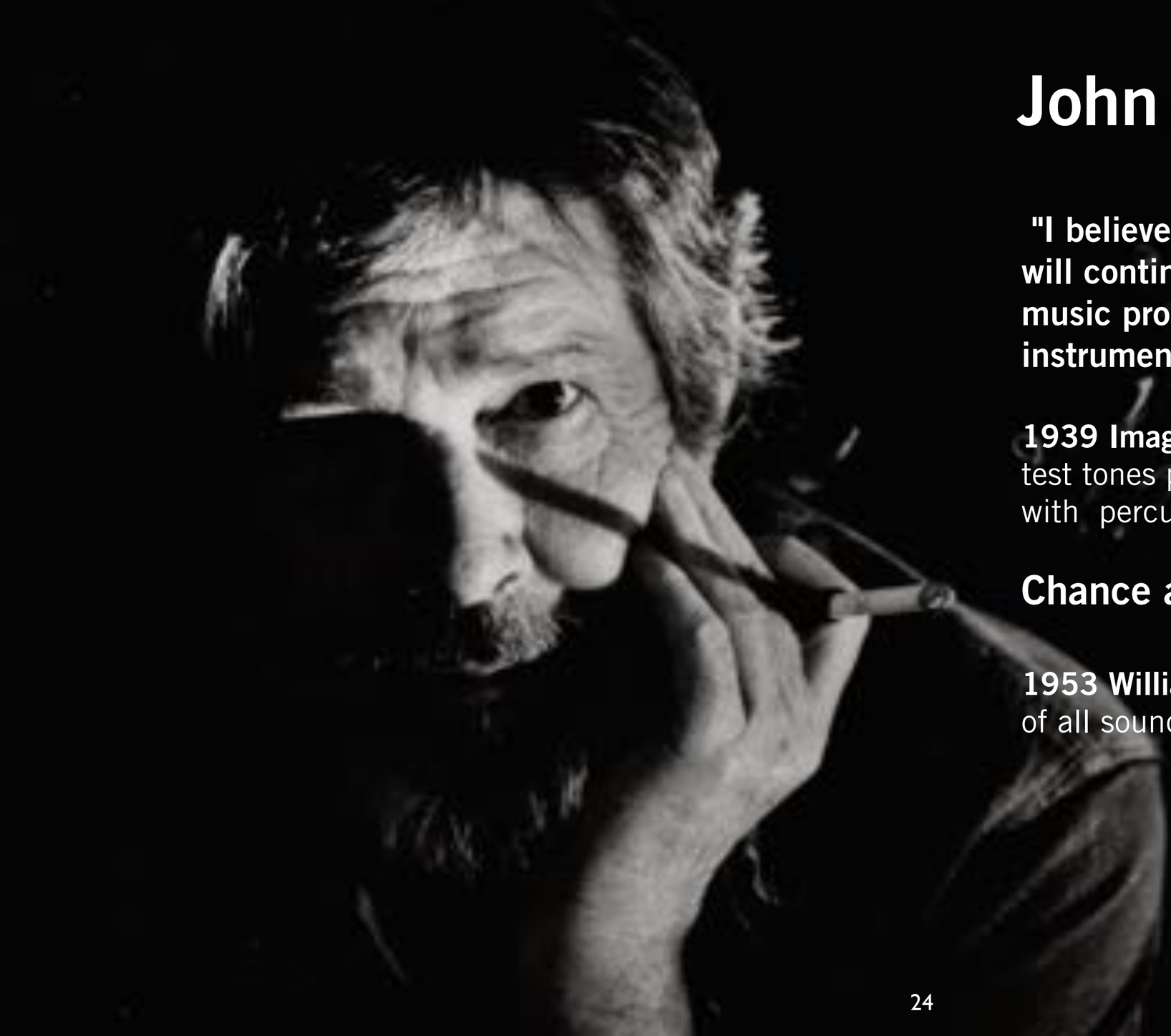
Electricity

Recording systems

Electronic Instruments

BASIC TAPE MANIPULATION PROCEDURES

1. Speed - transposition
2. Backwards - direction
3. Cutting - remove attacks, change envelopes
4. Splicing - editing, crossfade sounds
5. Looping - create rhythm from repetition
6. Mixing - record multiple layers of sound
7. Delay – run one tape past two machines, mix outputs



John Cage (1912-1992)

"I believe that the use of noise to make music will continue and increase until we reach a music produced through the aid of electrical instruments ..." (1937)

1939 Imaginary Landscape #1 - records of audio test tones played on two variable speed turntables, with percussion and noise.

Chance and Indeterminacy

1953 William's Mix - randomly constructed collage of all sounds.

TO RECORD OR TO SYNTHESIZE

Music Concrete	Elektronische Musik (moozeek)
France	Germany
Recorded Sounds	Synthesized Sounds
Montage, Film	Art Music, Serialism
Pierre Schaeffer	Herbert Einmert

PIERRE SCHAEFFER

Trained as a radio engineer for Radiodiffusion-Television Française (RTF) - 1940s

worked creating radio operas, combining non-musical sounds into montages

l'Objet Sonore (the sonic object) "Sound Object"

working directly with sounds (waveforms), not with symbols (scores)

Any sound source could become musical

ELEKTRONISCHE MUSIK

& the Cologne Studio

NWDR (Northwest German Broadcasting) Studio opens in 1951

Founded by Dr. Werner Meyer-Eppler, Herbert Einmert, Robert Beyer

Synthesized sounds over recorded sounds

An extension of serialism with all musical aspects carefully controlled, such as timbre, duration, volume, etc.

Music Concrete was just “fashionable and surrealistic”

Things changed when Stockhausen took over in 1963 (even a bit before)

listen: Herbert Einmart’s *Klangstudie II* (1952)

Karlheinz Stockhausen

GESANG DER JÜNGLINGE (SONG OF THE YOUTHS) (1955-56)

Karlheinz Stockhausen

combines electronic sounds with prerecorded and manipulated sounds. Recorded on five distinct tracks and one of the first surround-sound works.

Three sound sources: a boy soprano, generated sine tones, and generated noises (clicks).

Based on the biblical story of Daniel.

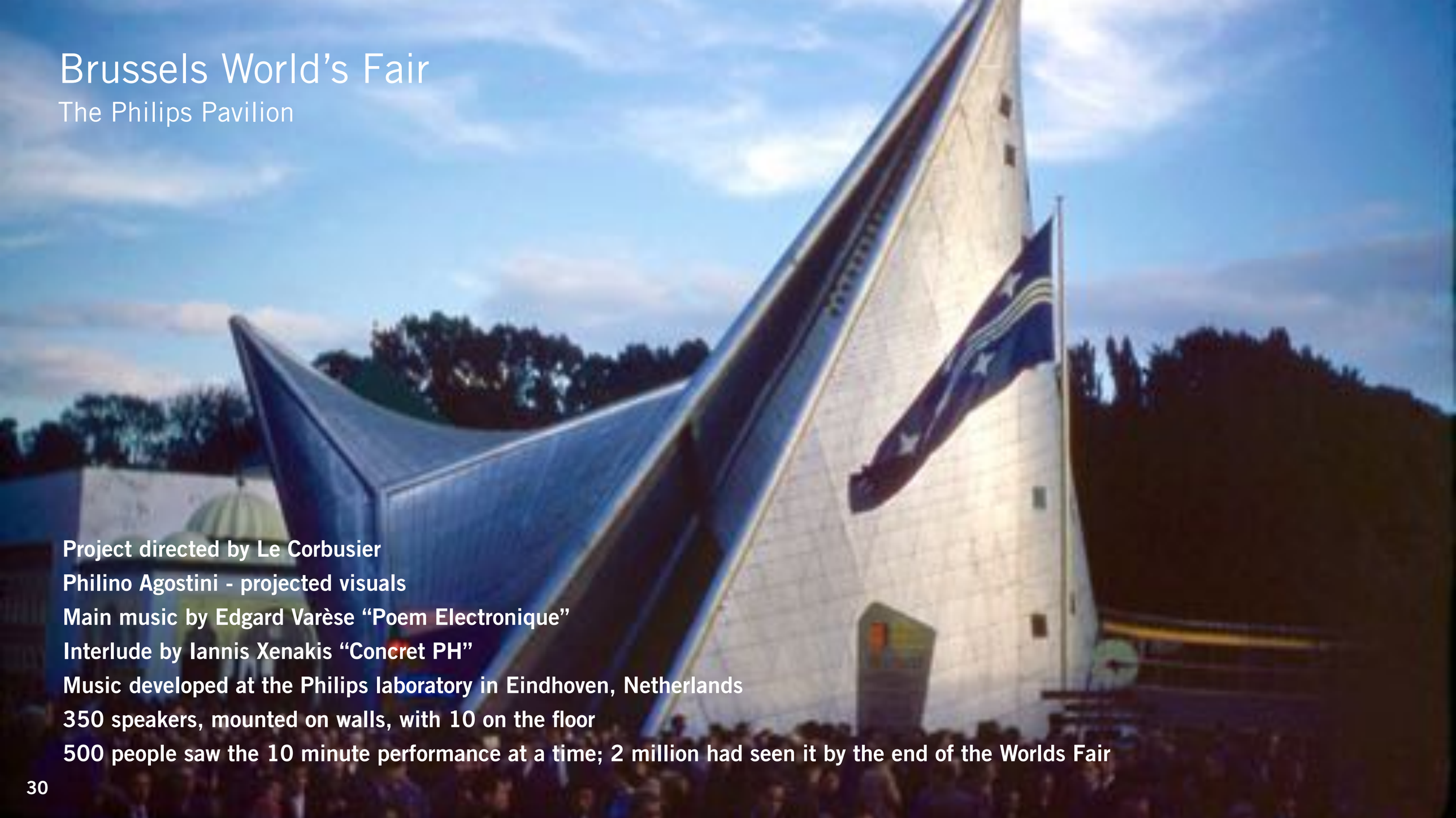
Plays in the space between recognizable speech & ‘abstract’ sound. Phonemes translated to sound, vowels are sine tones, consonants are bands of noises, plosives are impulses.

Sound as speech, speech as sound.

Built a bridge between French and German schools

Brussels World's Fair

The Philips Pavilion



Project directed by Le Corbusier
Philino Agostini - projected visuals
Main music by Edgard Varèse "Poem Electronique"
Interlude by Iannis Xenakis "Concret PH"
Music developed at the Philips laboratory in Eindhoven, Netherlands
350 speakers, mounted on walls, with 10 on the floor
500 people saw the 10 minute performance at a time; 2 million had seen it by the end of the Worlds Fair

Edgard Varèse

Poème Électronique (1958)

Iannis Xenakis

CONCRET PH (1958)

GRANULAR SYNTHESIS

Hugh Le Caine

Canadian scientist/composer with the National Research Council of Canada (NRC) in Ottawa

Transformations of a single sound source as an organizing principle, the sound of a single drop of water

Le Caine also invented the Electronic Sackbut in 1945, an early voltage controlled synthesizer (pictured)

Listen: Dripsody (1955)

BBC Radiophonic Workshop (1958)

Daphne Oram, Brian Hodgson, Delia Derbyshire, David Cain, and many more...

LOOK AT ORAMICS (1961)

Daphne Oram

Developed “Oramics” in 1959, a graphically controlled synthesizer.

Classically trained musician and BBC engineer.

Visited Schaeffer and RTF in Paris

First to notate ideas for synthetic sounds that could be reproduced by sound-generating instruments

Drawing Sounds

DELIA DERBYSHIRE

Doctor Who Theme (1963)

Top Engineer and Composer
at the BBC

SYNTHESIZER HISTORY

1897	Telharmonium (Thaddeus Cahill)
1919	Theremin (Leon Theremin)
1928	Ondes Martenot (Maurice Martenot)
1930	Trautonium (Trautwein)
1935	Hammond Organ (Laurens Hammond)
1945	Electronic Sackbut (Hugh Le Caine)
1956	RCA Mark I & II (Olson and Belar)
1964	First Buchla and Moog Modular Synths
1970	Minimoog (portability)

Types of Synthesis

Additive Synthesis
Combines sine waves to make more complex waveforms.

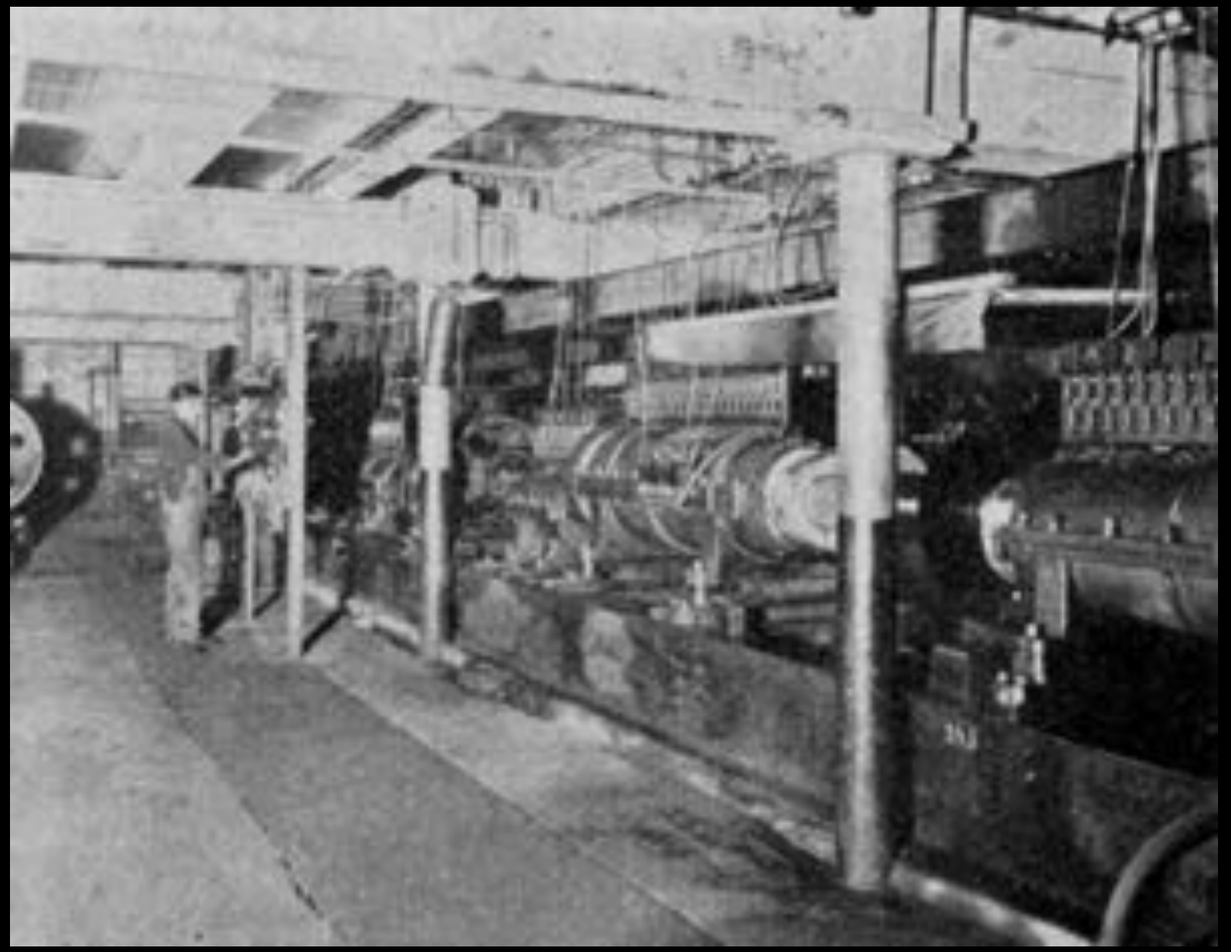
Subtractive Synthesis
Removes some aspect of a sound through filtering.

Modulation
- Amplitude Modulation --> Tremolo
- Frequency Modulation --> Vibrato

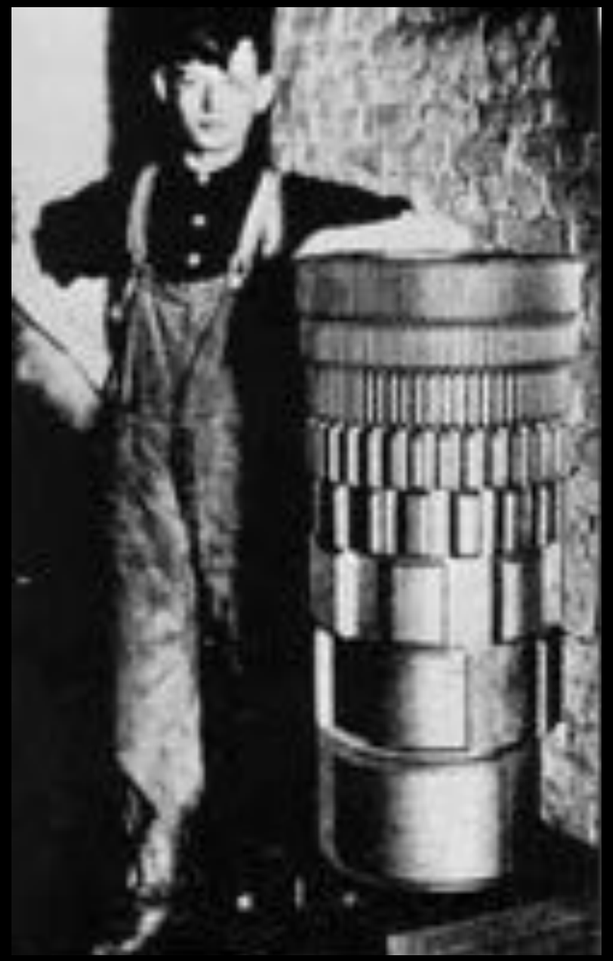
Telharmonium (1897)

Thaddeus Cahill

weighed 200 Tons and cost $200,000 to make in 1897



Additive Synthesis
rheotomes (later tone-wheels)



Theremin (1919)

Leon Theremin

monophonic

played without physically touching the instrument, gestural control

Clara Rockmore

ONDES MARTENOT (1928)

Maurice Martenot

Oraison (1937)

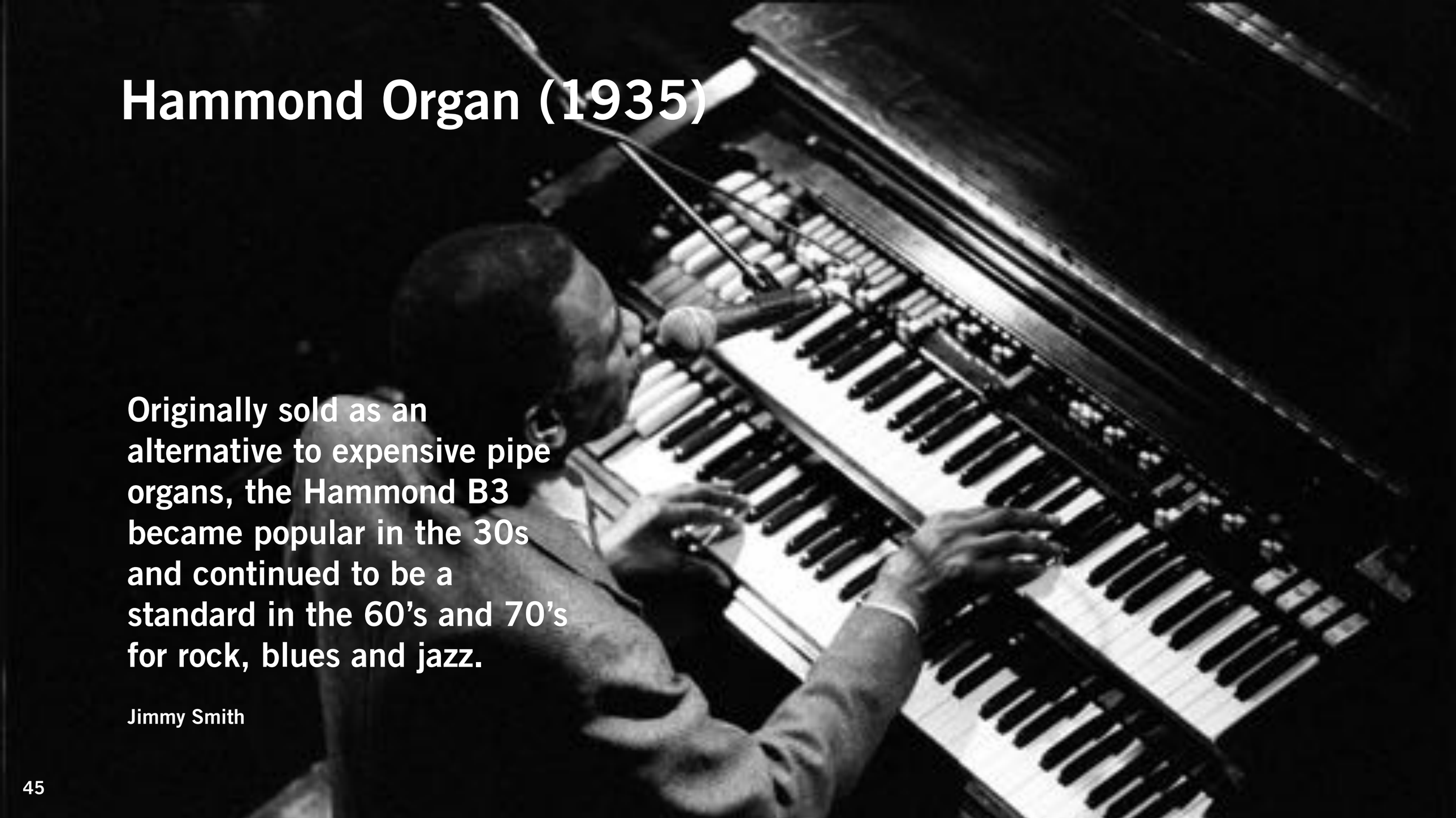
by Olivier Messiaen

Trautonium (1929)

Friedrich Trautwein

Oskar Sala

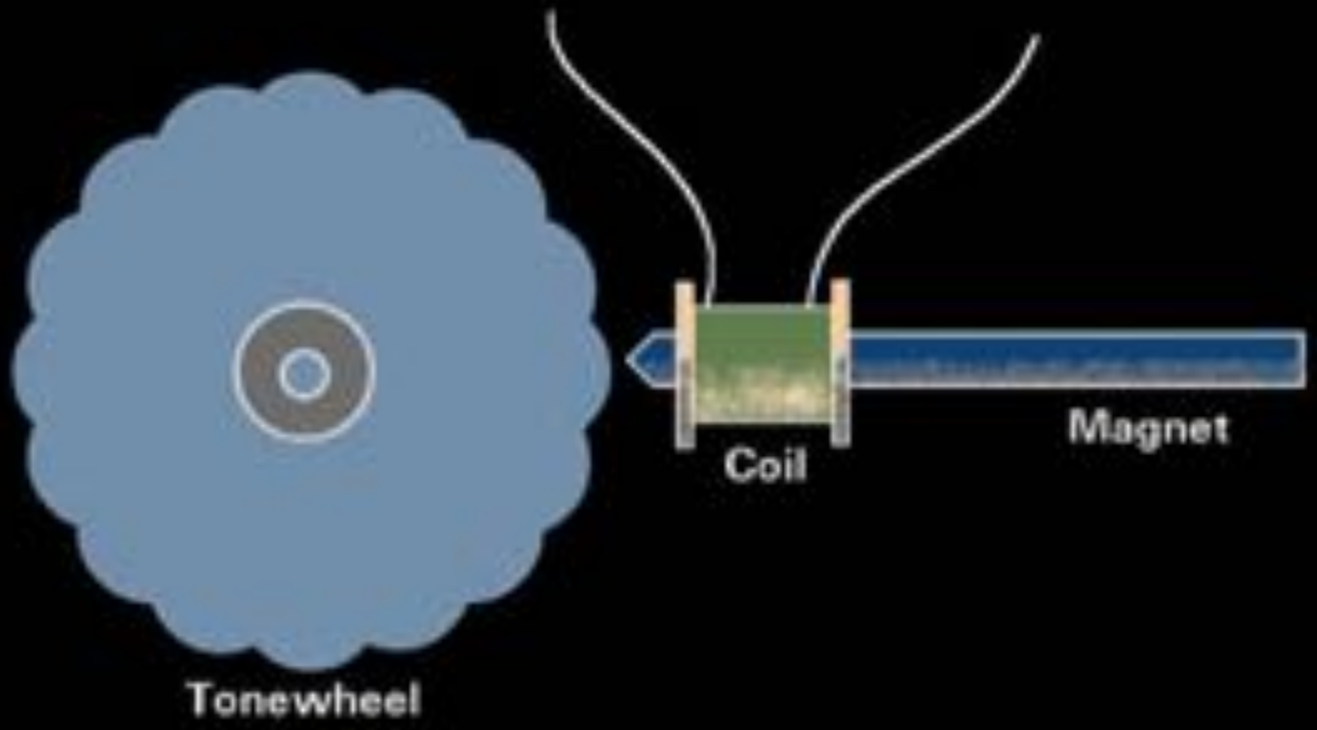
Hammond Organ (1935)

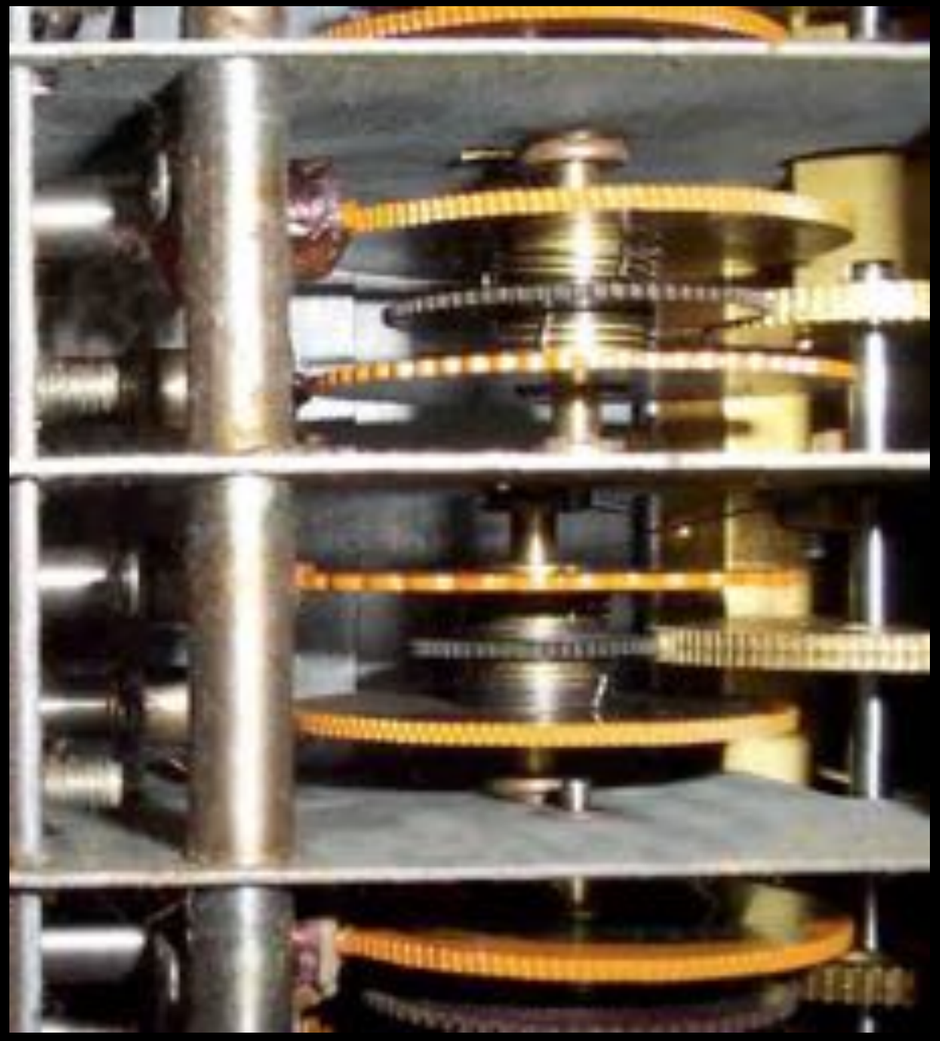


Originally sold as an alternative to expensive pipe organs, the Hammond B3 became popular in the 30s and continued to be a standard in the 60's and 70's for rock, blues and jazz.

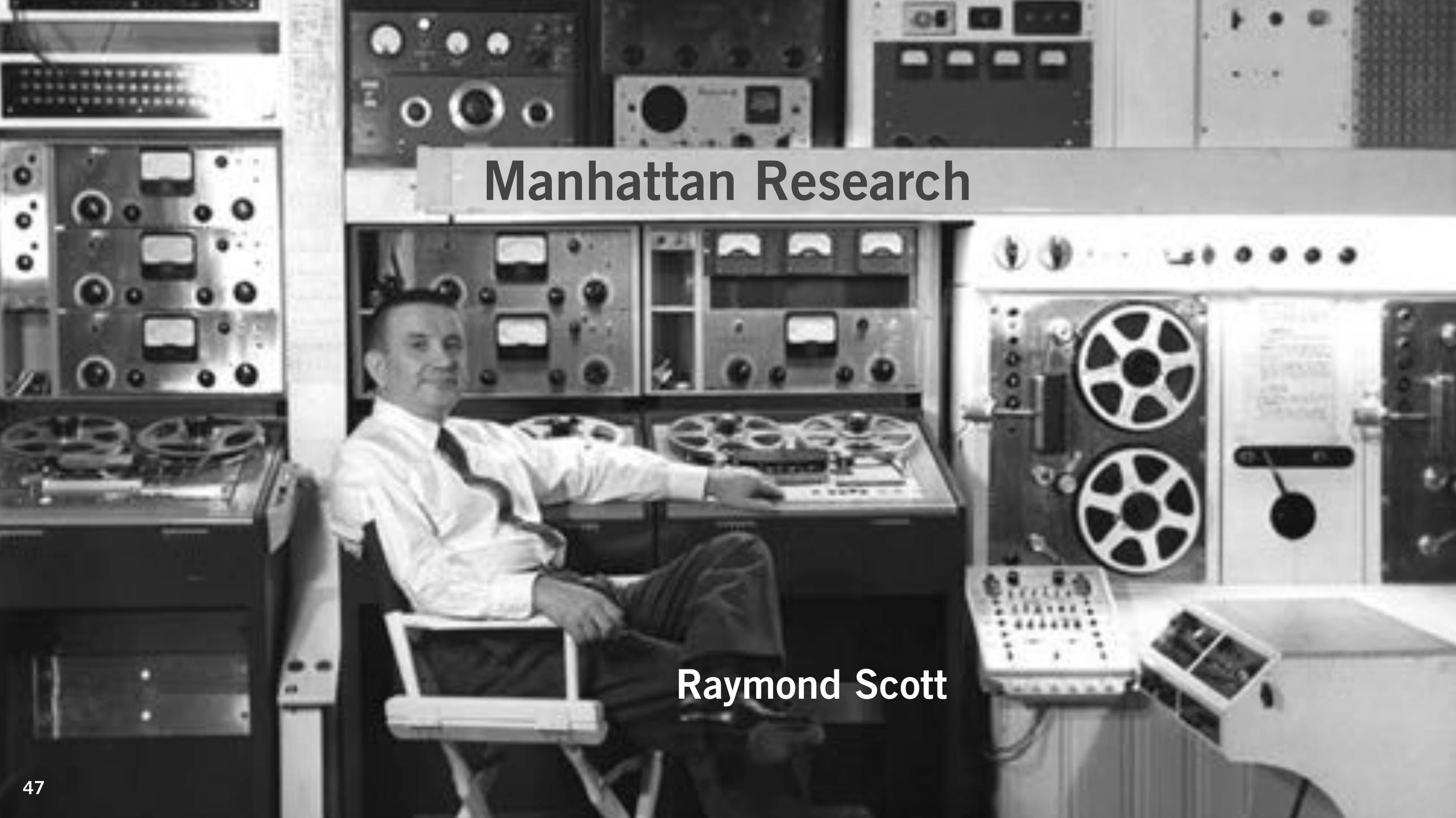
Jimmy Smith

Tonewheels





Manhattan Research



Raymond Scott

Donald Buchla West Coast

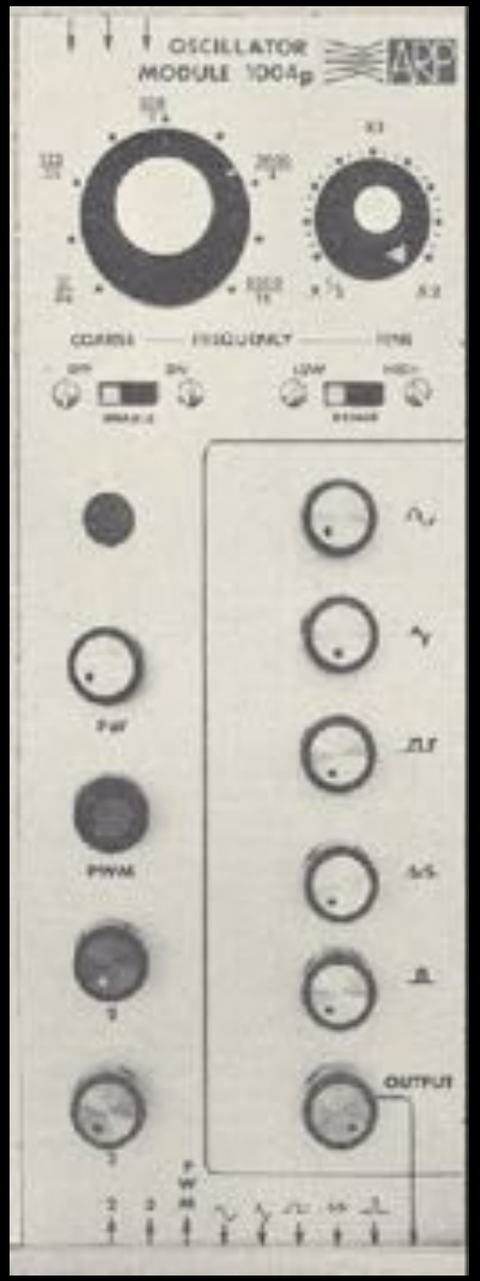
In 1964, Buchla, an engineer with a musical background, was approached by the San Francisco Tape Music Center to build a customized synthesizer for their studio.

The Buchla 100 used voltage control and featured the first sequencer. Instead of a keyboard, it had programmable metal plates.

Robert Moog East Coast

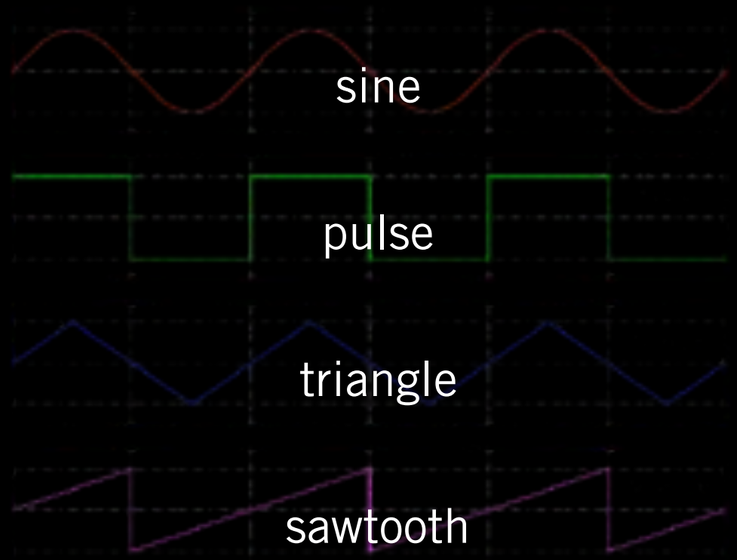
Moog studied physics and electrical engineering, putting himself through school by selling theremins he built.

In 1964, Moog began experimenting with voltage-controlled oscillators, eventually completing an early synthesizer with keyboard control; his first synthesizer was sold in 1965.



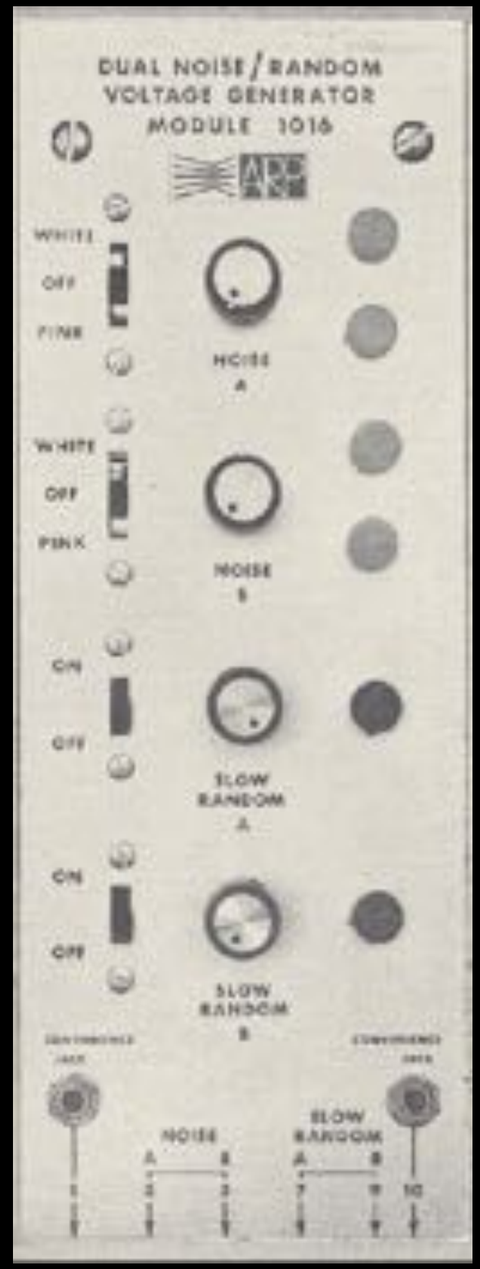
SOURCES

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.



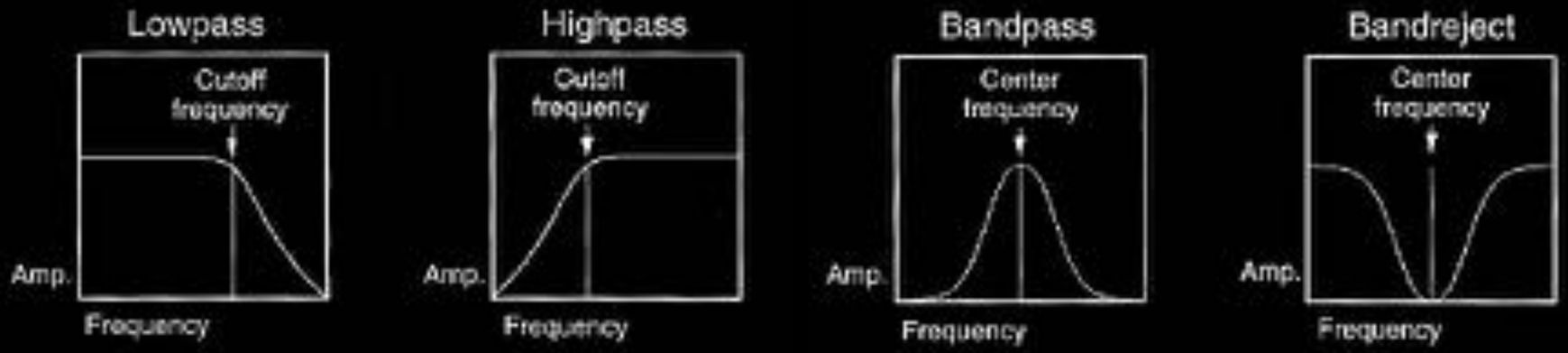
FILTERS

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

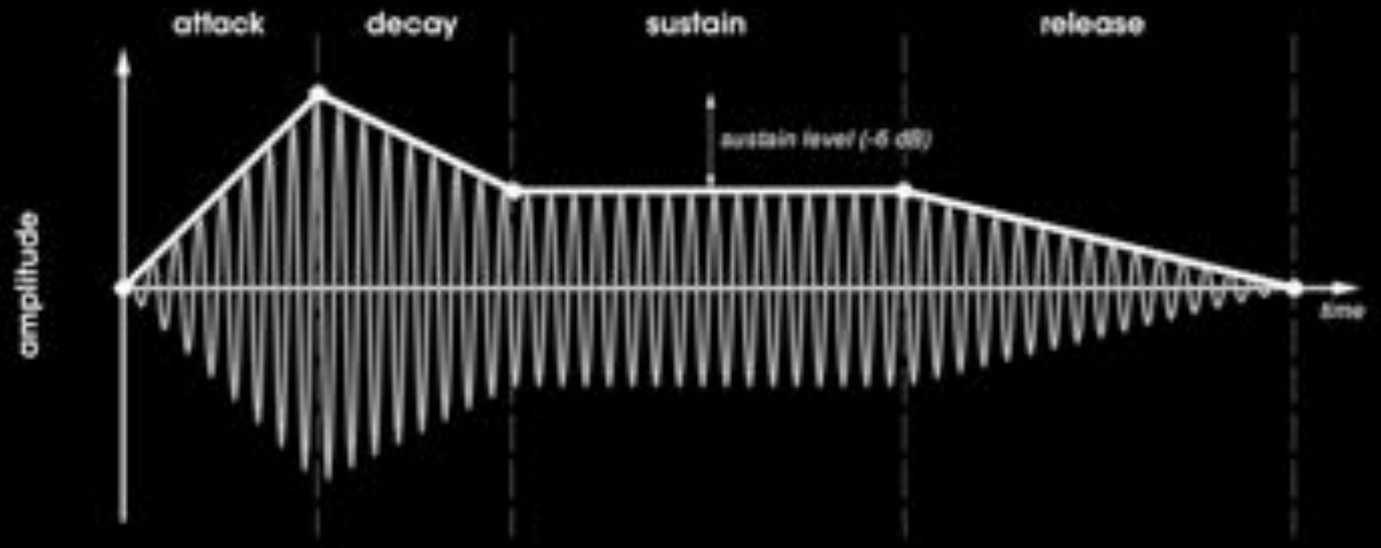


“Q” characterizes a resonator's bandwidth relative to its center frequency. Higher the Q, narrower the filter

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



SWITCHED-ON BACH
WENDY CARLOS

Performed by Wendy Carlos on a Monophonic Synthesizer!

Recorded on an 8-track tape recorder custom-built by Carlos.

One of the first classical albums to go platinum

Won Three Grammy awards

Brought the sound of the Moog synthesizer to the masses.

ISAO TOMITA

Like Carlos, built a career on covering classical works on monophonic synthesizers.

Pioneer of ‘Space Synth Music’

4 Grammy nominations for his album ***Snowflakes are Dancing***, 1974

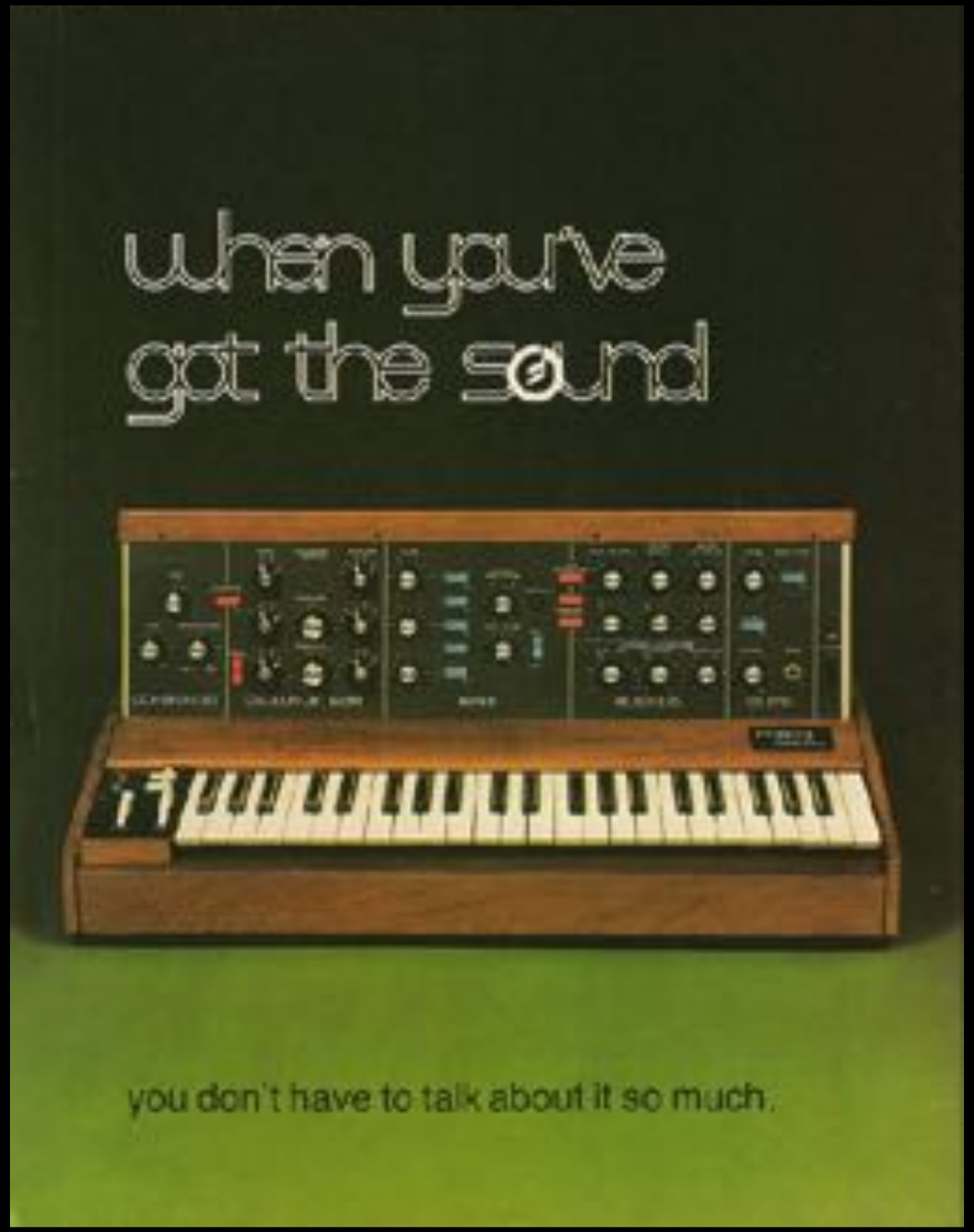
Played a Moog III modular synthesizer

His sounds are often emulated in synth presets

Morton Subotnick

Silver Apples of the Moon (1967)

created entirely with the Buchla 100 Synthesizer that he helped develop with Donald Buchla.



Minimoog (1970)

The first pre-patched, portable performance synthesizer.

Featured pitch bend and vibrato wheels (modulation wheels), which are now standard on all digital synthesizers.

popular and ‘affordable’ ($1500) - sold 13,000 units.

the analog circuits were largely the same, but switches replaced patch points in a simplified arrangement called "normalization"

Made famous by **Keith Emerson** of Emerson, Lake and Palmer (ELP), first to tour with the instrument. Later used by groups such as Yes, Kraftwerk, Devo, Bob Marley, George Clinton, Chuck Corea and Pink Floyd.

Keith Emerson

In designing the minimoog, Bob Moog worked with virtuoso keyboardist Keith Emerson.

Emerson played in the band Emerson, Lake & Palmer (ELP) and gladly swapped his modular touring rig for the portability of the Minimoog.

ELP also covered a few classical tunes...

SWING TO BOP

CHARLIE CHRISTIAN // GIBSON ES-150

1941 AT MINTON’S NYC

MUDDY WATERS

BLUES GUITARIST

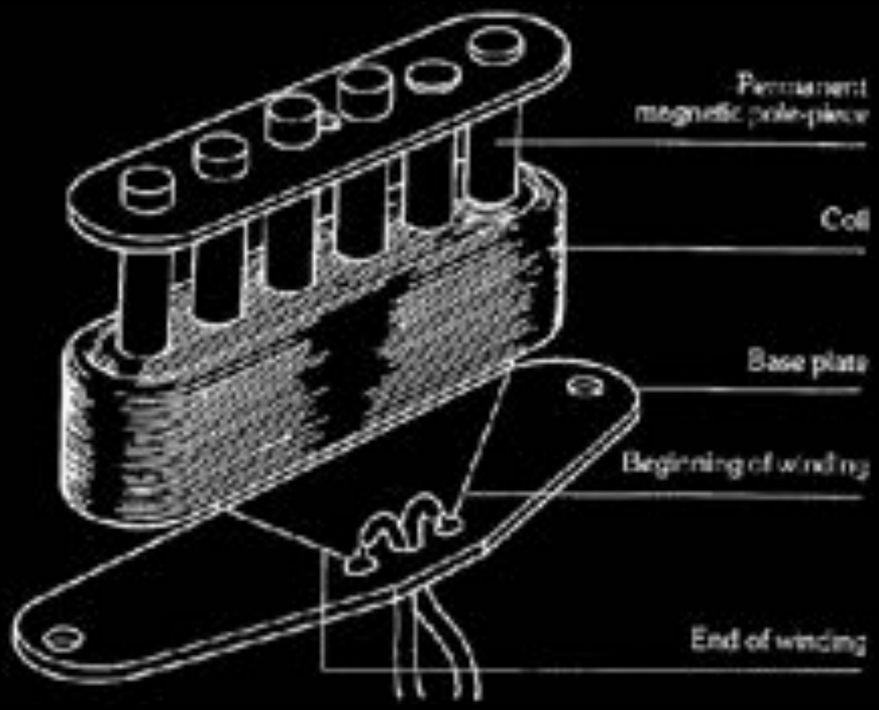
PART OF THE 1940s CHICAGO JAZZ SCENE

SOLID BODY ELECTRIC GUITARS

LES PAUL INVENTS “THE LOG” IN 1940

HOW DO GUITAR PICKUPS WORK?

Faraday's Law - a changing magnetic field will generate electricity in a conductive wire



Les Paul and Overdubbing

Listen: Lover (1948)

MULTITRACK TAPE

Late 50s and 60s

8 tracks recorded to 1 inch or 2 inch tape

Allowed for non-destructive overdubbing

no mechanical sync problems

creative bouncing

NEW FORMS

Concept Album: conceived as a single composition more than a collection of songs.

Studio Album: studio techniques and instrumental forces that could not be reproduced on stage.

NEW ELEMENTS

Synthesized sounds, surrealist collage, tape manipulation, echo, extreme panning, vocal processing, feedback, sound effects (everyday sounds), spatial effects, orchestral effects.

Beach Boys and Brian Wilson

songwriter, producer & studio perfectionist

- ★ studio arrangements were “impossible to perform live”
- ★ why mono?
- ★ the studio as an instrument, a compositional tool

using studio techniques (mixing, mixing, bouncing, collage, etc) and effects (primarily echo & reverb) songs became explorations of musical soundscapes.

context as a compositional device?

Good Vibrations (1966)

THE BEATLES

formed in 1960 in Liverpool, England

over 1 billion records sold

In 1966 they released the Revolver LP and followed with what would be their last commercial tour.

stopped touring in 1966 and focused on studio production

Listen: A Day in the Life (1967)

John Lennon, George Harrison, Paul McCartney, Ringo Starr at Shea Stadium 1966

FRANK ZAPPA

Zappa purchased a recording studio in LA in 1967, and devoted himself to learning to “play studio.”

Influenced by classical music, especially Varèse; later works combined synthesizers and Synclavier with orchestral instruments.

"conceptual continuity"

“***Brown shoes don’t make it”*** described as a 2-hour musical condensed into 8 minutes

Brown shoes don't make it (excerpt)

JIMI HENDRIX

in short time, redefined the electric guitar

pioneered the use of effects pedals and feedback.

Clear overdriven tone, extreme sustain, wah & octave

played guitar for Little Richard

Moved to London in 1966

first major US appearance was the **1967 Monterey Pops Festival** (guitar burn)

studio virtuoso (Electric Ladyland, 1968)

died of asphyxia at the age of 27

TYPES OF EFFECTS UNITS

Distortion	reshape sound by “clipping” the audio waveform
Dynamics	Boost / Compression / Noise Gate / (tremolo)
Filter	EQ / Talk Box / Wah Wah
Modulation	Chorus / Flanger / Phaser / Tremolo / Vibrato
Pitch / Frequency	Pitch Shifter / Harmonizer
Time-based	Delay / Looping / Reverb

STEVE REICH

influenced by both tape loops and Ghanian drumming

Phase Music

- **Come Out (tape loops)**
- **Piano Phase (acoustic instruments using techniques developed working with tape)**

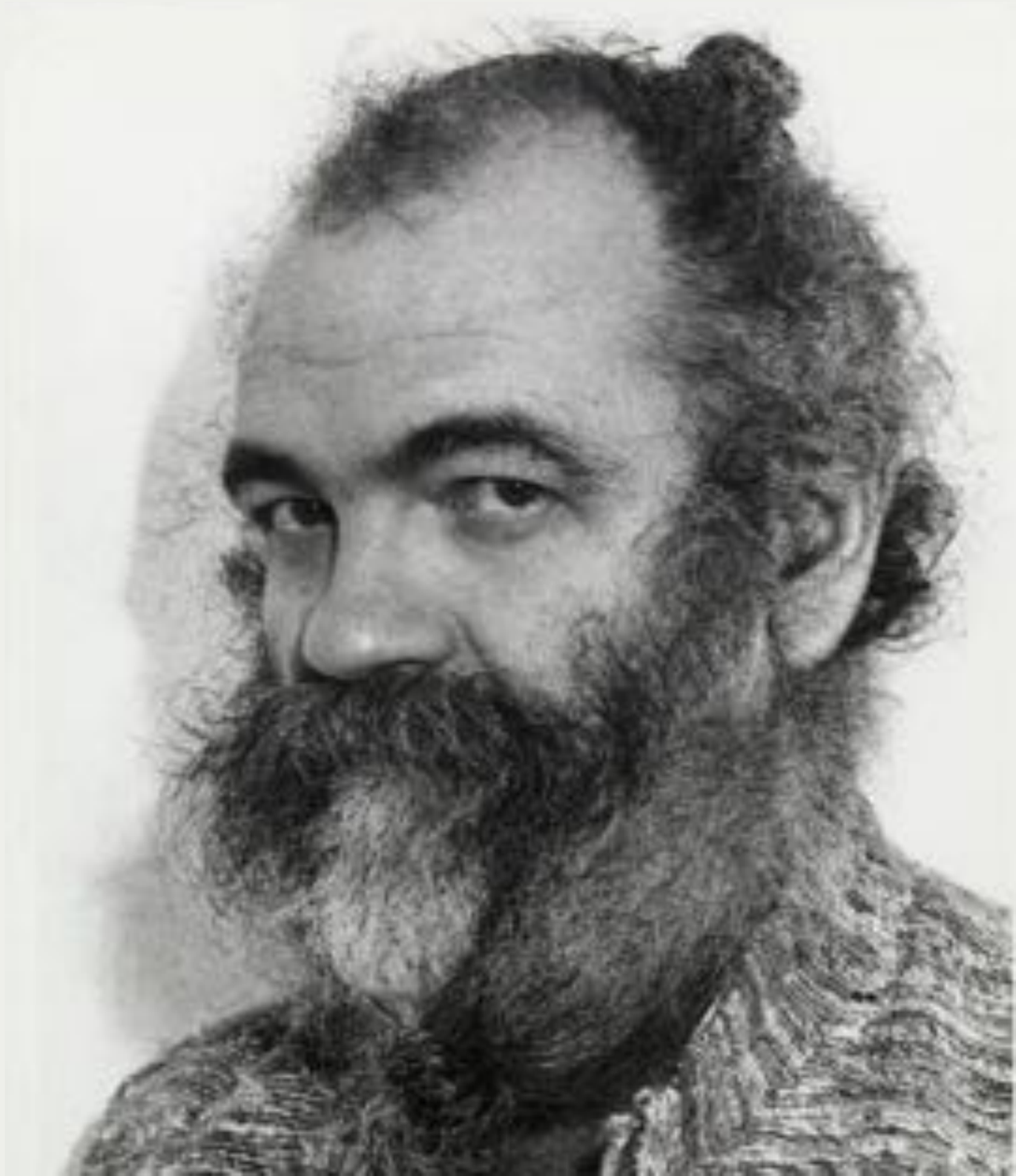
2009 Pulitzer Prize in Music

LA MONTE YOUNG

Often cited as the first “minimalist” composer - musical reductionist

Worked with Cage, Stockhausen, Tudor & Riley

Dream House project started in 1962.



ÉLIANE RADIGUE

Assisted Pierre Shaeffer and Pierre Henry

Studied at NYU

In 1975, Radigue became a disciple of Tibetan Buddhism, greatly influencing her music.

slow, purposeful "unfolding" of sound

Worked extensively with the Arp 2500 Modular Synthesizer

Early ‘drone music’

Listening: Arthesis (1973)

TERRY RILEY

Riley was part of the San Francisco Tape Music Center with Pauline Oliveros, Steve Reich and Morton Subotnick.

In C (1964) was inspired by tape loops and jazz improvisation. It consisted of 53 musical figures played sequentially, with each being repeated a few times.

The work brought minimalism to prominence, introducing rhythmic patterns that could be combined and repeated.

Electronic techniques inspiring methods for acoustic music.

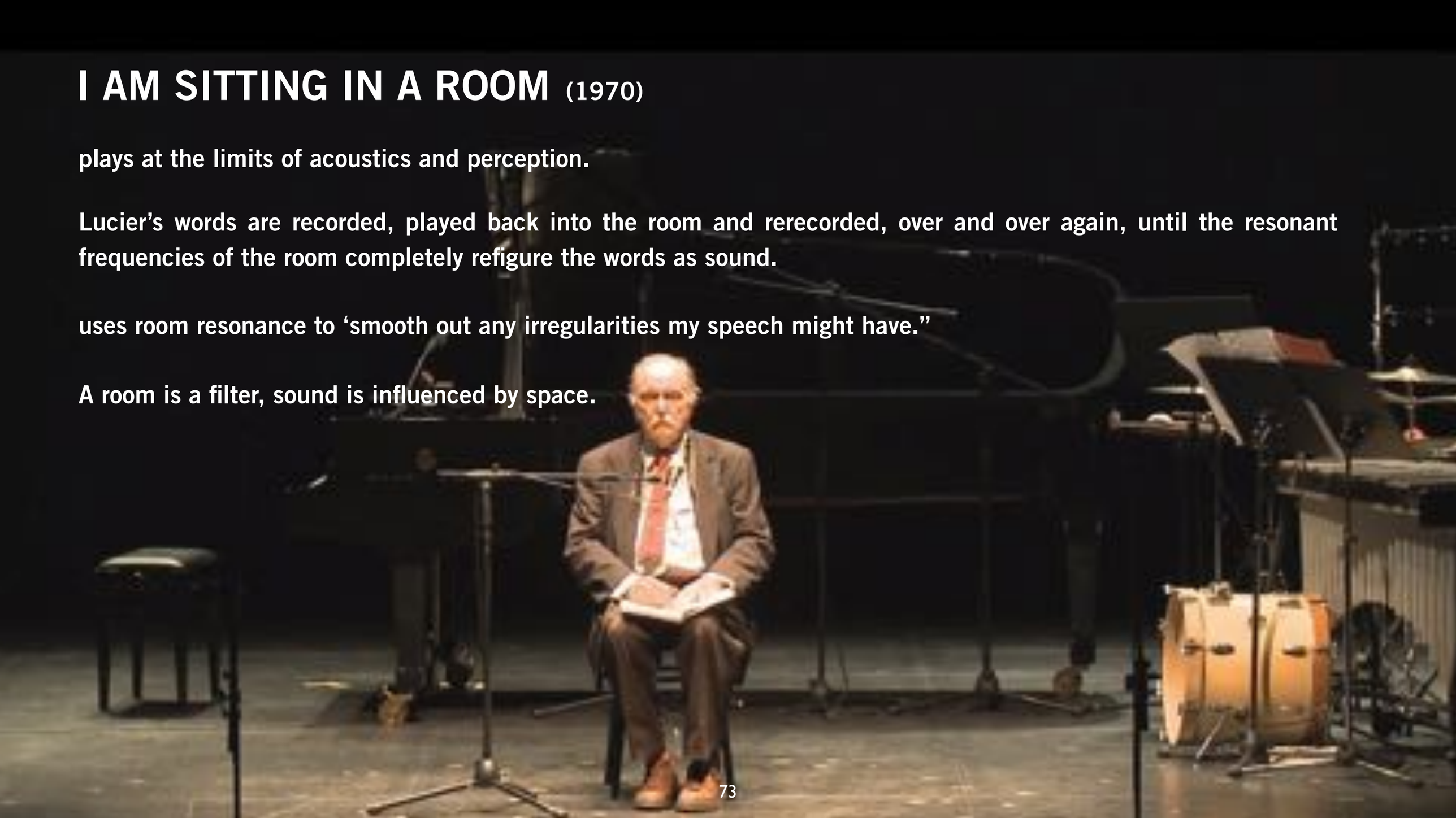
I AM SITTING IN A ROOM (1970)

plays at the limits of acoustics and perception.

Lucier's words are recorded, played back into the room and rerecorded, over and over again, until the resonant frequencies of the room completely refigure the words as sound.

uses room resonance to 'smooth out any irregularities my speech might have."

A room is a filter, sound is influenced by space.



Brian Eno

Credited with naming / inventing Ambient Music

Produced records by the Talking Heads, U2, David Bowie, Coldplay, and many others.

Oblique Strategies — chance based studio prompts

Listen: Music for Airports

Ambient Music Recap

Ambient Music often focuses on the timbre, changes in the quality of the sound rather than the traditional focus of rhythm, melody and harmony.

Often evocative of a “place,” “atmosphere,” “visual” or “environment.”

“Not music from the environment but music for the environment” - Eno

It’s typically less-dramatic, and often non-linear, without clear directionality.

It has roots in the work of John Cage, Wendy Carlos, La Monte Young and the “minimalist” composers.

It spans aesthetics ranging from Sound Art to Dance Music

matured as a genre through the work and writing of Brian Eno

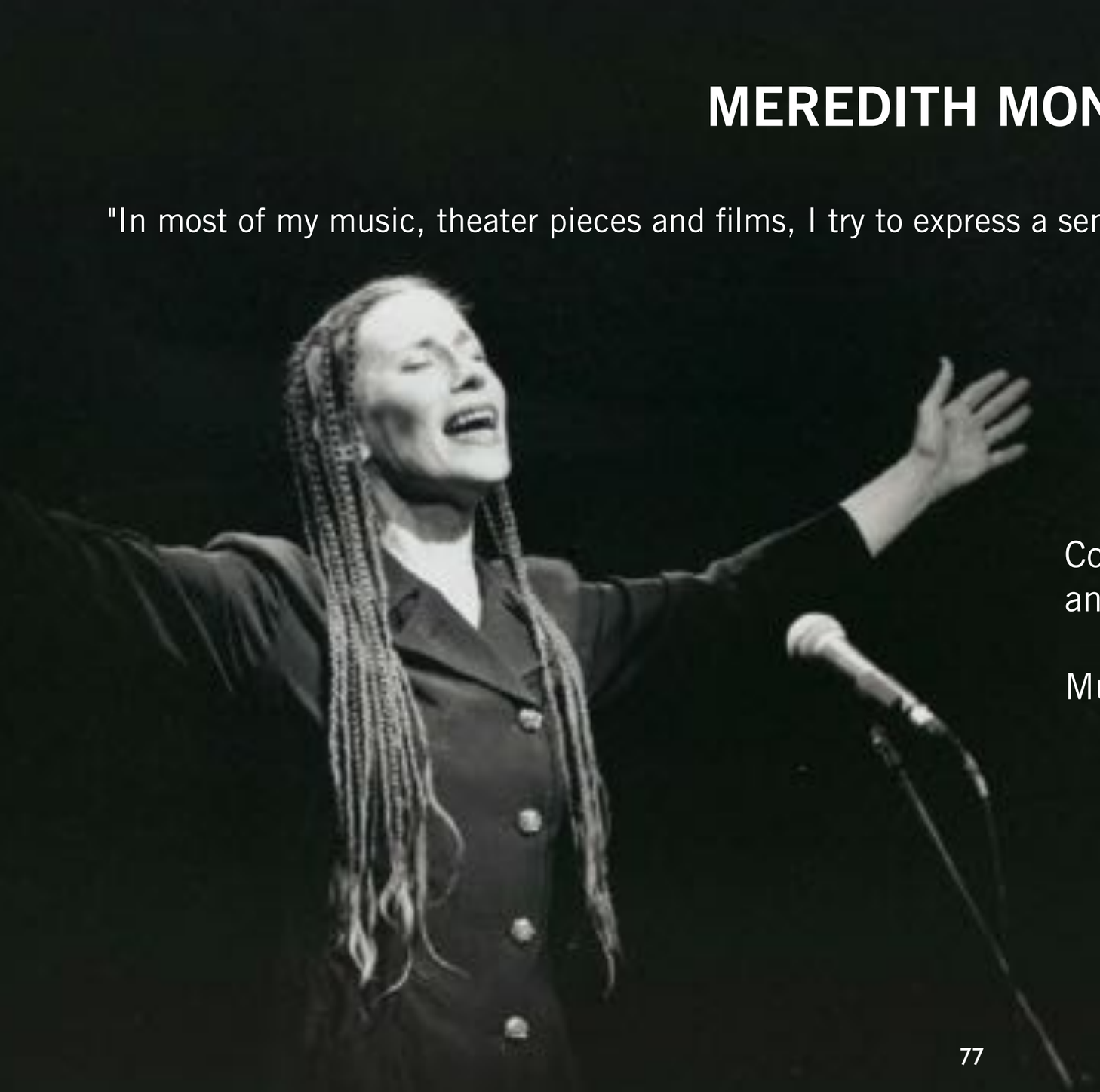
MARYANNE AMACHER

Otoacoustic emission

MEREDITH MONK

"In most of my music, theater pieces and films, I try to express a sense of timelessness; of time as a recurring cycle."

Liner notes of the album Book of Days, ECM New Series (1990)



Composer, performer, director, vocalist, filmmaker, and choreographer.

Multi-disciplinary work often focused around voice

ROCKIT

Herbie Hancock

DJ Grand Mixer DXT

CHRISTIAN MARCLAY

Experimental Sound Artist working primarily with records and record players

Grandmaster Flash

Expanded on Herc and Theodore’s techniques to elevate the turntables to a virtuosic instrument

DJ mixer

Maria Chavez

Book of Abstract Turntable Techniques!

Conlon Nancarrow

temporal dissonance

Often used poly-tempi and poly-meter

Complex temporal canons

Precise ratio-based acceleration and deceleration

Study 21

Tangerine Dream

Formed in 1967 by **Edgar Froese**.

Most permanent members were Christopher Franke and Peter Baumann. Klaus Schulze was an early member, and went on to a successful solo career.

Influenced by: Stockhausen, Jimi Hendrix, Steve Reich, Pink Floyd, and French composers Maurice Ravel and Claude Debussy.

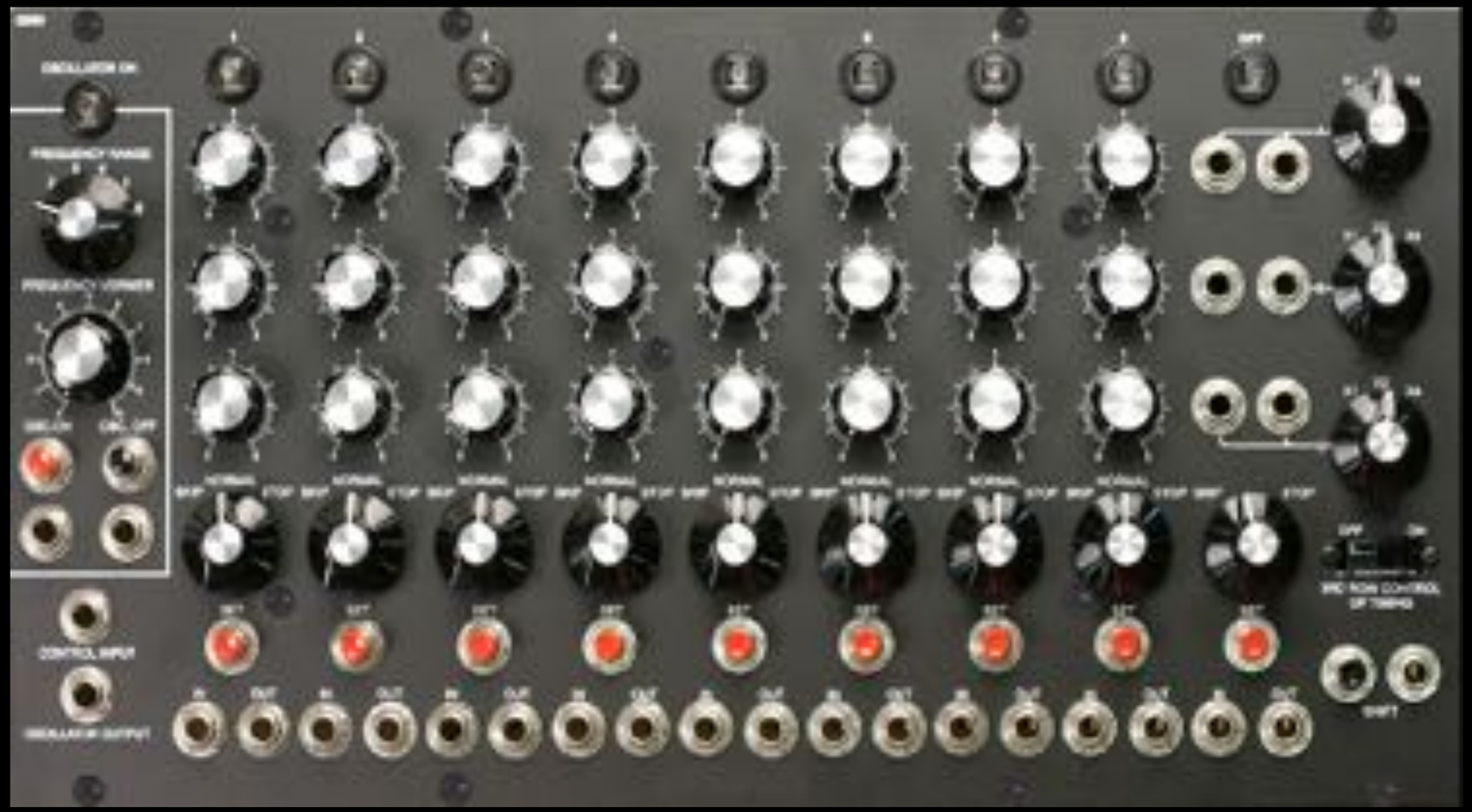
Played a pivotal role in the development of Krautrock, Ambient and New Age Music.

Moog 960 Sequential Controller (1968)

Used by Chris Franke for rhythmic and repetitive structures. Improvisation by using knobs and switches.

Three rows of eight potentiometers, each sends out a fixed voltage.

A control voltage “clock” controls the speed. Bottom row positions for “play,” “skip,” or “loop.”



Examples

Three rows could play three note chords if all are sent to **VCOs, Voltage-Controlled Oscillators**.

One row could control the pitch of a melodic sequence, while the second controlled filter cutoffs, while a third controls a **VCA, Voltage-Controlled Amplifier.**

Kraftwerk

Ralf Hütter and Florian Schneider

They began making music in 1968 with a tape recorder and an organ

built Kling Klang Studio in 1970, featured a plethora of synthesizers, custom built electronics, and “rhythm boxes.” Their self-titled debut album, released in 1970, had an industrial, mechanized sound.

The name Kraftwerk (“Power Plant”) reflects the influence of industry and machines on the band’s sound

they are from Düsseldorf, the industrial center of Germany.

1st album in 1972, very industrial, mechanized sound.

Kraftwerk’s first custom-made vocoder

Vocoder

“voice” + “encoder”

Developed in 1928 at Bell Labs as a way to encrypt voice communication.

combining the formant qualities of the input (typically speech) with the sonic qualities of the output (usually a synthesizer). The result is “robotic” sounding speech, with the filtering characteristics of the voice, and the timbre of a synthesizer.

Planet Rock (1982)

Afrika Bambaataa & the Soulsonic Force

Planet Rock fused hip-hop with Kraftwerk (electro)

In addition to being the first hip-hop song to use a drum machine, “Planet Rock” was an early example of the prominent use of sampling - the song borrowed elements from two Kraftwerk songs: the main theme from “Trans-Europe Express” was sampled directly and the beat from “Numbers” (from Kraftwerk’s 1981 *Computer World*) was imitated.

Excerpt from “Numbers”

1980: Roland TR-808 Rhythm Composer

transistor rhythm (TR); sixteen sounds; 32 programmable steps

Linn Drum (1982)

Used by Prince, Diana Ross, ABBA, Genesis, Madonna, Kraftwerk, Cindy Lauper, Depeche Mode, & a million others.

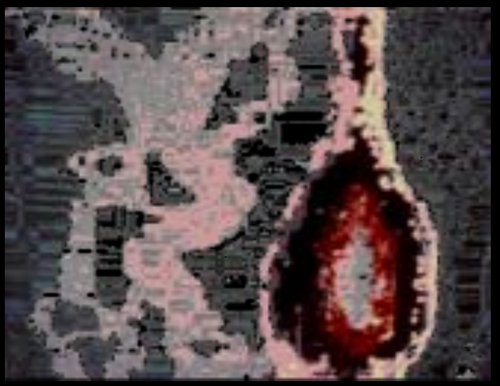
LAURIE SPIEGEL

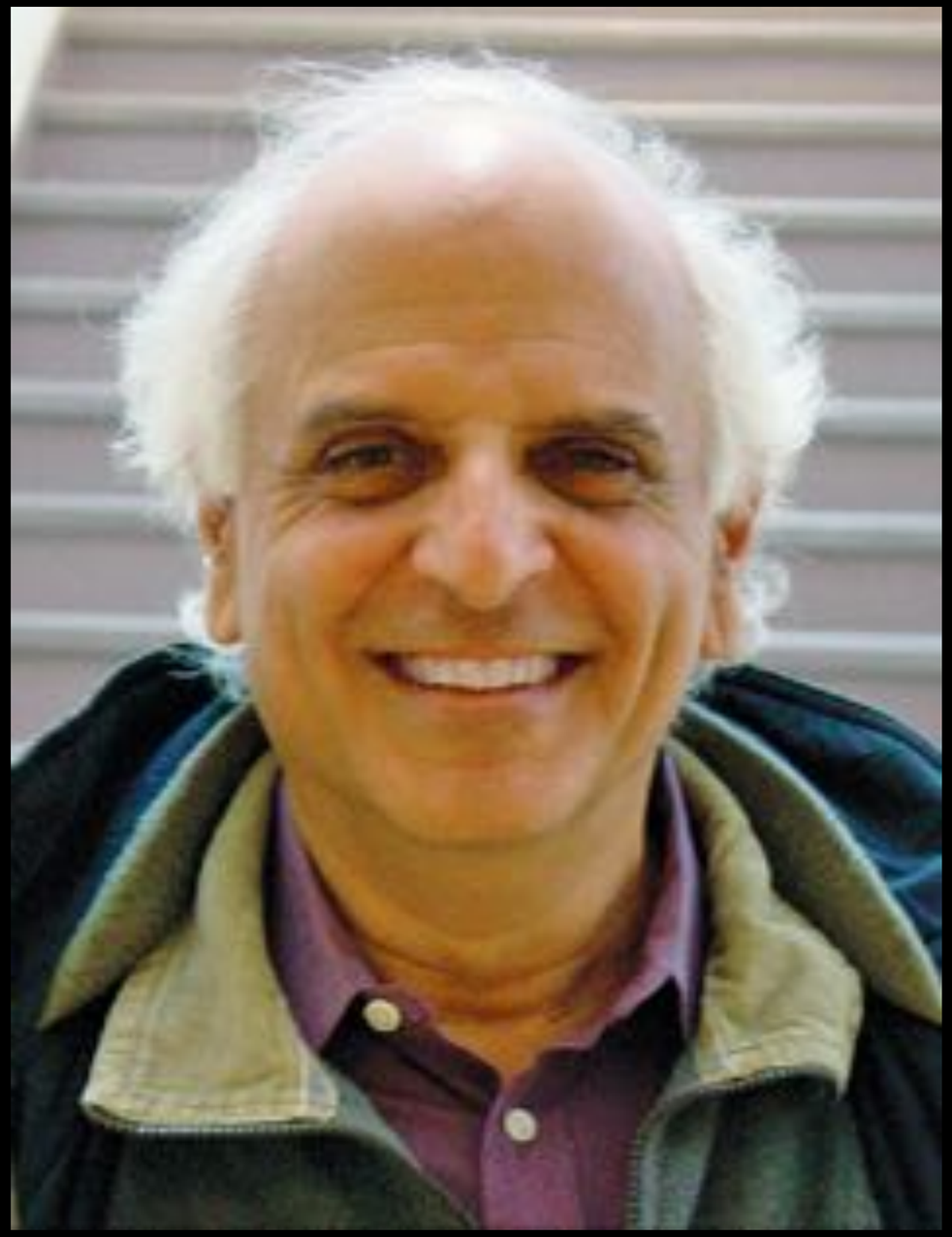
worked with Max Mathews at Bell Labs

pioneered hybrid digital/analog composition methods

built *Music Mouse - An Intelligent Instrument* (1986)

experimented with early computer animation





PAUL LANSKY

digital voices and formant synthesis, linear predictive coding

excerpt from “Idle Chatter Junior” (1985)

Radiohead sampled his "Mild und Leise" (1973) in their song “Idioteque” on Kid A (2000)

teaches at Princeton

JAMES TENNEY

Worked at Bell Labs from 1961-1963, composing 6 pieces.

Analog #1 (Noise Study) is an exploration of noise through filtering (digital subtractive synthesis).

Developed while listening during commutes through the Holland Tunnel

In 1967 he gave an influential FORTRAN workshop for a group that included Steve Reich, Nam June Paik, Dick Higgins, Jackson Mac Low, Phil Corner, Alison Knowles and Max Neuhaus.

Basics of Digital Audio

Quantization - The process of taking an analog signal and converting it into a finite series of discrete levels.

Levels stored as numbers stored as bits (binary).

Encoding - Analog to Digital Convertor (ADC) takes “snapshots” of electrical signals

Decoding - Digital to Analog Convertor (DAC) converts numbers into continuous electrical signals.

Two Parameters of Digital Encoding

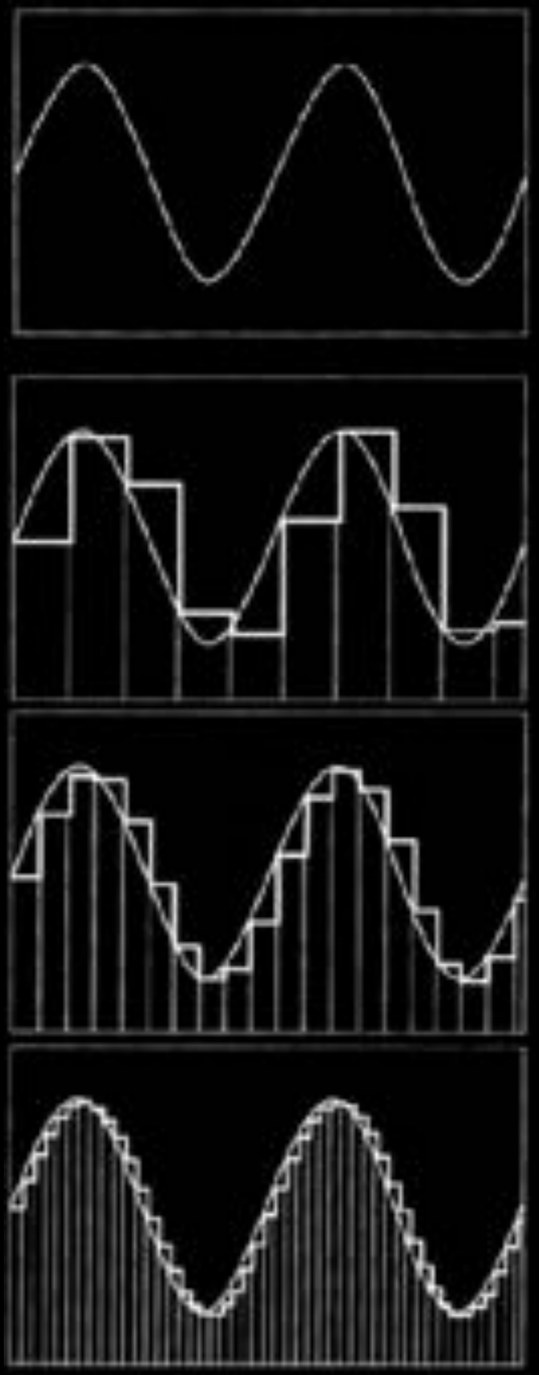
Pulse-code modulation (PCM)

Sampling Rate

How quickly are the amplitudes of a signal measured? (time interval)

Bit Depth

How accurate are amplitude measurements when sampled? (pressure resolution)



Sampling Rate

measured in hertz (Hz)

the faster we sample, the better chance we have of getting an accurate picture of the signal

in order to represent all sounds within the range of human hearing (20,000 Hz) we require a sampling rate of (at least) 40,000 Hz. (Nyquist Theorem)

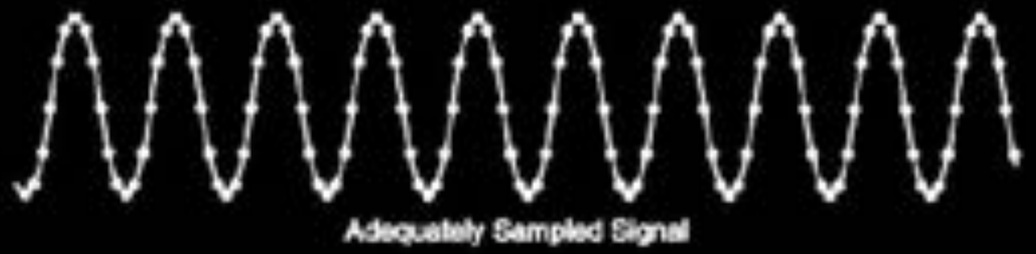
Unwanted artifacts are audible when the sampling rate drops below 2x the highest frequency. (Aliasing)

Aliasing

a result of undersampling

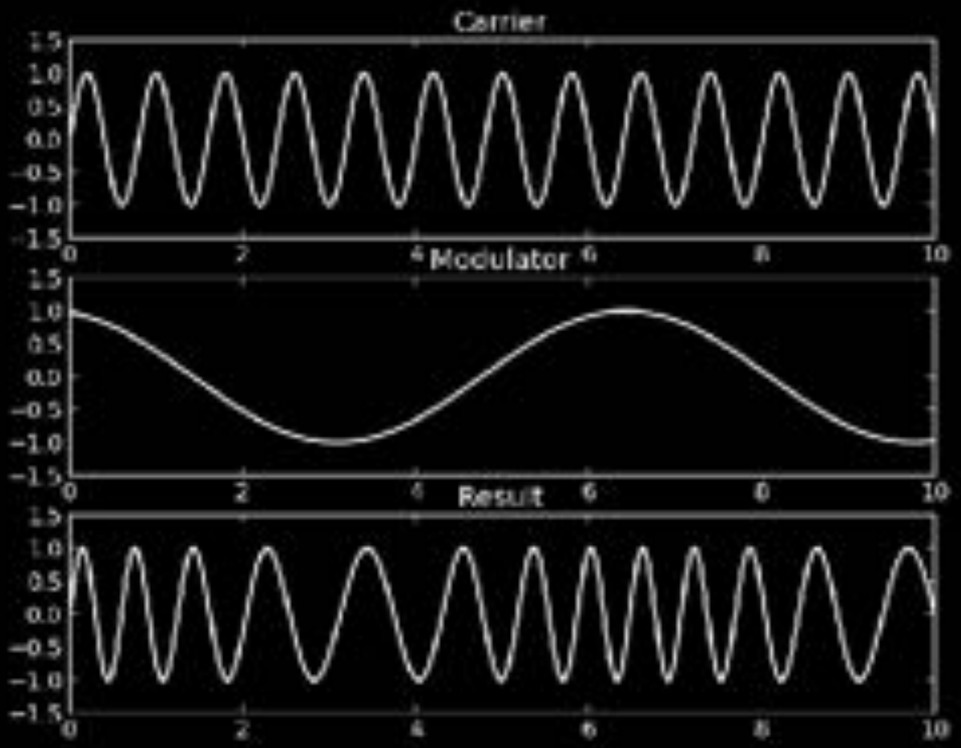
you not only lose information about the signal, but you get the wrong information.

the signal takes on a different “persona” -- a false presentation or “alias”



Common Types of Synthesis

Additive synthesis	complex tones can be created by the summation, or addition, of simpler tones (organ, telharmonium, fairlight CMI, Fourier theorem, Max Mathews)
Subtractive synthesis	sound sculpting—start with noise (many frequencies), and then filter them (James Tenney)
Formant synthesis	a type of subtractive synthesis based on the resonant physical structure of the sound-producing medium, think speech (Paul Lansky)
Granular synthesis	combining very short sonic events called 'grains' to generate complex textures (Xenakis)
Frequency Modulation (FM Synthesis)	the frequency of a simple waveform (carrier wave) is modulated by another frequency (modulator wave)(John Chowning)



FM SYNTHESIS

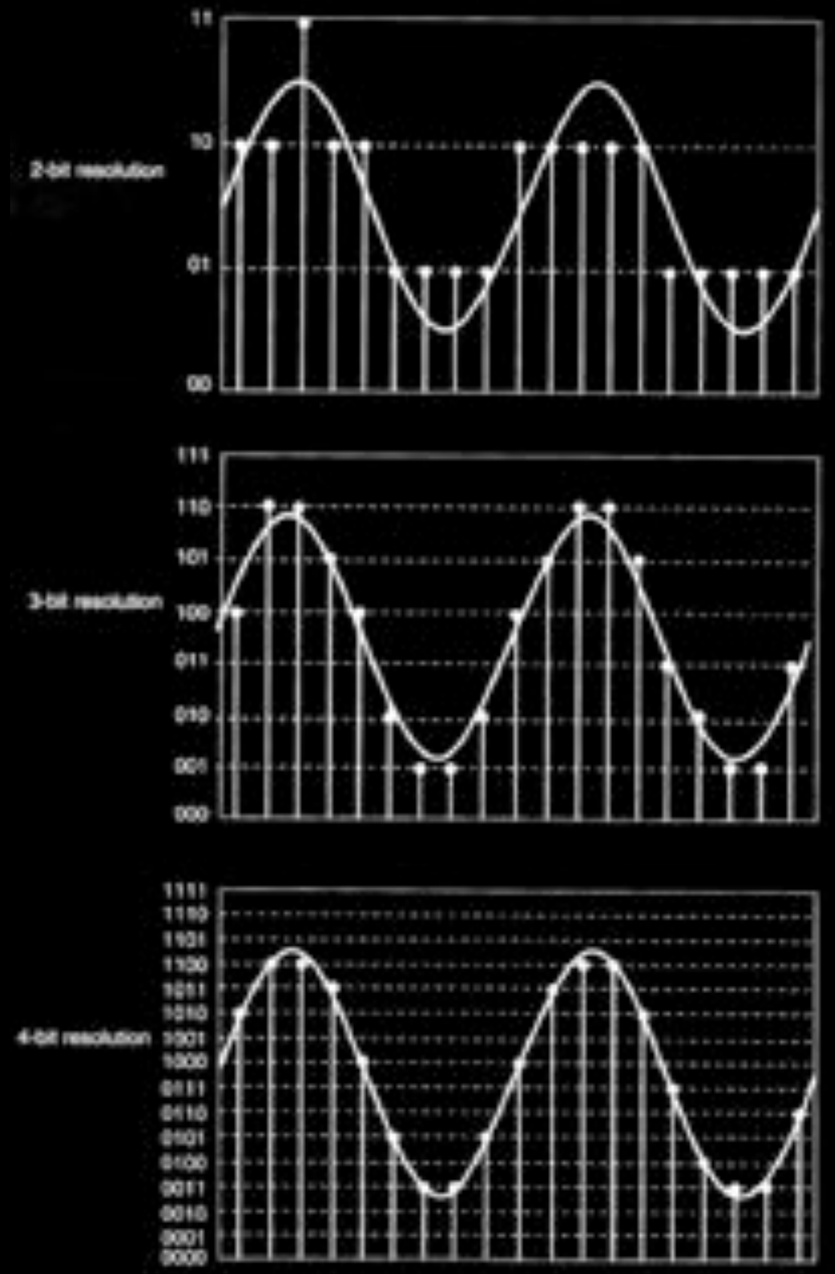
Frequency modulation first used in radio

FM synthesis developed by John Chowning in the early 1970s

efficient algorithm - little computation to generate rich sound palettes.

when the modulating frequency is less than 30 Hz, it’s called vibrato, but above 30Hz, sidebands are generated, adding to the carrier wave’s complexity

Yamaha DX7 (1980), one of the most popular synths of all time



Bit Depth

represents how accurately the analog wave can be represented.

A higher bit depth will have less noise and a better dynamic range.

16 bit-depth is the standard for CD audio. (65,536 values)

Professional audio systems have options for higher bit depths (DVD audio supports 24) and sampling rates (up to 96 and 192 kHz).

Binary

What is a bit? a binary digit

On/Off

Bits are a way of storing binary numbers

The number of bits tells us how many numbers (things, positions, values) are available

One bit encodes two possible values
0 1

Two bits encode four possible values
00 01 10 11

8 BITS = 1 BYTE

This is a Byte. It is read from right to left.

11111111

Each bit is represented as a doubling of the previous value

1 1 1 1 1 1 1 1

128 + 64 + 32 + 16 + 8 + 4 + 2 + 1

An entire Byte has 256 values when all the bits are "on" and added together

EXAMPLE

Byte = 00001001

= 9

Decimal = 8 + 1

SYNCLAVIER II (1980 - 1982)

- 16-bit hard drive recording device. $200,000 - $500,000
- Micheal Jackson [Thriller], The Cure, New Order, Stevie Wonder, Paul Simon, Pink Floyd, Kraftwerk, Depeche Mode, Genesis, Frank Zappa, many film studios.

FAIRLIGHT CMI (1979)

- CMI = computer musical instrument
- first polyphonic digital sampling synthesizer ($20k)
- 28MB of memory
- Used by Afrika Bambaataa, Jean Michel Jarre, Kate Bush

DX7

FM Synthesizer based on the research of John Chowning

first commercially successful digital synthesizer

MIDI (Musical Instrument Digital Interface)

MUSICAL CONTEXT

INFLUENCES:

prog rock — over-the-top ideals

soul / funk — beat/structural aspects

hippie (free love) movement - ideology

a reaction against rock’s hyper-masculinity

Chic

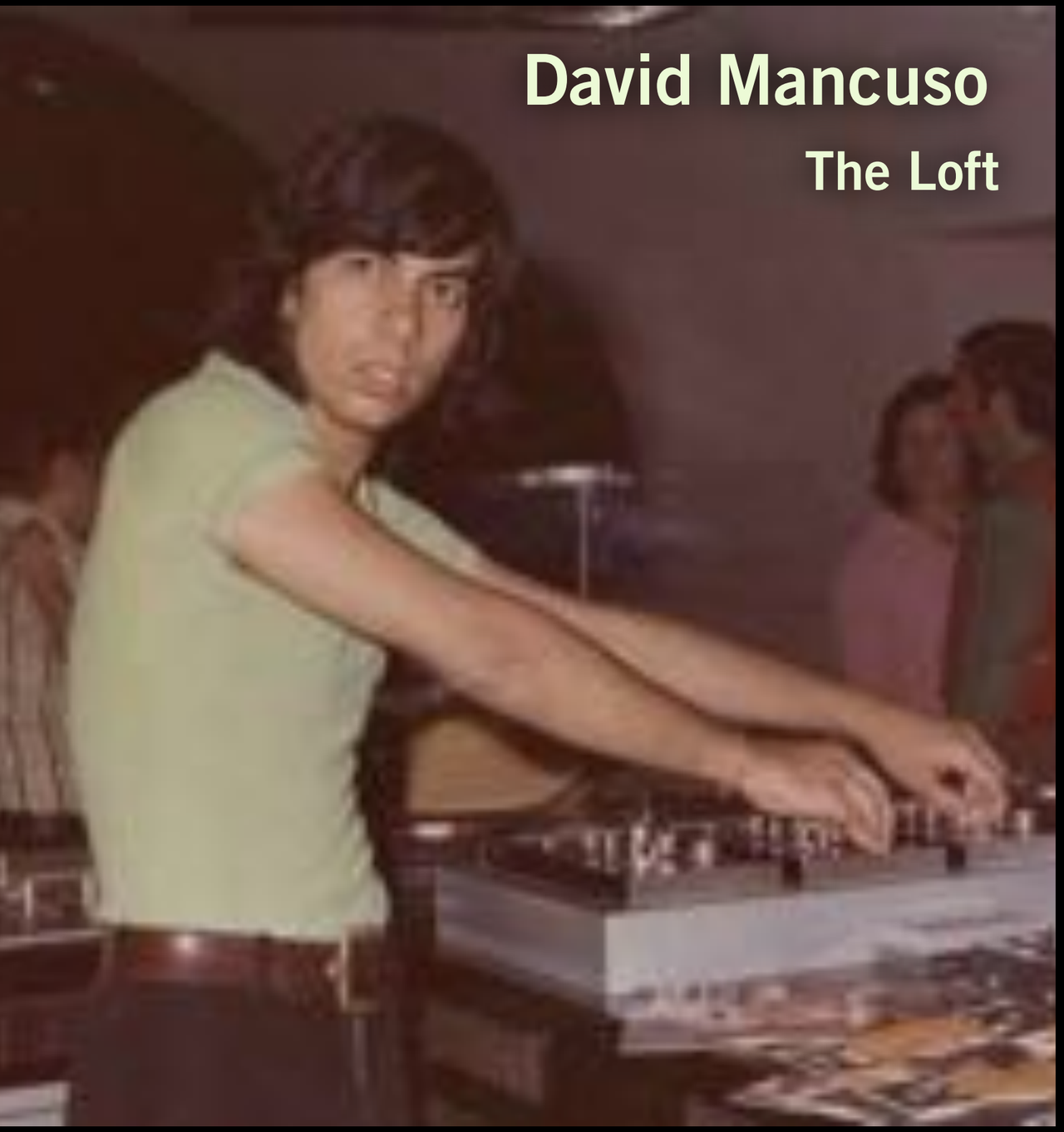
formed by Niles Rodgers

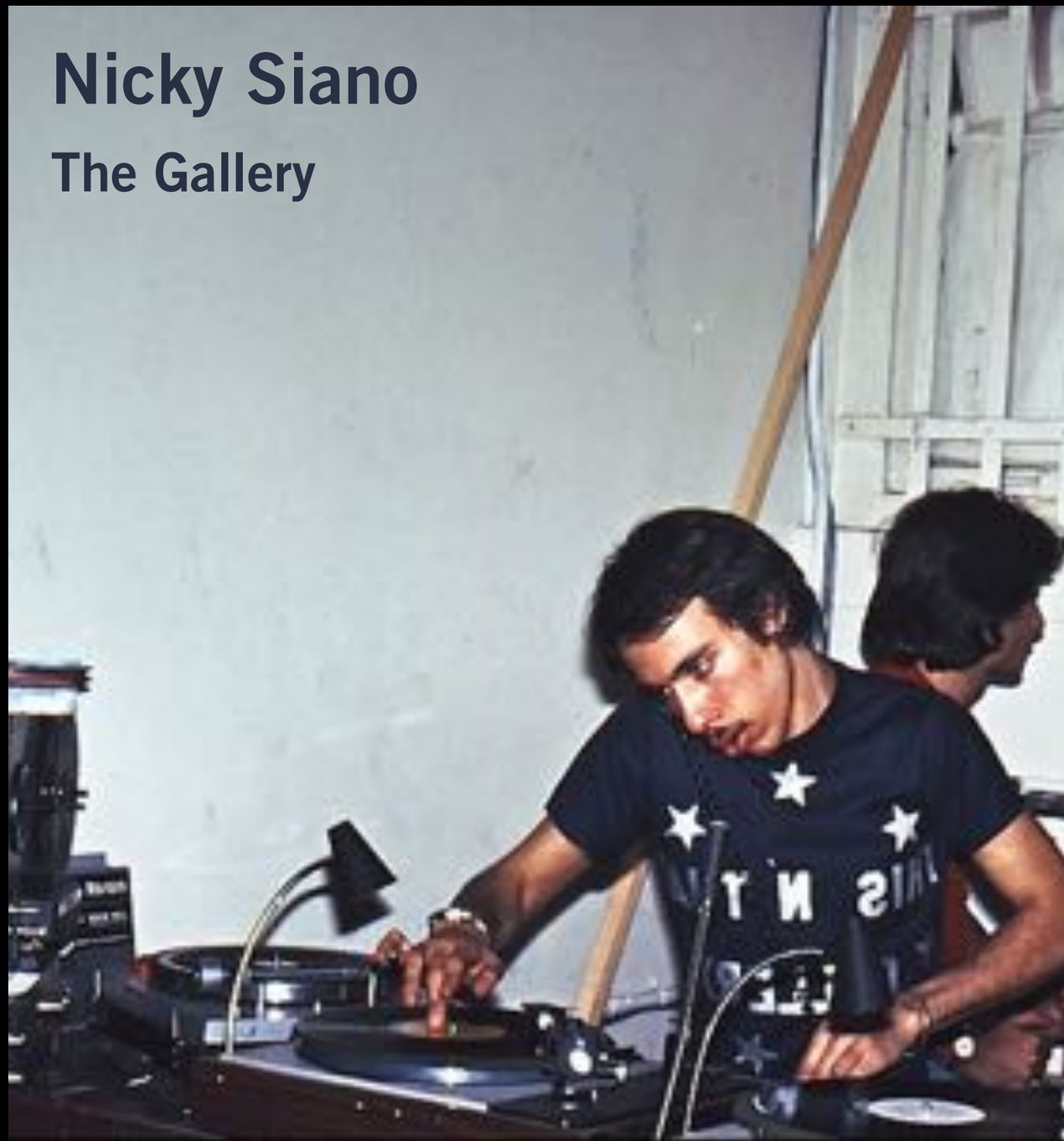
Listening: 1978's "Le Freak"

Donna Summer + Giorgio Moroder

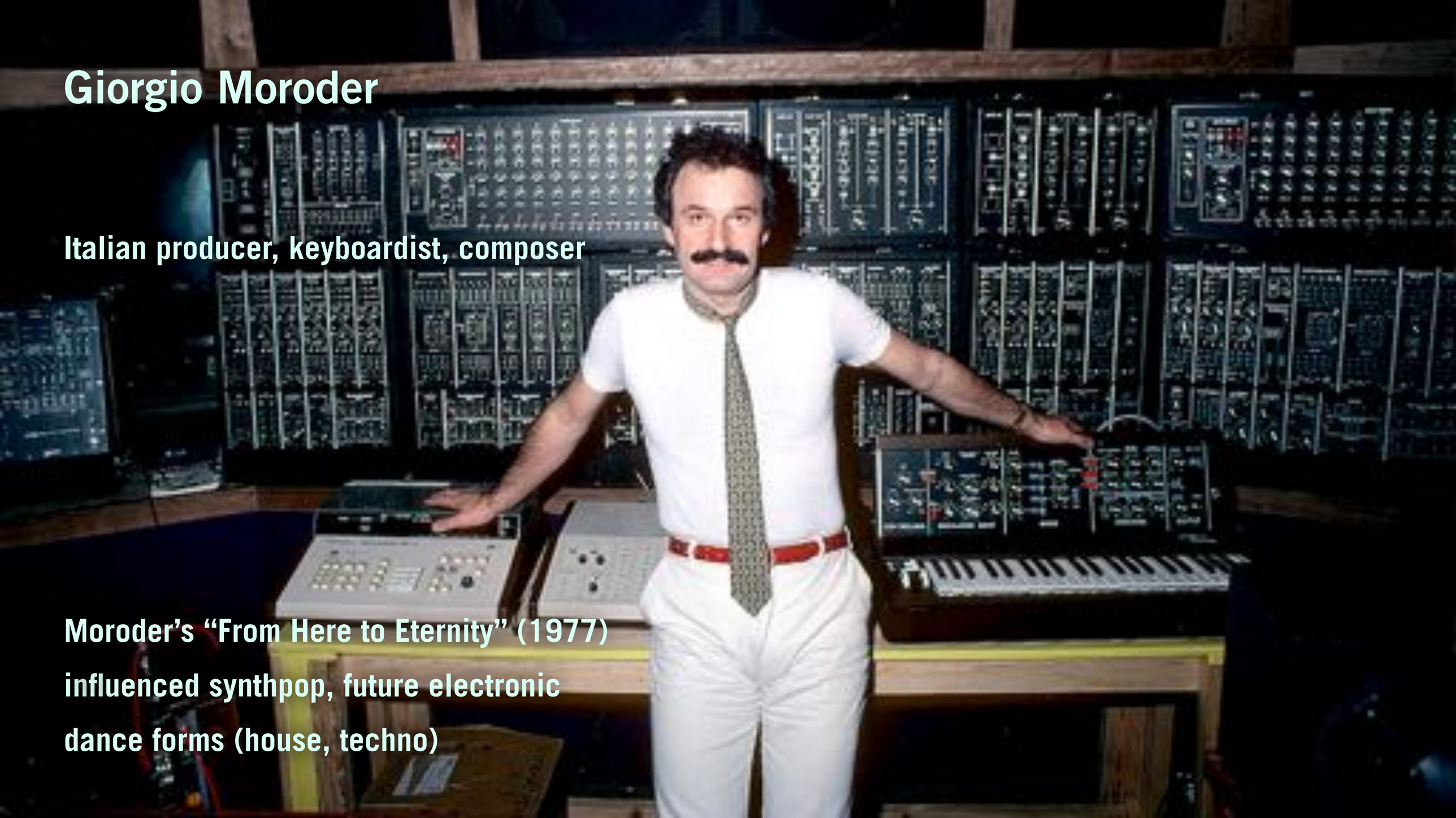
Listen: “I Feel Love” (1977)

- completely synthesized accompaniment
- use of a sequencer to provide a driving bass line


David Mancuso
The Loft


Nicky Siano
The Gallery

Giorgio Moroder



Italian producer, keyboardist, composer

Moroder's "From Here to Eternity" (1977) influenced synthpop, future electronic dance forms (house, techno)

GLORIA GAYNOR

won Grammy for “best disco track” in 1980

previously her tracks were pitch shifted to make her voice higher

Listen: Never Can Say Goodbye (1974)

Disco Demolition Night

July 12, 1979 - Comiskey Park, Chicago

Chicago House Music

House music borrowed disco's percussion, with the bass drum on every beat, with hi-hat 8th note offbeats on every bar and a snare marking beats 2 and 4.

House musicians added synthesizer bass lines, electronic drums, electronic effects, samples from funk and pop, and vocals using reverb and delay. They balanced live instruments and singing with electronics.

Like Disco, House music was "inclusive" (both socially and musically), influenced by synthpop, rock, reggae, new wave, punk and industrial.

Music made for dancing. It was not initially aimed at commercial success.

Frankie Knuckles and The Warehouse

"The Godfather of House Music"

Grew up in the South Bronx and worked together with his friend **Larry Levan** in NYC before moving to Chicago.

Main DJ at “**The Warehouse**” until 1982

In the early 80’s, as disco was fading, he started mixing disco records with a drum machines and spacey, drawn out lines. The style spread to NYC by the mid 80’s.

Listen: “Your Love” (1985)

Jesse Saunders

"the originator of House music"

Chicago DJ who headlined major clubs and opened up his own club, "**The Playground**" in 1982.

set up the first house record label, was the first house artist signed to a major label, and was the first house DJ to enter the Billboard music charts

"I used the bassline from Space Invaders and I wrote original arrangements around it to produce and write 'Fantasy'! 'On & On' is the DJ track version of 'Fantasy'!"

In 1984 he released the first House single, "On and On."

Listen: "On and On" (1984)

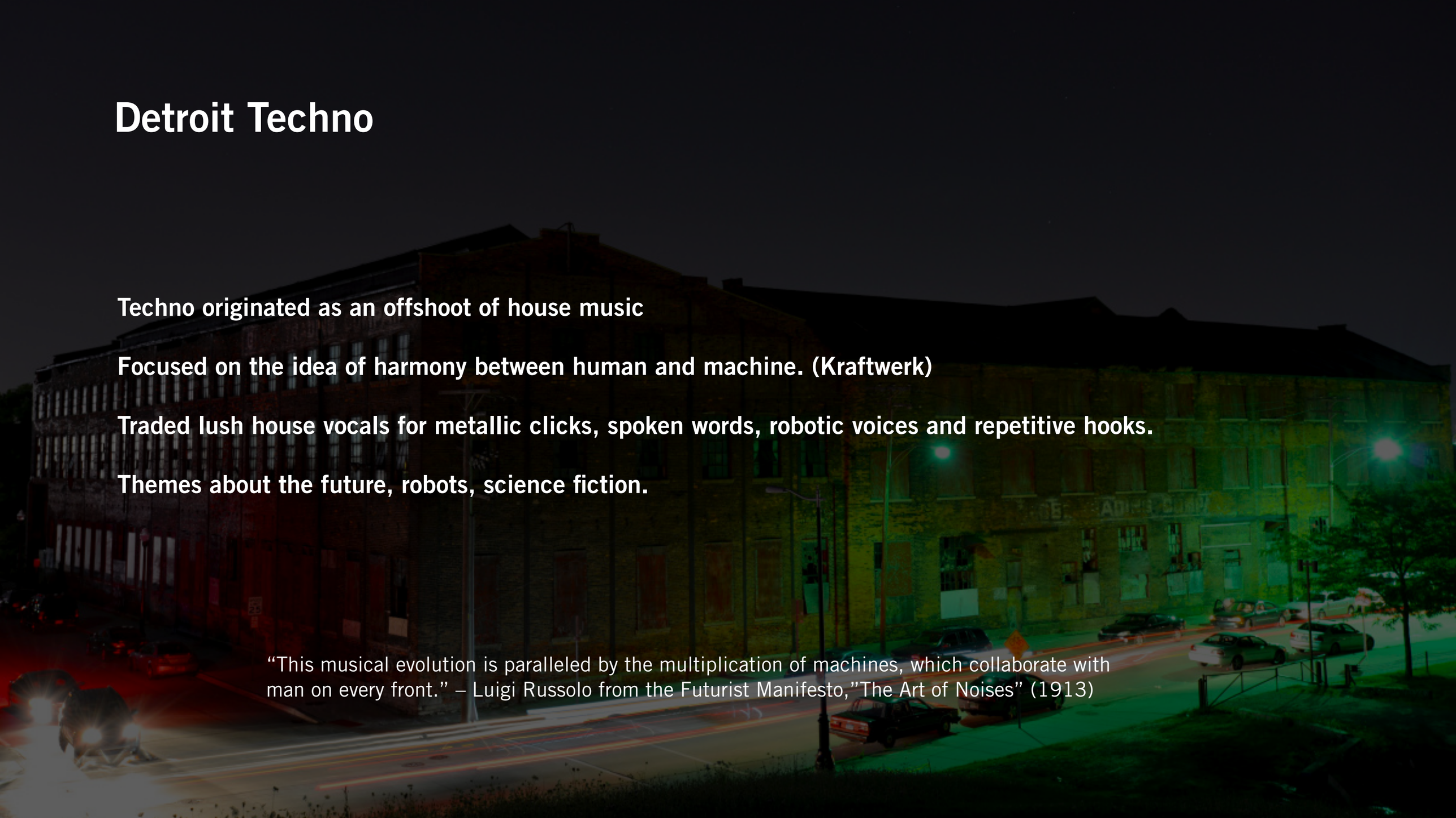
Detroit Techno

Techno originated as an offshoot of house music

Focused on the idea of harmony between human and machine. (Kraftwerk)

Traded lush house vocals for metallic clicks, spoken words, robotic voices and repetitive hooks.

Themes about the future, robots, science fiction.



“This musical evolution is paralleled by the multiplication of machines, which collaborate with man on every front.” – Luigi Russolo from the Futurist Manifesto,”The Art of Noises” (1913)

The Belleville Three

Juan Atkins, Derrick May and Kevin Saunderson are often referred to as the “Belleville Three” - all attended Belleville High School. Considered the pioneers of the techno genre.

Atkins

Saunderson

May

Acid House

Acid house has a repetitive, hypnotic, trance-like style, with samples or spoken lines preferred to sung lyrics.

Acid developed in 1987 with Chicago DJs experimenting with the **Roland TB-303** bass synthesizer and sequencer.

Innovators included DJ Pierre (**Phuture**), Larry Heard (**Mr. Fingers**), and **Marshall Jefferson**.

Phuture's seminal house track "**Acid Tracks**" (1987), allegedly the first acid house record, influenced techno, trance, and other electric dance music. The style spread widely throughout the UK and Europe.

Excerpt Phuture's "Acid Tracks" (1987)

The Roland TB-303 Bass Line Synthesizer, released in 1982, was a commercial failure and was only in production for 18 months. In the late 1980's these boxes, now inexpensive, were repurposed to create Acid. The upper knobs could be controlled to change the timbre on a repeating patter, adjusting a VCF - resonance, filter cutoff and envelope. Other knobs controlled tuning, decay, and accent.

from *The Shape of Things That Hum*, a documentary on technology that has impacted popular music.

DUBPLATES

Selector plays records and the deejay “toasts”

Deejay needs instrumentals to talk over

Initially a vocal-less mix on the B-sides of records

Emergence of one-off “dubplates” of current songs

Acetate cuts, limited to a few plays

High demand

SOUNDSYSTEMS

Studio + label + speaker system

Fierce competition - “clashes”

Stone Love Movement
Tom the Great Sebastian
Arrows the Ambassador
Tubby's Hometown Hi-Fi
Jah Shaka
Tippatone
Emperor Faith
Killamanjaro
Bass Odyssey
Black Chiney
Creation Rock Tower

KING TUBBY

Listen: Augustus Pablo, “King Tubby Meets Rockers Uptown”

MIXER AS INSTRUMENT

Music Center Incorporated (US) 12-track mixer with 4 aux channels for effects send + unknown custom modifications

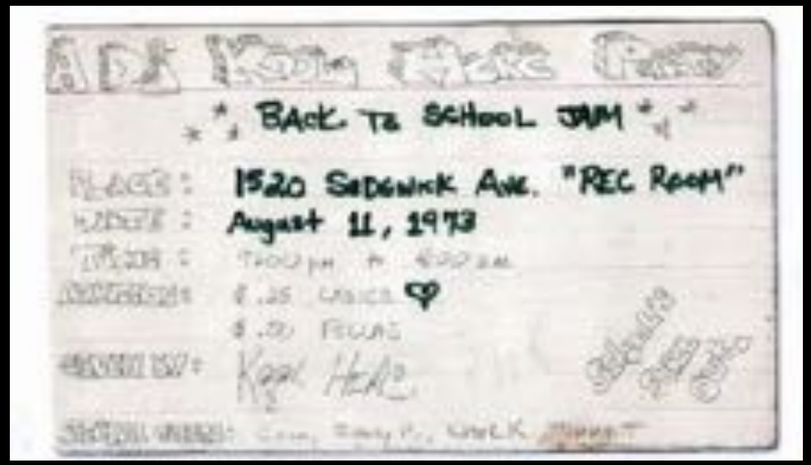
Originally installed in Dynamics studio in Miami

Presto acetate lathe-cutter

KOOL HERC

Clive Campbell immigrated from Kingston, Jamaica in 1967 at age 12 to the South Bronx in NYC

Started throwing Kingston-style parties, playing hard funk and soul – eventually had his own soundsystem, Herculords



AFRIKA BAMBAATAA

Godfather of hip-hop, went from being a gang leader in the Black Spades to a community leader and DJ

Outlined the four elements of hip-hop:
DJing, MCing, breakdancing, graffiti

GRANDMASTER FLASH

Expanded on Herc and Theodore's techniques to elevate the turntables to a virtuosic instrument

Listen: "The Adventures of Grandmaster Flash on the Wheels of Steel" 1981

DJ mixer

UNIVERSAL ZULU NATION

After a transformative trip to Africa, Bambaataa created the Universal Zulu Nation in mid-70s, a group that promoted hip-hop culture as a means of promoting social justice. Associated with early innovators in hip-hop

DJ Red Alert
KRS-ONE
Public Enemy
Jungle Brothers
A Tribe Called Quest
Queen Latifah
De La Soul
Monie Love

Public Enemy

Listen: “Fight the Power” (1989)

Theme of Spike Lee’s *Do the Right Thing*

Bomb Squad production – multitracking DJ mixes

QUEEN LATIFAH

Listen: “Ladies First”, 1989

Activist, Native Tongues and Zulu Nation collectives

Later successful as an actor and TV personality

Erik B and Rakim

Listen: “Paid in Full”, 1987

Aspirational themes

Remixed by Coldcut (also ’87) – international crossover success in the dance clubs

SAMPLING

"Funky Drummer" by James Brown

"You'll Like It Too" by Funkadelic

"West Coast Poplock" by Ronnie Hudson and the Street People

"Get Me Back on Time, Engine No. 9" by Wilson Pickett

"Amen, Brother" by The Winstons

"One for the Treble" by Davy DMX

Carl Stone


Plunderphonics
John Oswald


Negativeland

Danger Mouse

The Grey Album (2004)

+

=

Maryanne Amacher

Head Rhythm 1 And Plaything 2

Album:
Sound Characters: Making The Third Ear

Janet Cardiff

Annea Lockwood

Christina Kubisch

German artist and composer, interested in synesthetic experiences.

Works outside of traditional concert and gallery contexts, began Electrical Walks series in 2004

Electromagnetic induction sonifies electromagnetic fields via custom headphones

Electrical devices in the urban landscape produce patterns – she creates tours/compositions for listening to those patterns

A map of space becomes an electronic composition

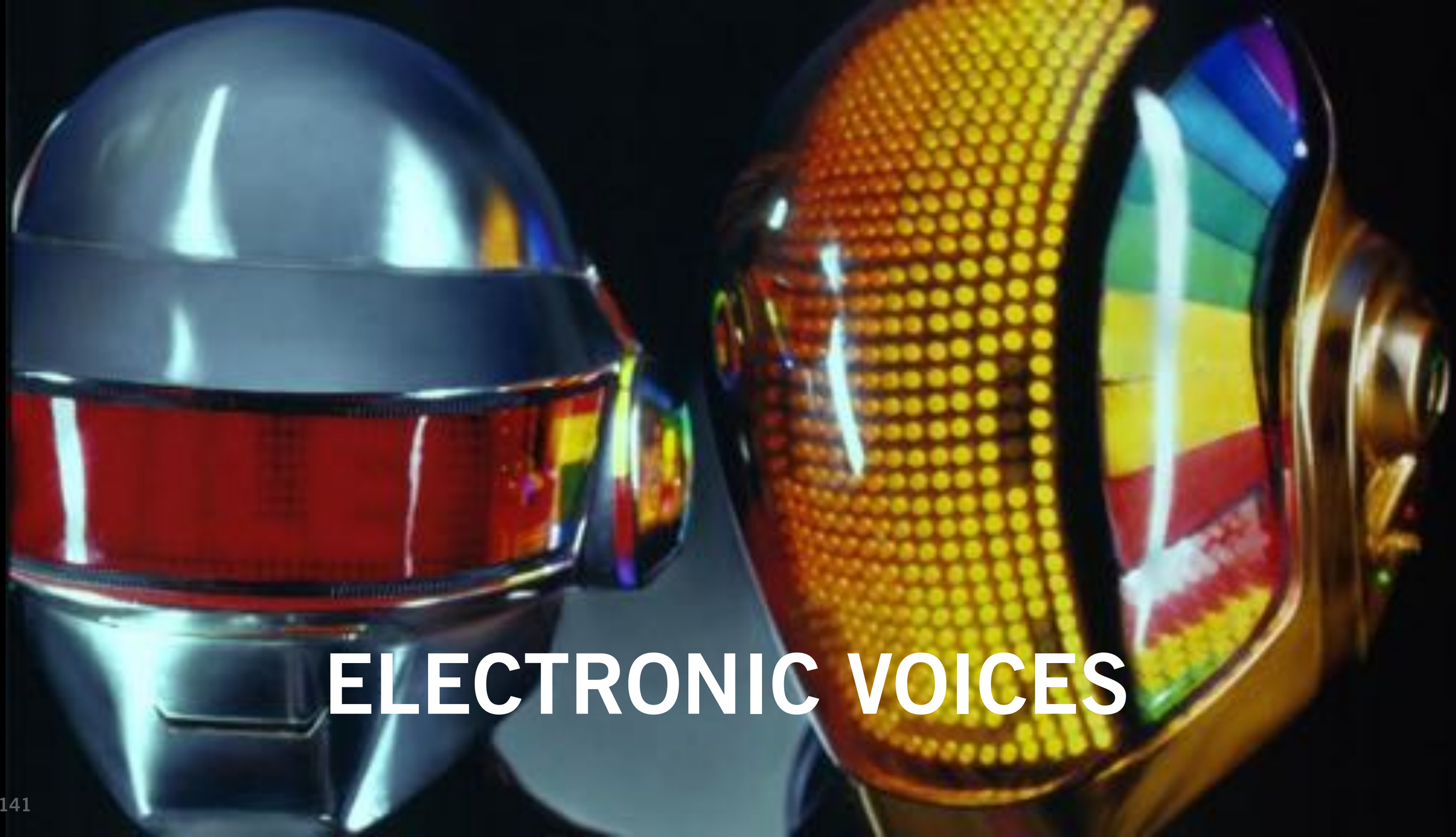

Trimpin

Pauline Oliveros

A composer, performer, and theorist known for the concept and practice of “deep listening”

Sonic Awareness

Listening to how you listen. "Sonic awareness is a synthesis of the psychology of consciousness, the physiology of the martial arts, and the sociology of the feminist movement" and describes two ways of processing information, focal attention and global attention


ELECTRONIC VOICES

BON IVER
(JUSTIN VERNON)

WOODS, FROM THE BLOOD BANK EP (2009)

Sampled By Kayne on “Lost in the World” (2010)

Microphones

Transducers!

dynamic

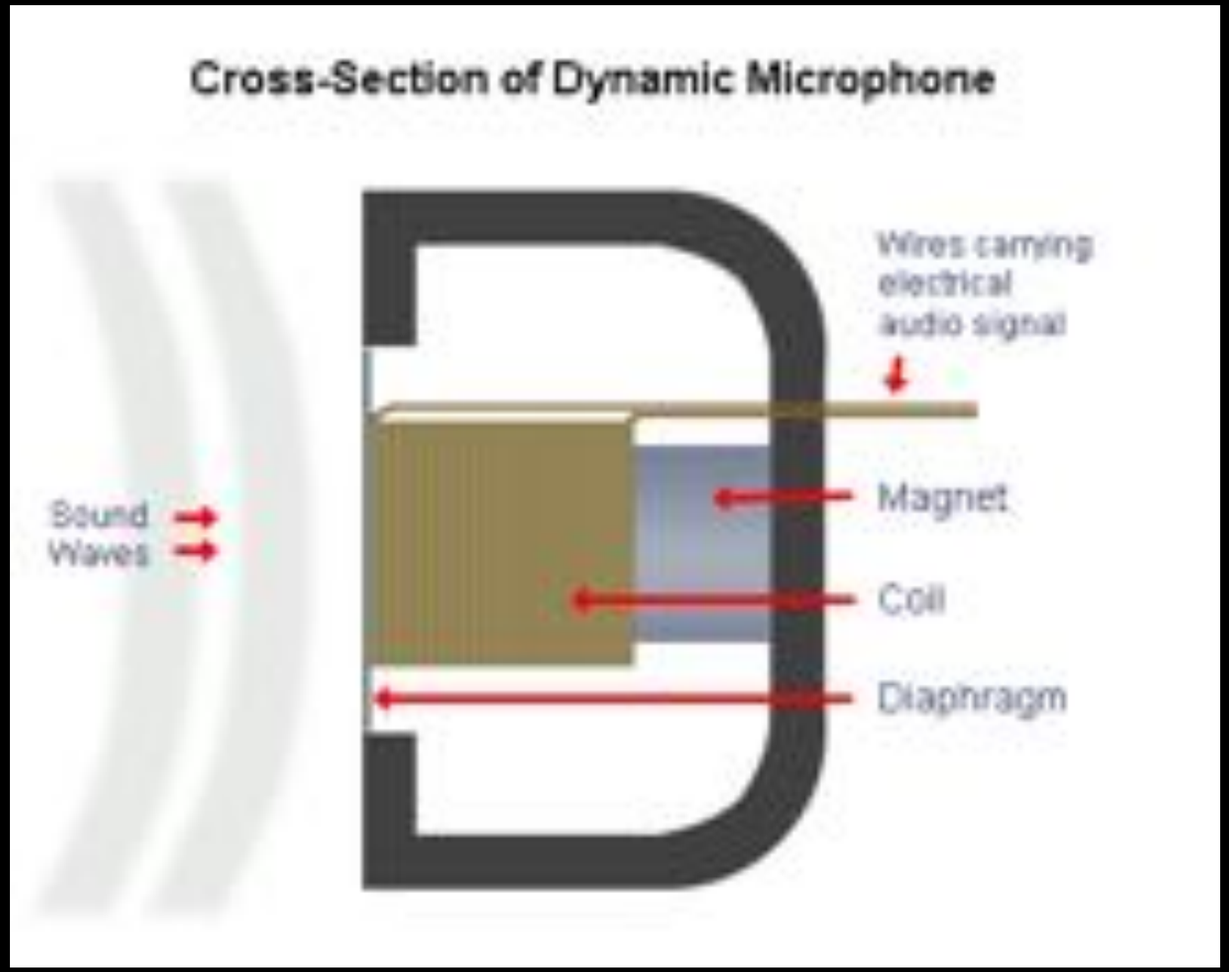
Two most common types of microphones:

Dynamic

Condenser

condenser

Dynamic Microphones

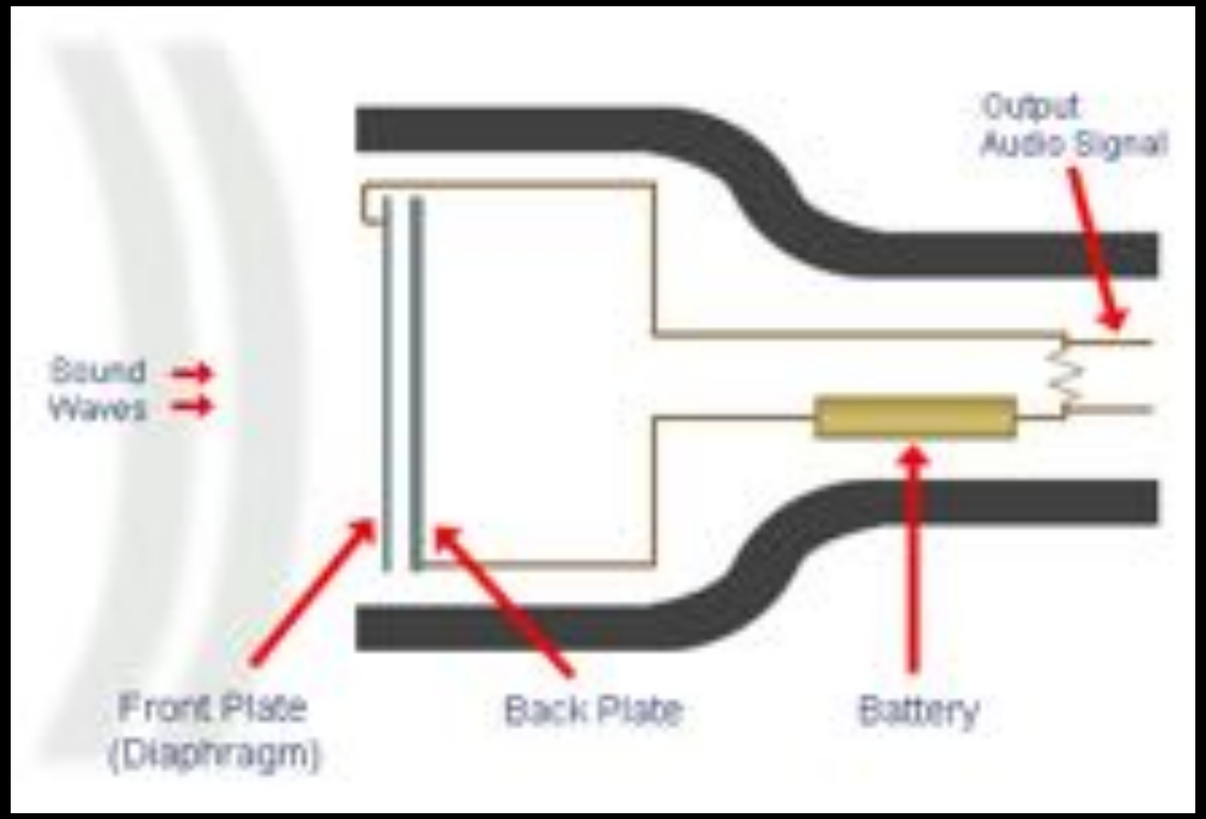


versatile and ideal for general-purpose use

relatively sturdy and resilient

better suited to handling high volume levels

Condenser Microphones



require power from a battery or external power source

tend to be more sensitive and responsive than dynamic mics, but less suited for high volumes

Considerations for Microphone Placement

inverse-square law: distance vs. intensity

High frequencies are more **directional** than low frequencies.

Room sound: close mic for less hall sound (reverberation)

Proximity Effect: (Bass boost) on directional mics.

Bass Rolloff: reduces low frequency sensitivity

Phase Cancellation: frequencies 180 degrees out of phase will cancel - **Constructive-Destructive Interference**

Bing Crosby

Crooning

Crooning: a style from 1920s to 1950s

intimate

Associated with Rudy Vallee, Bing Crosby, Mildred Bailey, Perry Como, Annette Hanshaw, & Frank Sinatra

Listen: Bing Crosby, To Learn to Croon (1933)

Trevor Wishart

Professor at the University of Oxford

composer whose interests deal mainly with the human voice, in particular with the transformation of it and the interpolation by technological means between human voice and natural sounds.

Excerpt from *Tongues of Fire* (1994)

Transposition (pitch shift)
Truncation (cutting)
Overlap (mixing)
Inversion
Speed Change

Joan La Barbara

Vocalist and composer

Has worked with John Cage, Robert Ashley, Morton Feldman, Philip Glass, Larry Austin, Peter Gordon, and Merce Cunningham.

Listen/Watch: Joan La Barbara Performing Christian Marclay's Manga Scroll

TALK BOX

An effects pedal that allows a musician to shape the sound of their instrument much like the vibrations of our vocal cords are shaped by our mouths.

When activated, the sound from the amplifier is directed through the tube into the performer's mouth. The shape of the mouth filters the input signal (synthesizer, guitar, etc) using the vocal cavity, effectively making it sound like the guitar is talking.

LAURIE ANDERSON

Known primarily for her multimedia presentations she has cast herself in roles as varied as visual artist, composer, poet, photographer, filmmaker, instrument builder, vocalist, and instrumentalist.

O Superman launched Anderson's recording career in 1980, rising to number two on the British pop charts and subsequently appearing on *Big Science*, the first of her seven albums

AUTO-TUNE

audio effect that measures and alters pitch in vocal and instrumental input through use of a phase vocoder.

scale both the frequency and time domains of audio signals by using phase information. The computer algorithm allows for time expansion/compression and pitch shifting

Uses a **Fast Fourier Transform** to quickly analyze and resynthesize the frequency domain of the voice

“Photoshop for the human voice”

Authenticity Controversies

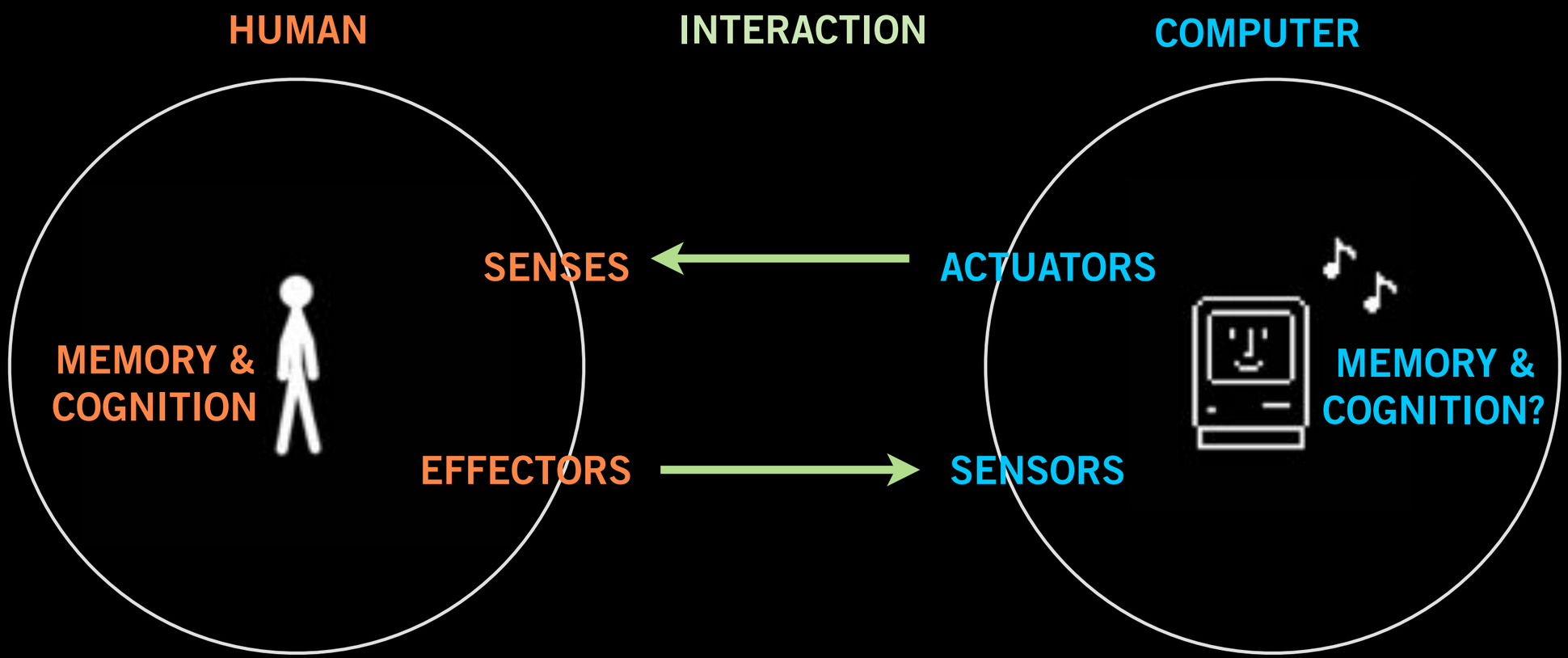

HOLLY HERNDON

NEW INSTRUMENTS AND DIGITAL CONTROLLERS

PERFORMING WITH DIGITAL SYSTEMS

Interaction between a human and a system is a two way process: control and feedback

PERFORMING WITH DIGITAL SYSTEMS



PERFORMING WITH DIGITAL SYSTEMS

Sensors are the sense organs of the machines.

Actuators output electrical energy in sensible forms.

TYPES OF DIGITAL CONTROLLERS

Augmented Instruments

Instrument-like Controllers

Alternate Controllers

Musical Robots (deferred control)

Robots controlling humans (reversed control)

AUGMENTED INSTRUMENTS

metasax (Burtner)

MIMICS (Rovan)

hyperviolin

Augmented instruments are acoustic instruments that have been fitted with sensors so that information concerning gestural parameters can be transmitted in real-time.

INSTRUMENT-LIKE CONTROLLERS

EWI (Akai)

Electronic Trumpet (Yamaha)

Often build upon existing paradigms to add the potentials of electronic synthesis to well-established practices.

Little need to develop new playing techniques

ALTERNATE CONTROLLERS

Alternate controllers are not directly modeled on or inspired by existing acoustic instruments

REACTABLE

a tabletop Tangible User Interface that has been developed by the Music Technology Group at the Universitat Pompeu Fabra in Barcelona, Spain

Pamela Z

composer, performer, and sound artist who works primarily with voice and live electronic processing.

MICHEL WAISVISZ

Dutch composer, performer and inventor of experimental electronic musical instruments.

He was the artistic director of STEIM in Amsterdam from 1981, where he collaborated with musicians and artists from all over the world.

LAETITIA SONAMI

sound artist and performer

Her signature instrument, the lady's glove, allows her to control sounds, mechanical devices, and lights in real-time.

MONOME

Debuted in 2006

They have been quoted, "The wonderful thing about this device is that is doesn't do anything really... It wasn't intended for any specific application. We'll make several applications, and others will make more. We hope to share as many of these as possible."