

History and Impact of Computers in Music

Thomas Hughes

Why Computers & Music?

- Store & Retrieve
- Manipulate
 - Cut, Copy, Paste, Undo
 - Non-destructive editing
- Network
 - Control, Share, Expand
- Cost
- Time

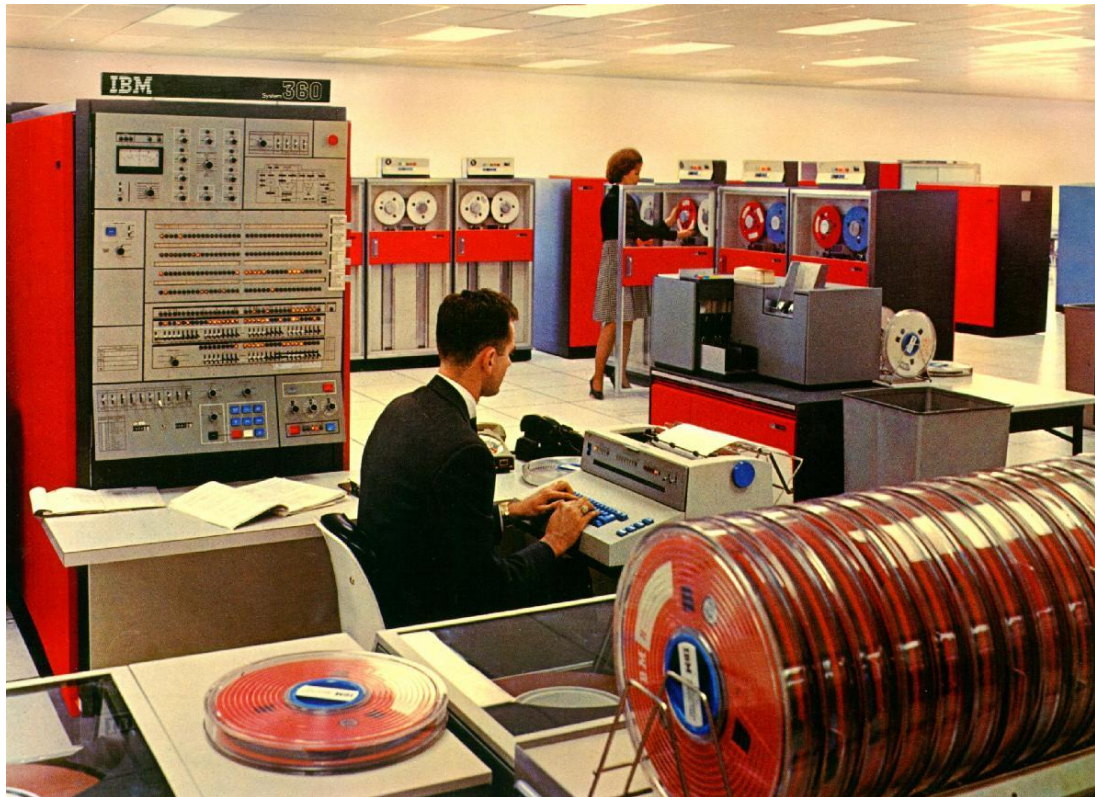
Why Computers & Music?

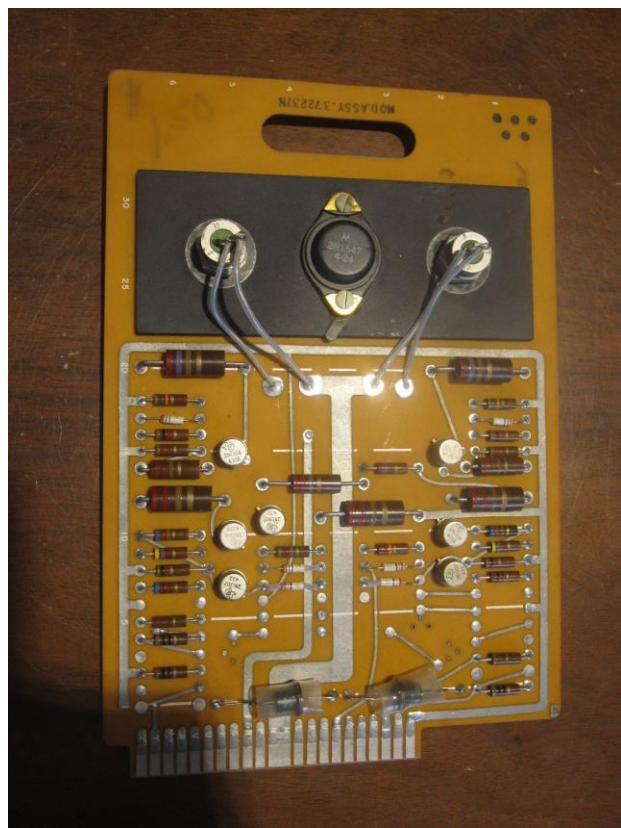
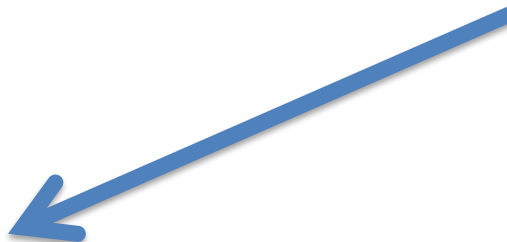
- Sampling
- Size reduction
- Complexity
- Electronic musicians like to hook up stuff to other stuff
 - Geek factor

The 1970's

In the early 1970's, computer components shrink dramatically.

1960s IBM
Mainframe





The Microprocessor

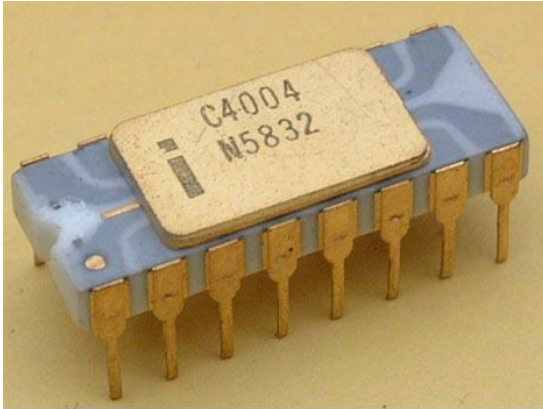
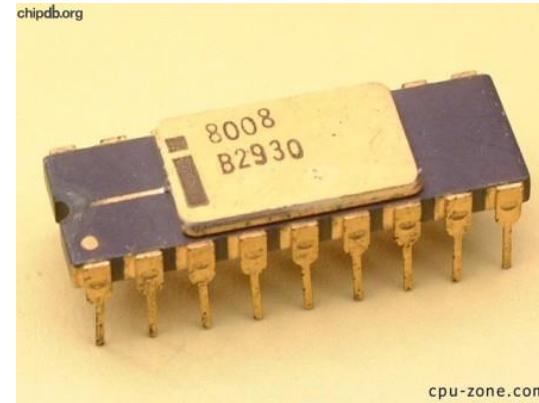


Image courtesy of CPU-Zone.com. Used with permission.

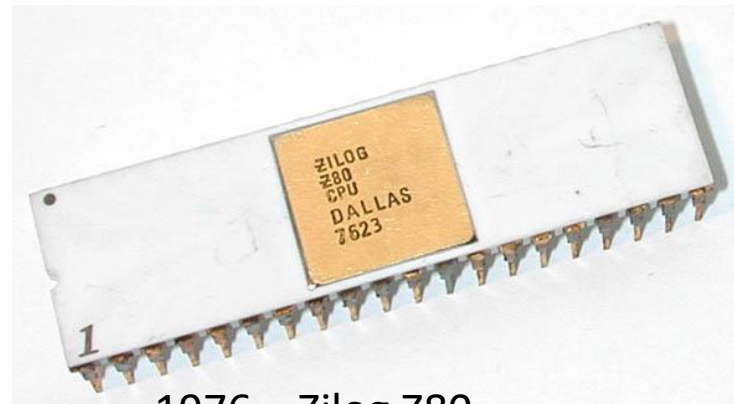
1971 – Intel 4004



1972 – Intel 8008



1974 – Motorola MC6800



1976 – Zilog Z80

Late 1970s → 1980s

The reduction of both size and cost of computer parts results in a huge wave of microprocessor controlled devices and personal computers

This puts computing power and speed in the hands of a much wider range of people



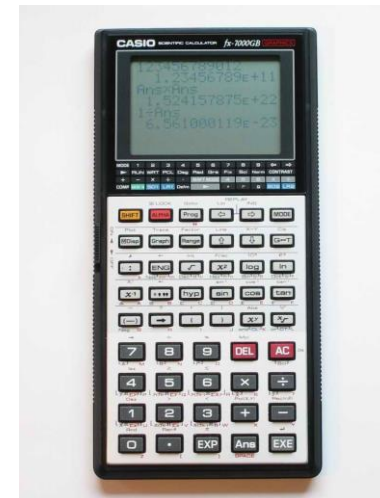
Electronic Instruments



Personal Computers



1978 – 1985 The Golden Age
of Arcade Video Games



Advanced Calculators

Impact

- Keyboard players benefit early on from the use of microprocessors
 - Many keyboard players are already “techy”
 - Store and retrieve programs or “patches”
 - Store and retrieve sequences of notes
 - Gain greater polyphony
 - Can play more notes at the same time
 - Advanced sounds and effects



Wendy Carlos – late 1960s



1978 - Sequential
Circuits Prophet-5



1979 - Oberheim
OB-X Series



Led Zeppelin – Mid 1970s



Depeche Mode – Early 1980s

MIDI

- Most keyboard manufactures are using proprietary systems at this time
 - Very hard or impossible to connect devices from different manufacturers together
- A common communication protocol was needed so musical devices could control, share, store, and retrieve

MIDI

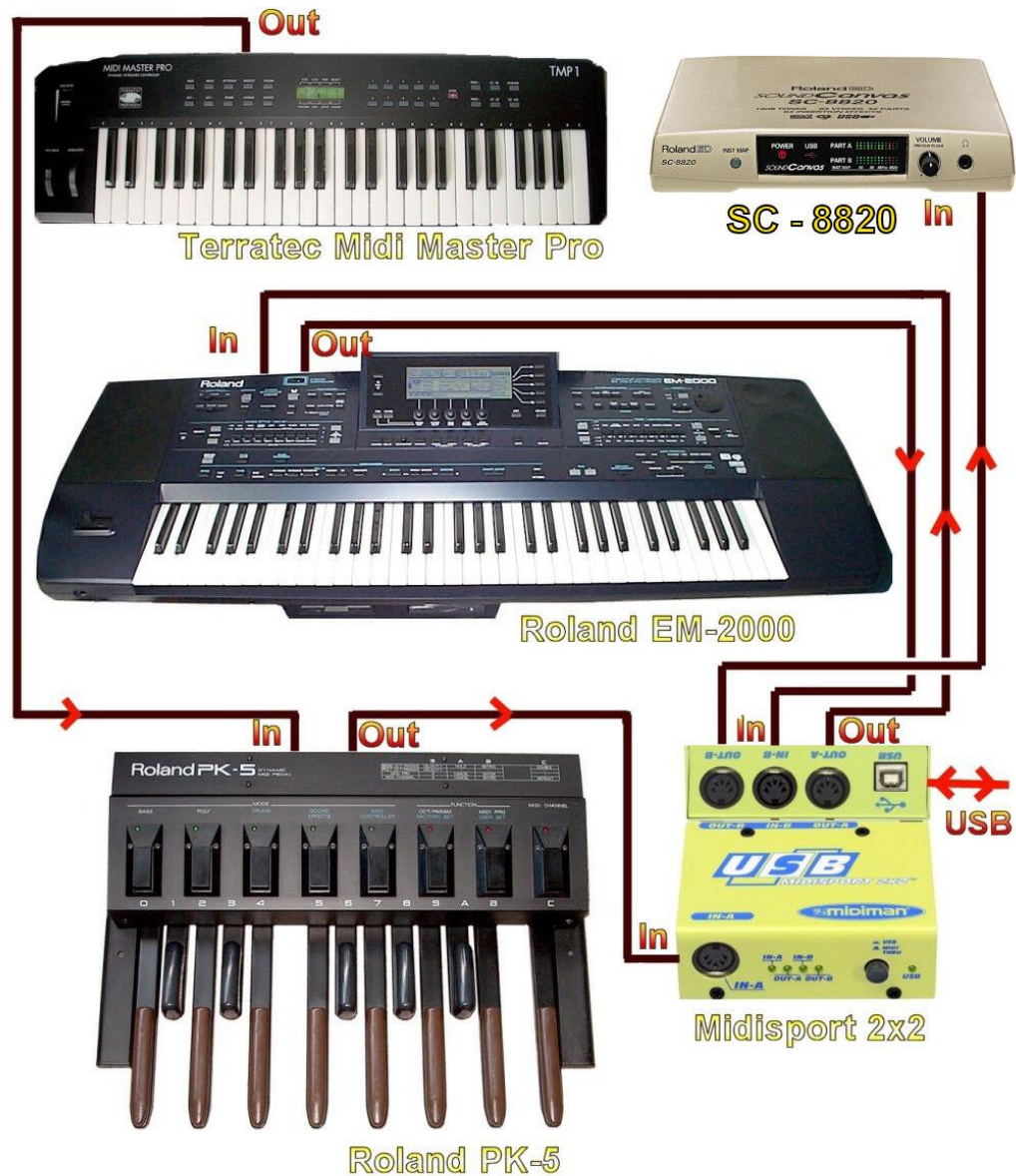
- Musical Instrument Digital Interface
- Standardized in 1983 by a panel of music industry representatives
- 16 channels of information
- Note on/off, tempo, control change, program change, Sysex (System Exclusive)

MIDI

MIDI Connections
– uses 5 pin DIN
plugs and cables



MIDI allows many different devices, from many different manufacturers, to communicate



Midi connection

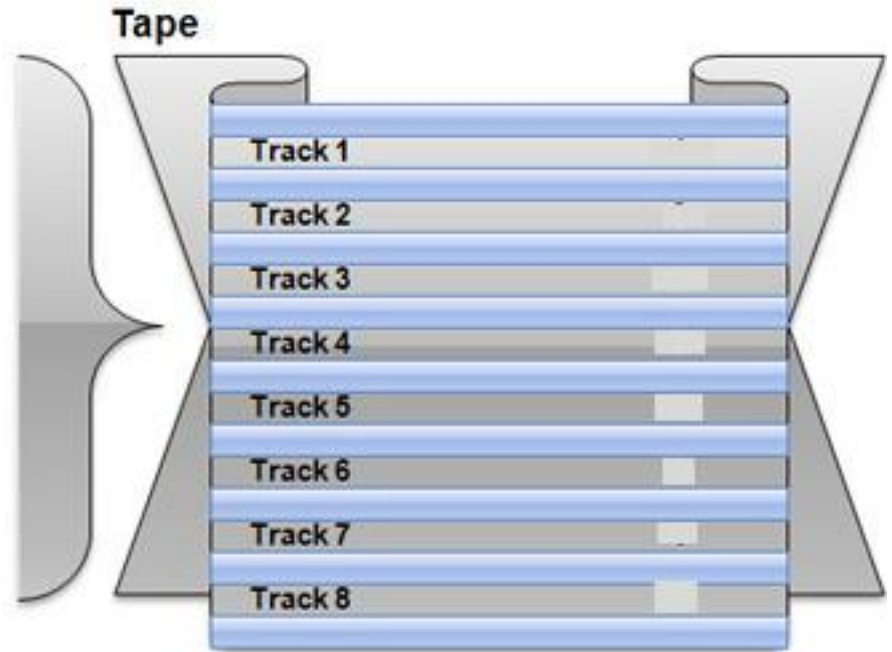
Computer Recording

1985 – Atari 1040ST

Comes with MIDI ports from the factory



Computer Recording



Tape system

Computer Recording

File Edit Structure Functions Options Modules Windows

Arrange - CLUE.ARR

Snap BAR Mouse Quantize 16 Cycle Rec Normal

Trackinfo	A	M	C	T	Track	Chn	Instrument
elecplano			♪		piano	1	piano
Instrument			♪		elecplano	2	e.piano
e.piano			♪		chromperc	3	chromprc
Output			♪		organ	4	organ
ATARI			♪		guitar	5	guitar
Chan 2			♪		bass	6	bass
			♪		strings	7	strings
			♪		ensemble	8	ensemble
			♪		brass	9	brass
Bank OFF			♪		percussion	10	perc.
Prg OFF			♪		percus 2	10	perc.
Volume OFF			♪		reed	11	reed
Transp 0			♪		flute	12	flute
Veloc 0			♪		syn lead	13	synlead
Delay 0			♪		syn pad	14	synpad
Length OFF			♪		ethnic	15	ethnic
Compr OFF			♪		effects	16	effects

SOLO OVERDUB 1. 1. 0 LEFT LOCATOR

EDSOLO REC MODE 300. 1. 0 RIGHT LOCATOR

CYCLE IN OUT PUNCH

SONG POSITION 1. 1. 0

SMPT TIME 0: 0: 0: 0

4/ 4 SIGN 120.000

CLICK MASTER SYNC

Computer Recording

The screenshot displays a music software interface with a menu bar at the top: **File Edit Structure Functions Options Modules Windows**. Below the menu is a title bar with **KEEP**, **CANCEL**, **Key - elecpiano, 1. 1. 0, 104. 1. 0**, and **FULL**. The main workspace is a piano roll with a grid. The top of the piano roll has a header with **START**, **LENGTH**, **PITCH**, **VELO-ON**, **VELO-OFF**, and **CHN**. The piano roll shows a sequence of notes on a keyboard, with a **Key** column on the left. The notes are labeled with numbers 7, 8, 9, and 10. The piano roll is divided into two sections, **C3** and **C2**. Below the piano roll is a **NOTEV.** section with a **PP** (piano) and **ff** (forte) indicator. The bottom control panel includes buttons for **SOLO**, **OVERDUB**, **EDSOLO**, **CYCLE**, **REC MODE**, **IN**, **OUT**, **PUNCH**, **LEFT LOCATOR**, **RIGHT LOCATOR**, **SONG POSITION**, **SMPT TIME**, **SIGN**, **TEMPO**, **CLICK**, **MASTER**, and **SYNC**. The control panel also displays numerical values: **1. 1. 0**, **300. 1. 0**, **1. 1. 0**, **4/ 4**, **0: 0: 0: 0**, and **120.000**.

Impact

- All keyboard parts can be recorded at one time
- Parts can be perfected and manipulated
 - Cut, copy, paste, edit, delete, undo
 - Non-destructive editing
- Quantization – perfect timing
 - Good or bad?

Impact

- Memory at the time is still very expensive
- Because MIDI information is just hexadecimal data, its small size makes it economical to store.

15-Megabyte Hard Disk Drive



2495⁰⁰ Requires appropriate installation kit (see below)

Adds 15 million characters of high-speed storage. U.L. listed.

Primary Unit. 26-4155	2495.00*
Secondary Unit. 26-4156	1995.00*
Model II/12/16 Installation Kit. 26-4157	495.00
NEW! Model 4 Kit. 26-1134	79.95
NEW! Model III Kit. 26-1133	99.95

Drums

Standard acoustic
drum set



Drums

Electronic Drums –
drum pads or
“triggers” control
keyboards or can
be recorded
through MIDI



Drums

Drum Machine



Guitar

Standard Guitar
Setup





Advanced guitar
setup using
microprocessor
controlled devices

Guitar

ADA MP-1 Guitar
Preamp –
Microprocessor
driven, MIDI
controlled



Guitar



Synth Guitar – allows guitar players to play synth parts

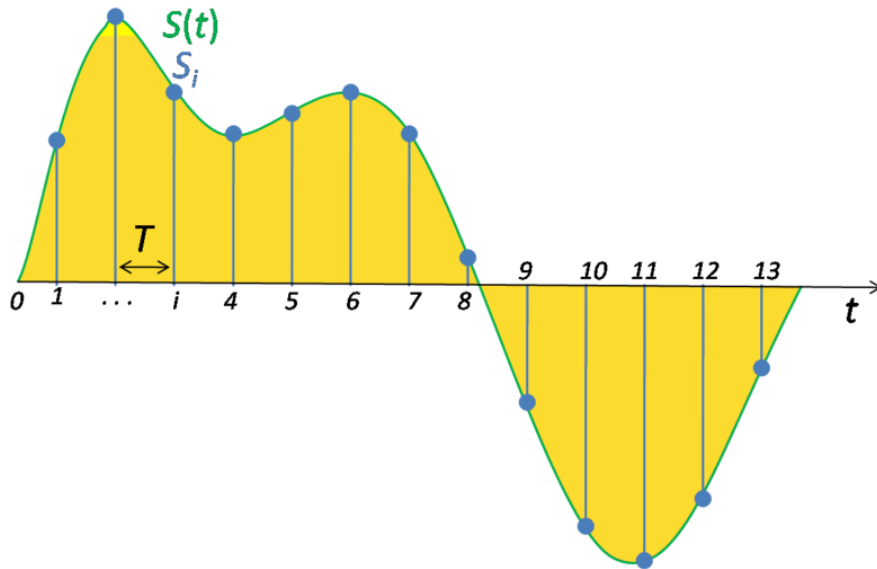
Impact

- The rest of the band can exploit the power of MIDI
- Allows for complex sounds that can be changed, stored, and recalled at the touch of a button
- Smaller and cheaper gear that has several functions
- Some people get carried away

Sampling

- As processing speed increases and memory cost decreases, real sounds are able to be captured and stored in memory, through a process known as **sampling**
- Uses a device known as the **Digital-to-Analog Converter (DAC)** & the **Analog- to-Digital Converter (ADC)**

Sampling



Sampling Rate -
Number of samples per
second.
Measured in Hz or Khz

Sampling

1980s Linn Drum Computer –
\$5 000



Generated sounds vs. manipulating captured sounds

1980s Fairlight –
\$20 000 - \$50 000



1980s Synclavier–
Up to \$200 000

Sampling

1988 AKAI S1000 -
\$5 000



Impact

- Sounds no longer need to be electronically generated, but real sounds can be captured and manipulated
- Sounds are manipulated digitally
- Range of sounds available become unlimited

Impact

- Rap/Hip Hop artists grab on to this new technology
- Sampling bits of older songs and incorporating them into their own music

Funky Cold Medina – Tone Loc



Foreigner *Hot Blooded* + Kiss *Christine Sixteen*

Impact

- CD – Compact Disc
 - Music digitally stored, read by a laser
 - Sampling rate of 44.1 kHz



Computer Recording

- As the price of personal computers, memory, and storage drops, as well as processing speed increases, computer recording allows MIDI and real audio files to be used together.
- Eventually, prices drop so low that anyone can afford to produce very high quality recordings at home
- Today, everything can be done on the computer, with very little outboard gear



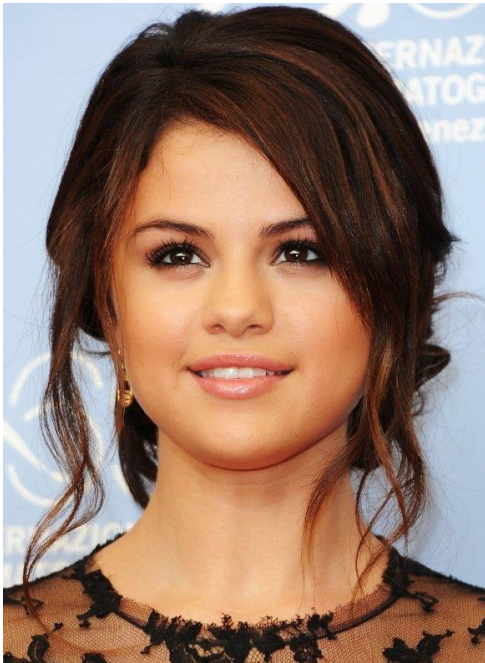
Pro Tools

Computer Recording

- Like Photoshop, recording software can be expanded through the use of PLUGINS
 - Synths, effects, virtual instruments, virtual guitar amplifiers, etc.
 - Much of the music we hear today has no “real” instruments on it

Computer Recording

- The most infamous of these plugins is probably AUTOTUNE
- used both in the studio and live



MP3

- July 1994, the Fraunhofer Society released the first software MP3 encoder called l3enc
- Lossy compression format
- Shrink a 60 meg cd track into 3-4 megs
- These explode onto the internet in the later 1990s,
 - allowing the illegal sharing of songs
 - The rise of the mp3 player (iPod, etc)

- MP3 and other compression formats make way for the iTunes store and others

19. Buffalo, New York



Source.

The Loudness War

- Advanced dynamic compression plugins have influenced The Loudness War
- Songs are compressed very heavily during the mastering stage to make them sound as loud as possible,
 - to make them stand out on radio, tv, etc.
- Every instrument and vocal are at the same volume as each other
- There is a growing backlash against this

