

PAT 463/563 (Fall 2025)

Music & AI

Lecture 3: AI & Music

Instructor: Hao-Wen Dong

AI Music in the Early Days

| The Early Days

Musical Dice Game (1792)



(Source: gbrachetta)

gbrachetta.github.io/Musical-Dice/

ILLIAC Suite (1957)



(Source: Illinois Distributed Museum)

Emily Howell (2003)



(Source: The Guardian)

gbrachetta.github.io/Musical-Dice/
distributedmuseum.illinois.edu/exhibit/illiac-suite/
theguardian.com/technology/2010/jul/11/david-cope-computer-composer

Musical Dice Game (1792)


Table des Chiffres pour le Walzer.
Zahlentafel für den Walzer.

Première Partie.
Erster Theil.

	A	B	C	D	E	F	G	H
2	96	22	141	41	105	122	11	30
3	32	6	128	63	146	46	134	81
4	69	95	158	13	153	55	110	24
5	40	17	113	85	161	2	159	100
6	148	74	163	45	80	97	36	107
7	04	157	27	167	154	68	118	91
8	52	60	171	53	99	133	21	127
9	19	84	114	50	140	86	169	94
10	98	142	42	156	75	129	62	123
11	2	87	165	61	135	47	147	33
12	10	03	28	37	106	5		

Seconde Partie.
Zweiter Theil.

	A	B	C	D	E	F	G	H
2	70	121	26	9	112	49	109	14
3	117	39	126	56	174	18	116	83
4	66	139	15	132	73	58	145	79
5	90	176	7	34	67	160	52	170
6	25	143	64	125	76	136	1	93
7	138	71	150	29	101	162	23	151
8	16	155	57	175	43	168	89	172
9	120	88	48	166	51	115	72	111
10	65	77	19	82	137	38	149	8
11	102	4	31	164	144	59	173	78
12	35	20	108	92	12	124	44	131



(Source: gbrachetta)

gbrachetta.github.io/Musical-Dice/

Lejaren Hiller – ILLIAC Suite for String Quartet (1957)

3

ILLIAC SUITE FOR STRING QUARTET

I. EXPERIMENT NO. 1

L.A. HILLER, JR. AND L.M. ISAACSON

PRESTO

Violin I, Violin II, Viola, Cello

Measure numbers: 10, 20, 30

Dynamic markings: *f*, *p*, *mp*

Section (A)



(Source: Illinois Distributed Museum)

youtu.be/n0njBFLQSk8 &
music.arts.uci.edu/abauer/3.1/scores/Hiller_Illiatic_Suite.pdf



ILLIAC & ILLIAC Suite @ UIUC!



| Emily Howell (by David Cope) – Prelude (2007)



youtu.be/QHJqp4SIsou

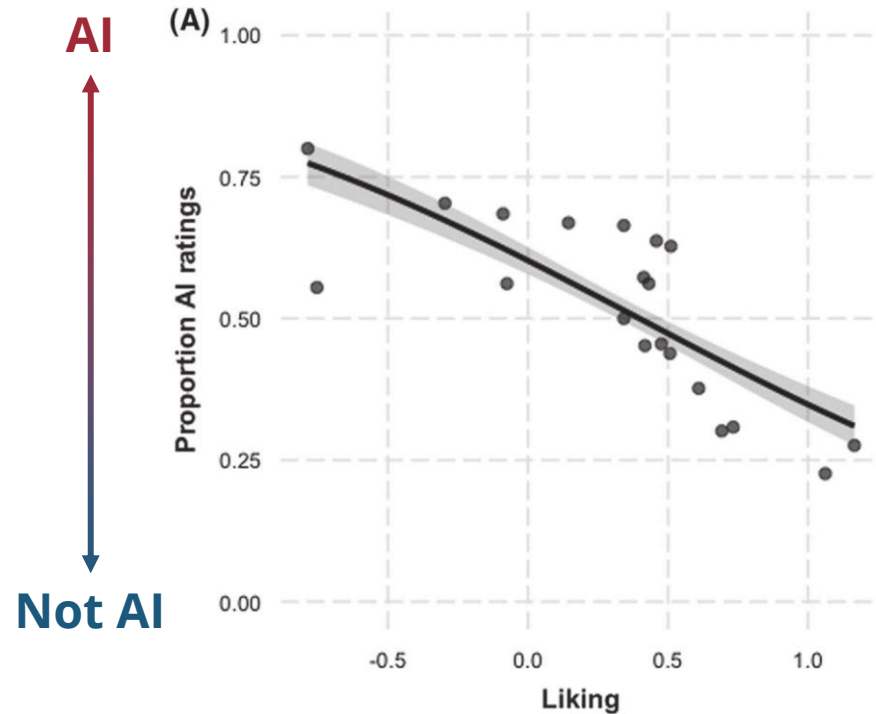
Reading: David Cope on Emily Howell

- David Cope: 'You pushed the button and out came hundreds and thousands of sonatas'
 - Interview by Tim Adams published on *The Observer*, *The Guardians*, July 10, 2010

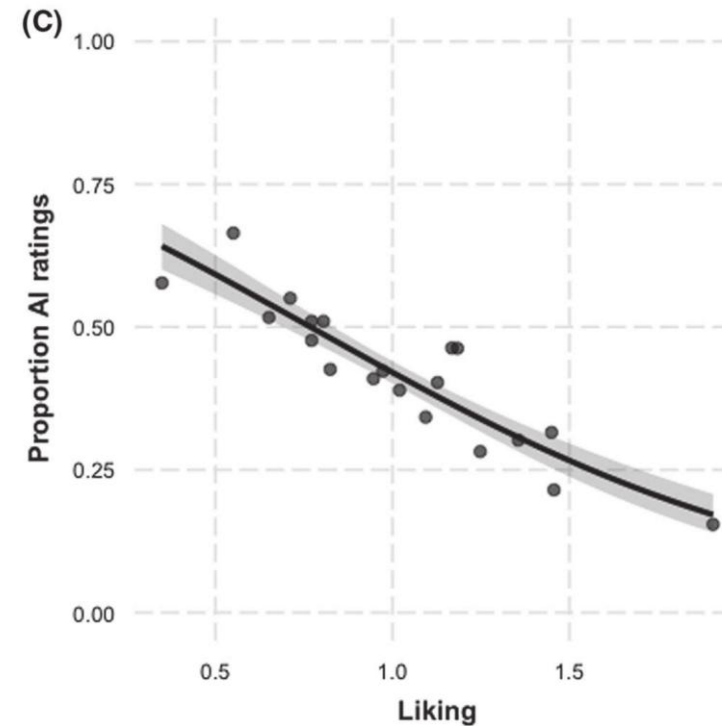
"People tell me they don't hear soul in the music," he says. "When they do that, I pull out a page of notes and ask them to show me where the soul is. We like to think that what we hear is soul, but I think audience members put themselves down a lot in that respect. **The feelings that we get from listening to music are something we produce, it's not there in the notes. It comes from emotional insight in each of us, the music is just the trigger.**"

AI Composer Bias (Shank et al., 2023)

Electronic music



Classical music

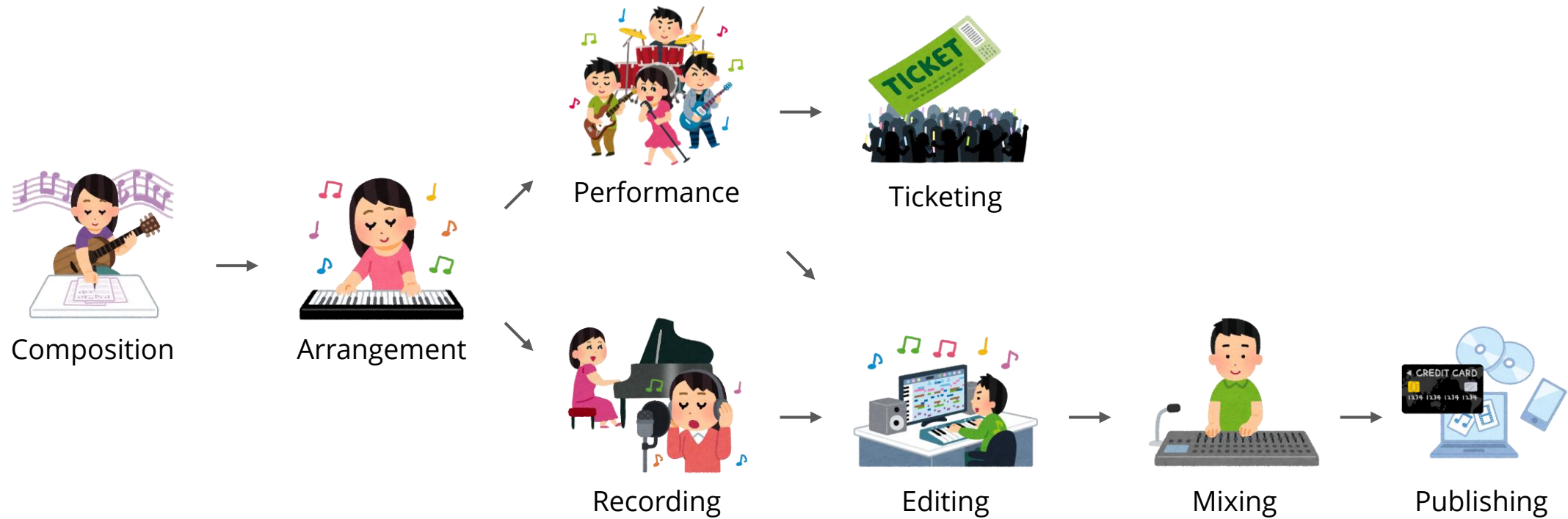


How should we interpret these two figures?

Correlation ≠ Causality

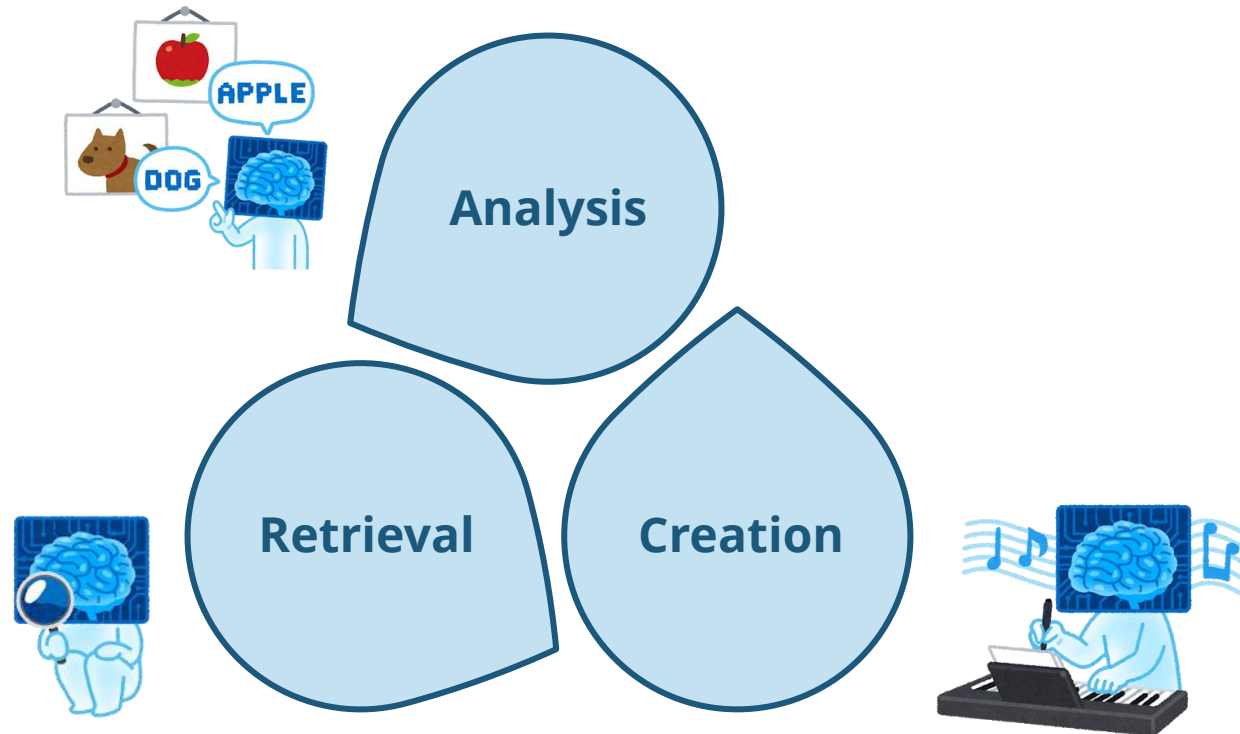
The Landscape

An Overly-Simplified Music Production Workflow



Music Information Research (MIR)

- “Intelligent ways to analyze, retrieve and create music” (Yang 2018)



Music Information Research (MIR)

Electrical Engineering



a female cat engineer making an electric chip in a classroom

Music



a cat playing heavy metal

Computer Science



a cat engineer debugging on laptop

Made in September 2023!

Music Information Research (MIR)

Electrical Engineering



a cat engineer making an electric chip in a classroom

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a cat playing heavy metal

Computer Science



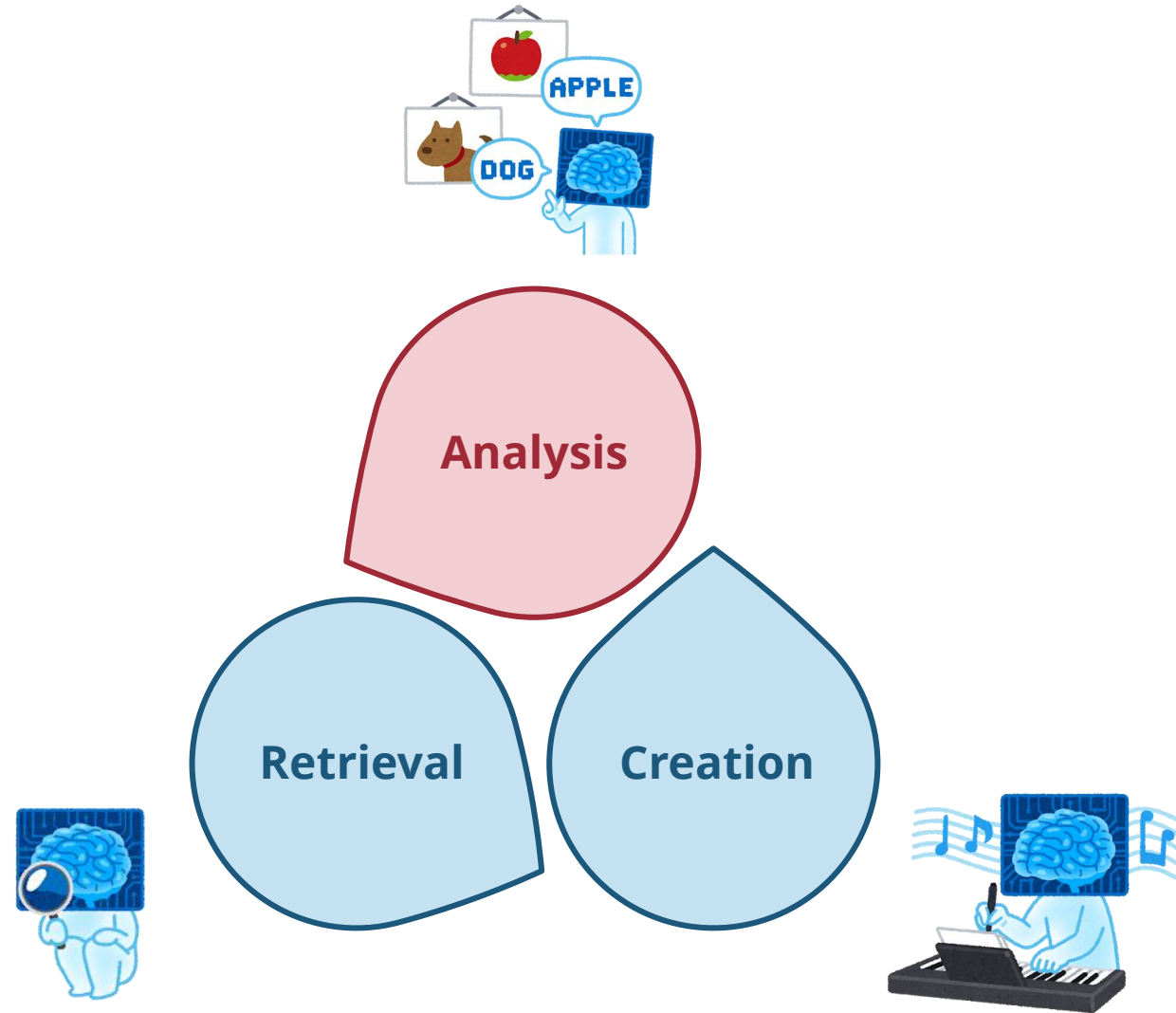
a cat engineer debugging Python programs on a laptop

January 2025
Made in ~~September 2023~~!

Use Cases of AI for Music & Audio



Universitaetsmedizin, [CC BY-SA 4.0](#), via Wikimedia Commons
uploadvr.com/iron-man-vr-breaks-free-from-cords-load-screens-on-quest-2/
descript.com/blog/article/what-is-the-best-audio-interface-for-recording-a-podcast
denverpost.com/2019/08/02/colorado-symphony-movie-scores-harry-potter-star-wars/
dailybruin.com/2023/04/theater-review-the-musical-les-misrables-offers-stellar-displays-and-impassioned-vocals

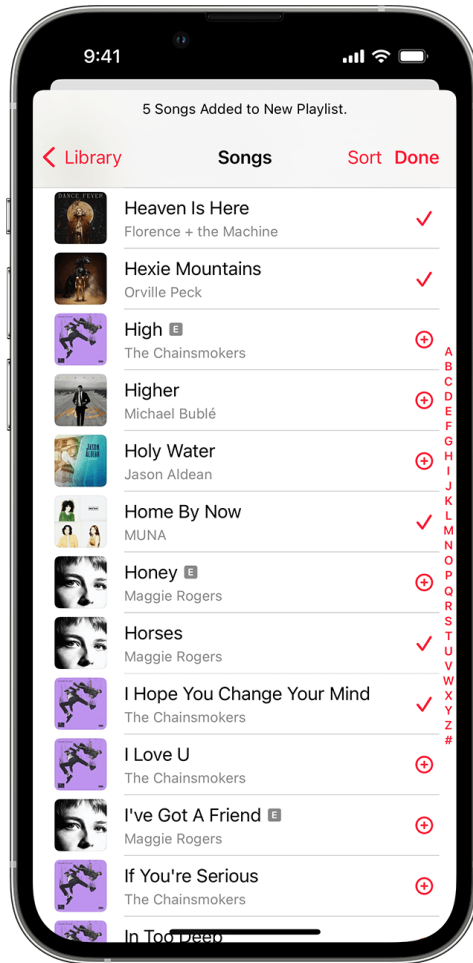


Music Classification for Recommendation

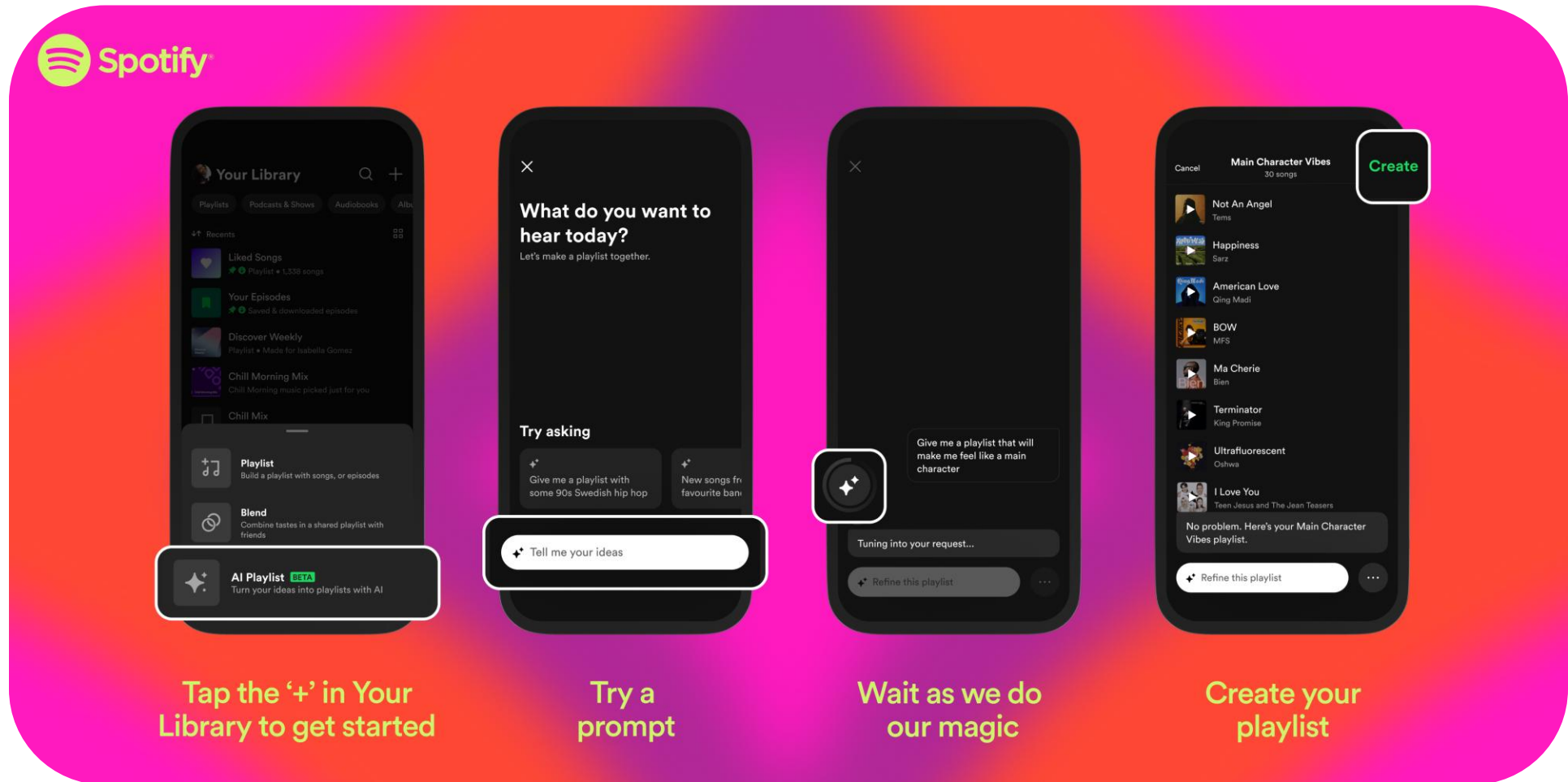
What to play next?



Music Classification for Playlist Generation

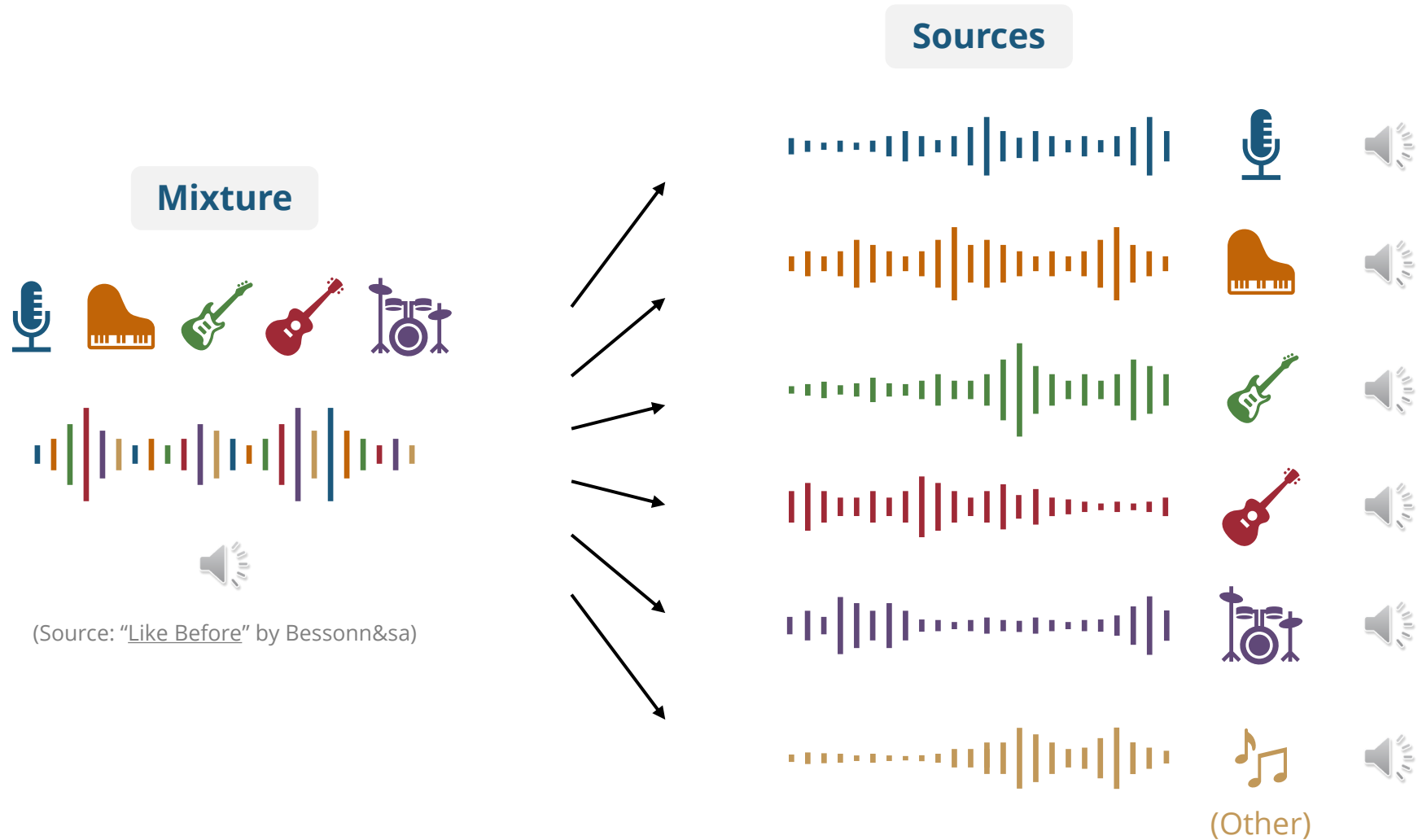


AI Playlist (Spotify)

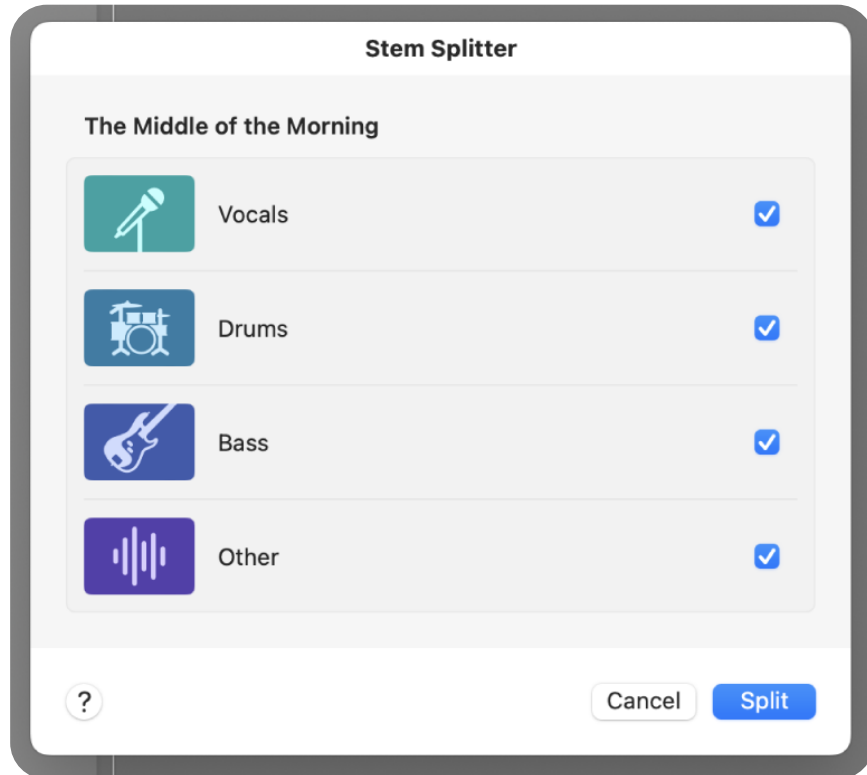


(Source: Spotify)

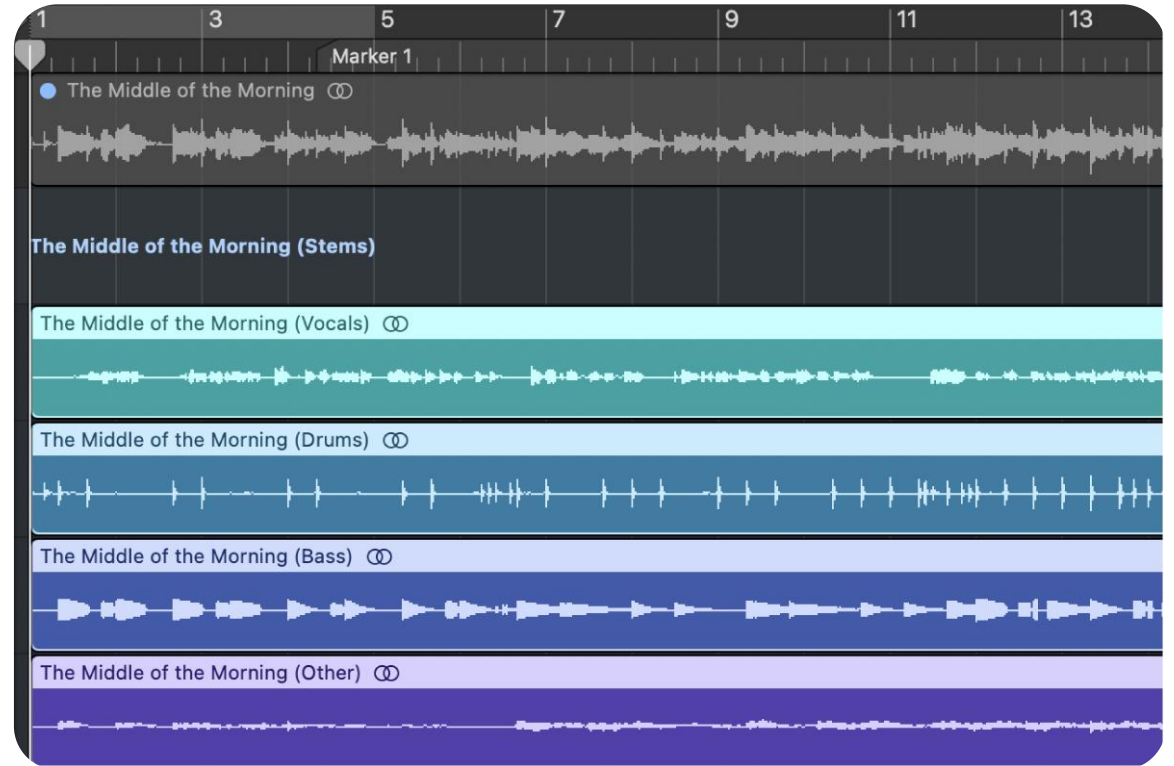
Source Separation



Stem Splitter in Logic Pro

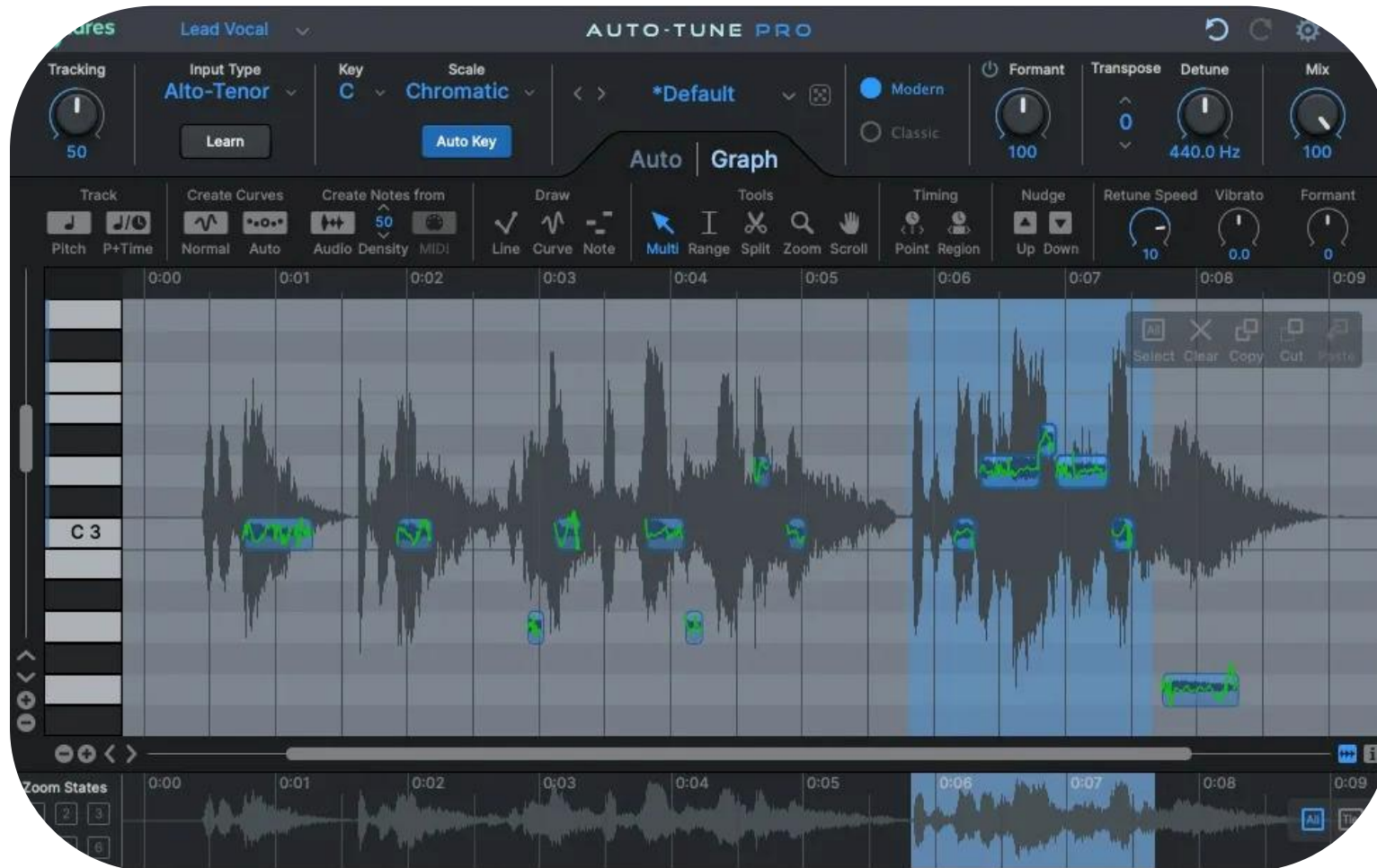


(Source: Logic Pro User Guide)



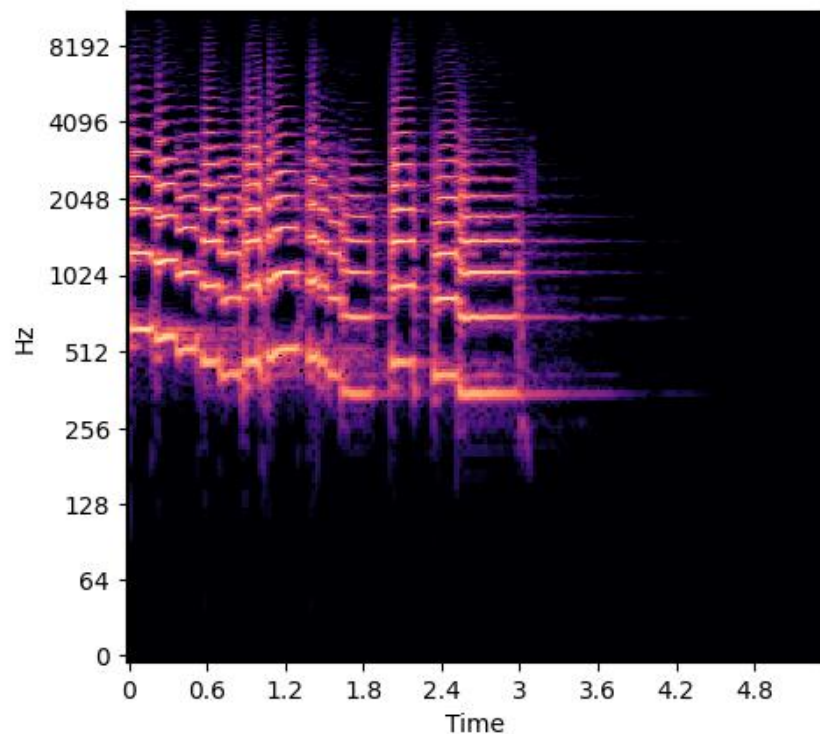
(Source: Logic Pro User Guide)

Auto-tune Pro

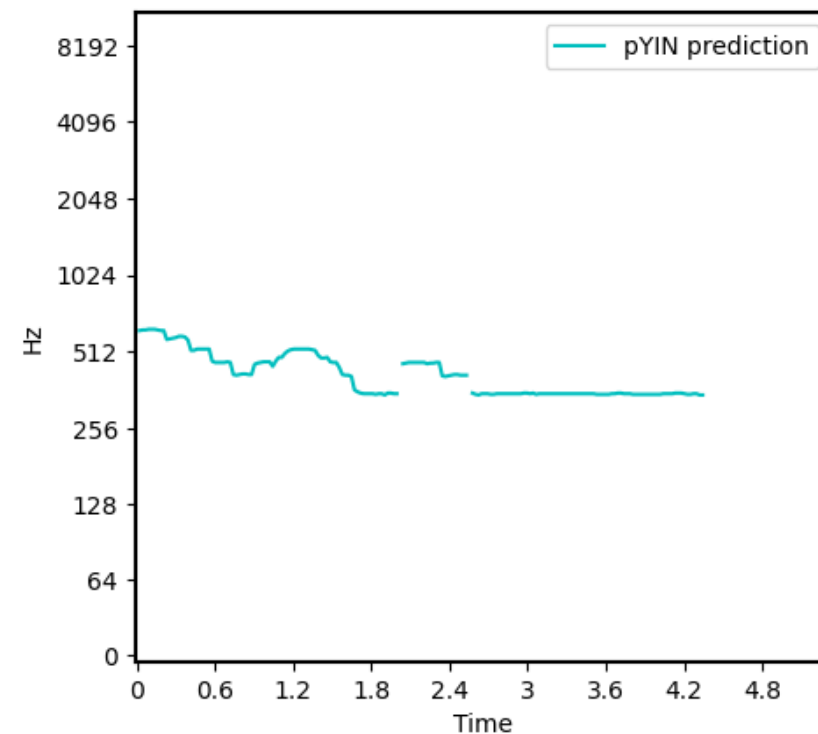


(Source: Antares Audio Technologies)

Fundamental Frequency (F0) Estimation

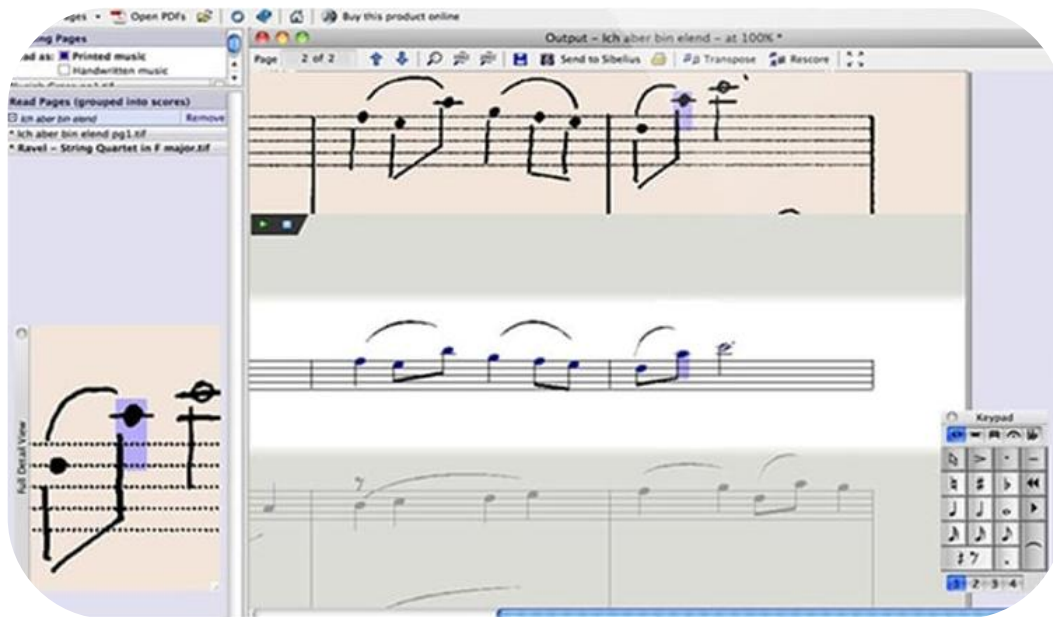


→ **F0 Estimation** →



Optical Music Recognition (OMR)

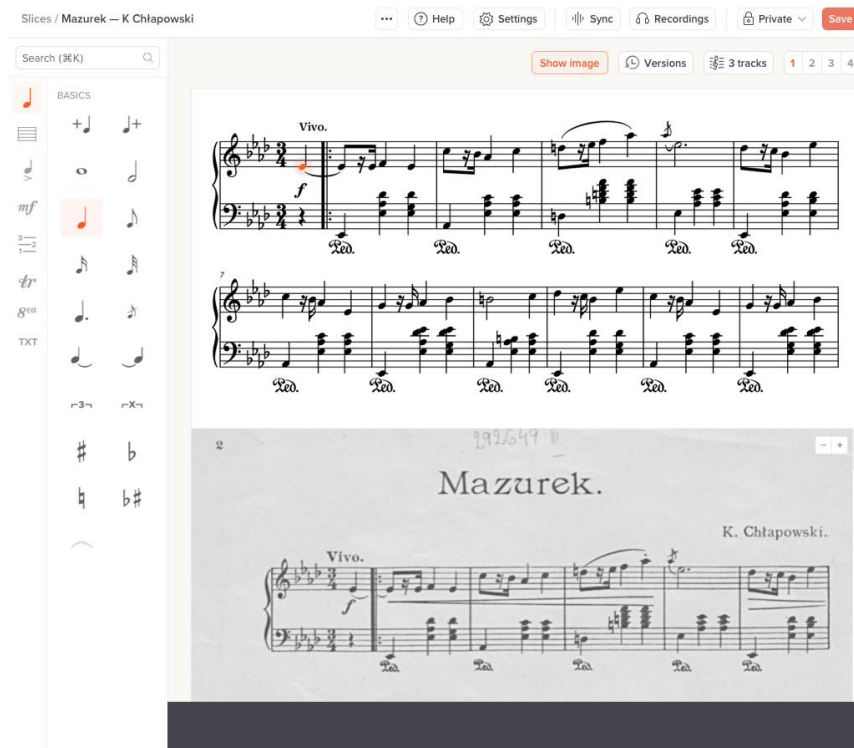
PhotoScore & NotateMe in Sibelius



(Source: Avid)

avid.com/products/photoscore-and-notateme-ultimate
soundslice.com/sheet-music-scanner/

Soundslice

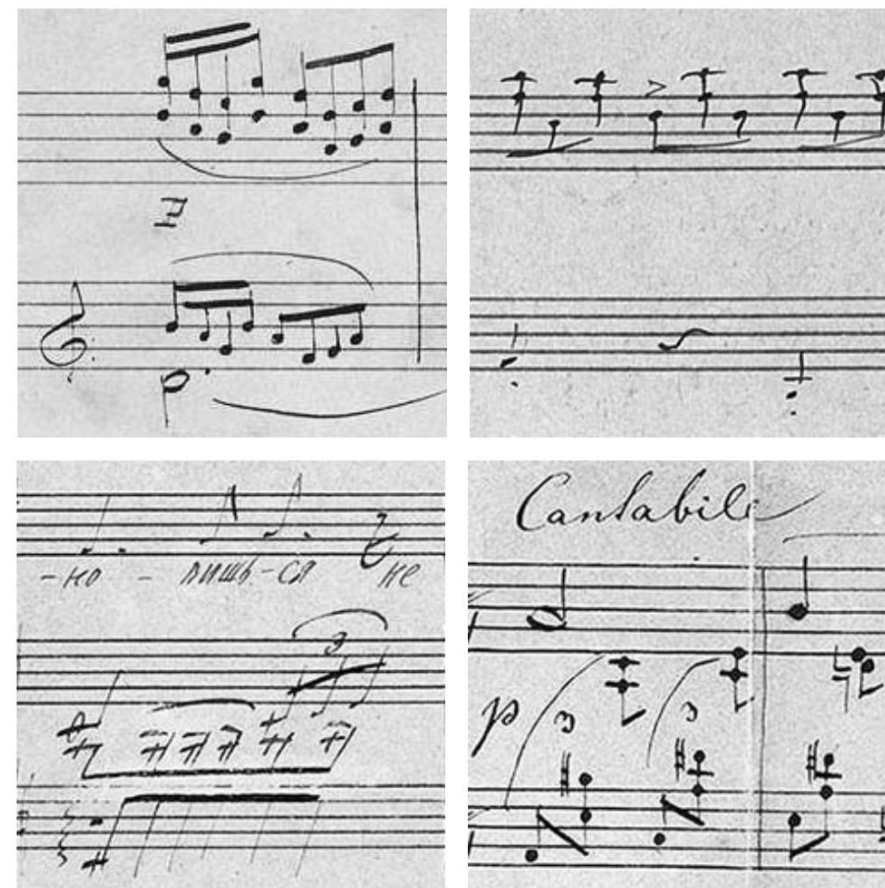


(Source: Soundslice)

Challenges of OMR



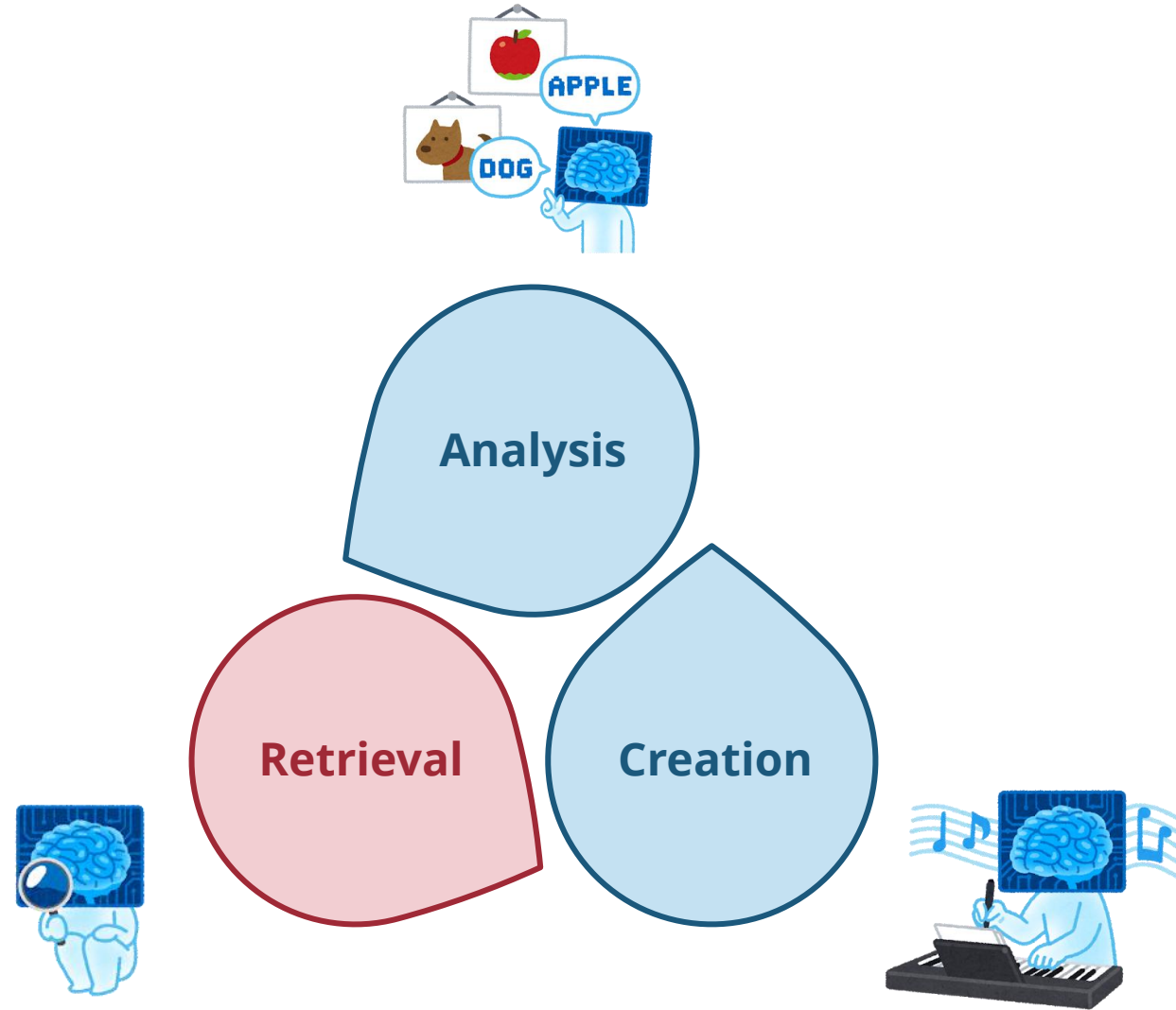
(Source: Calvo-Zaragoza et al., 2018)



(Source: Novotný & Pokorný, 2015)

Jorge Calvo-Zaragoza, Juan C. Martinez-Sevilla, Carlos Penarrubia, and Antonio Rios-Vila, "Optical Music Recognition: Recent Advances, Current Challenges, and Future Directions," *ICDAR*, 2023.

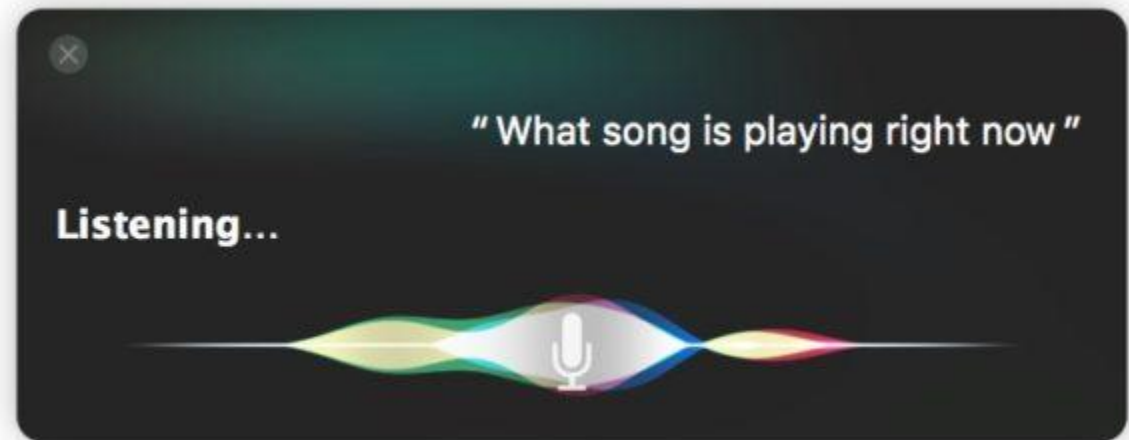
Jiří Novotný and Jaroslav Pokorný, "Introduction to Optical Music Recognition: Overview and Practical Challenges," *DATESO*, 2015.



Shazam & Siri

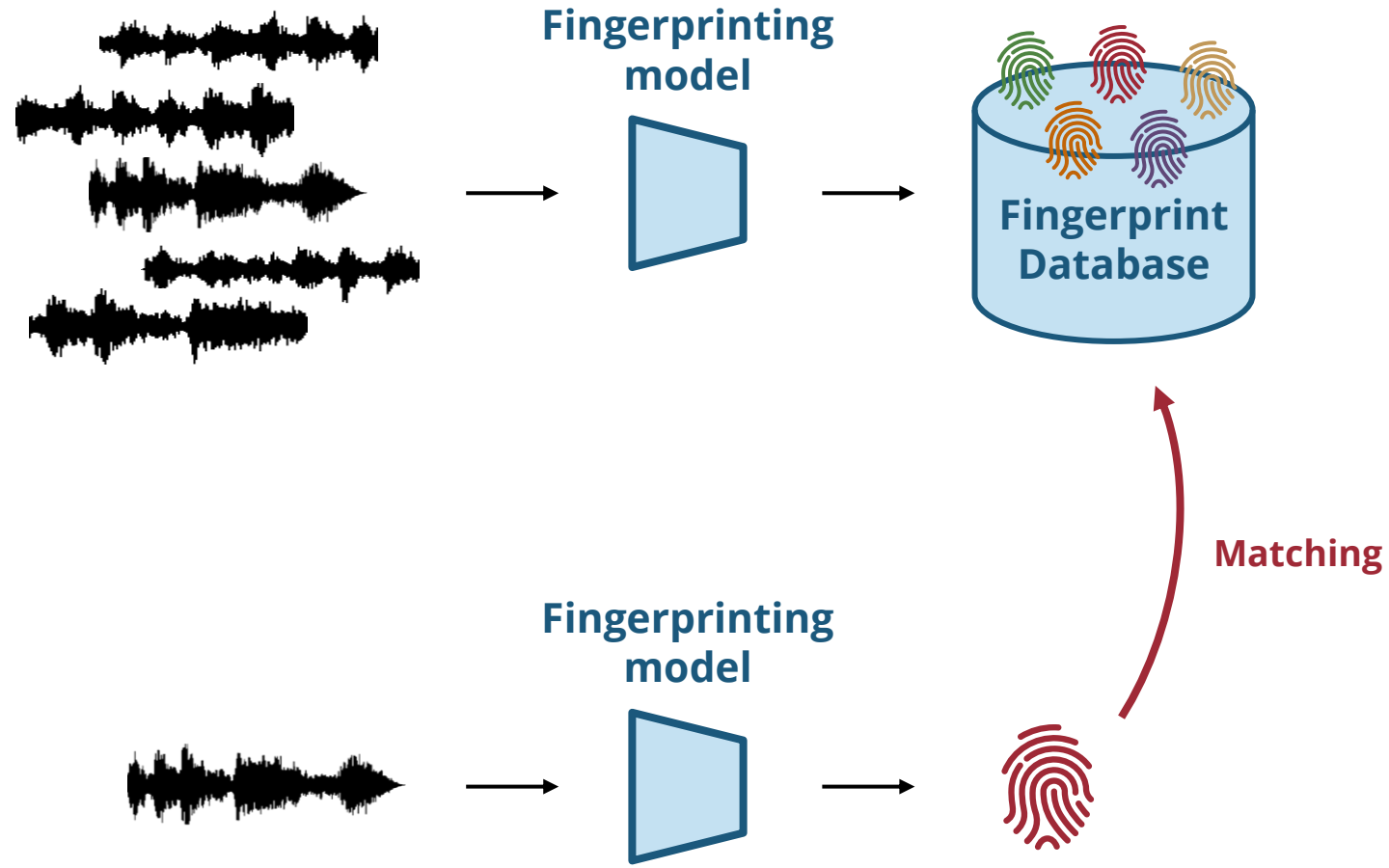


(Source: Shazam User Guide)

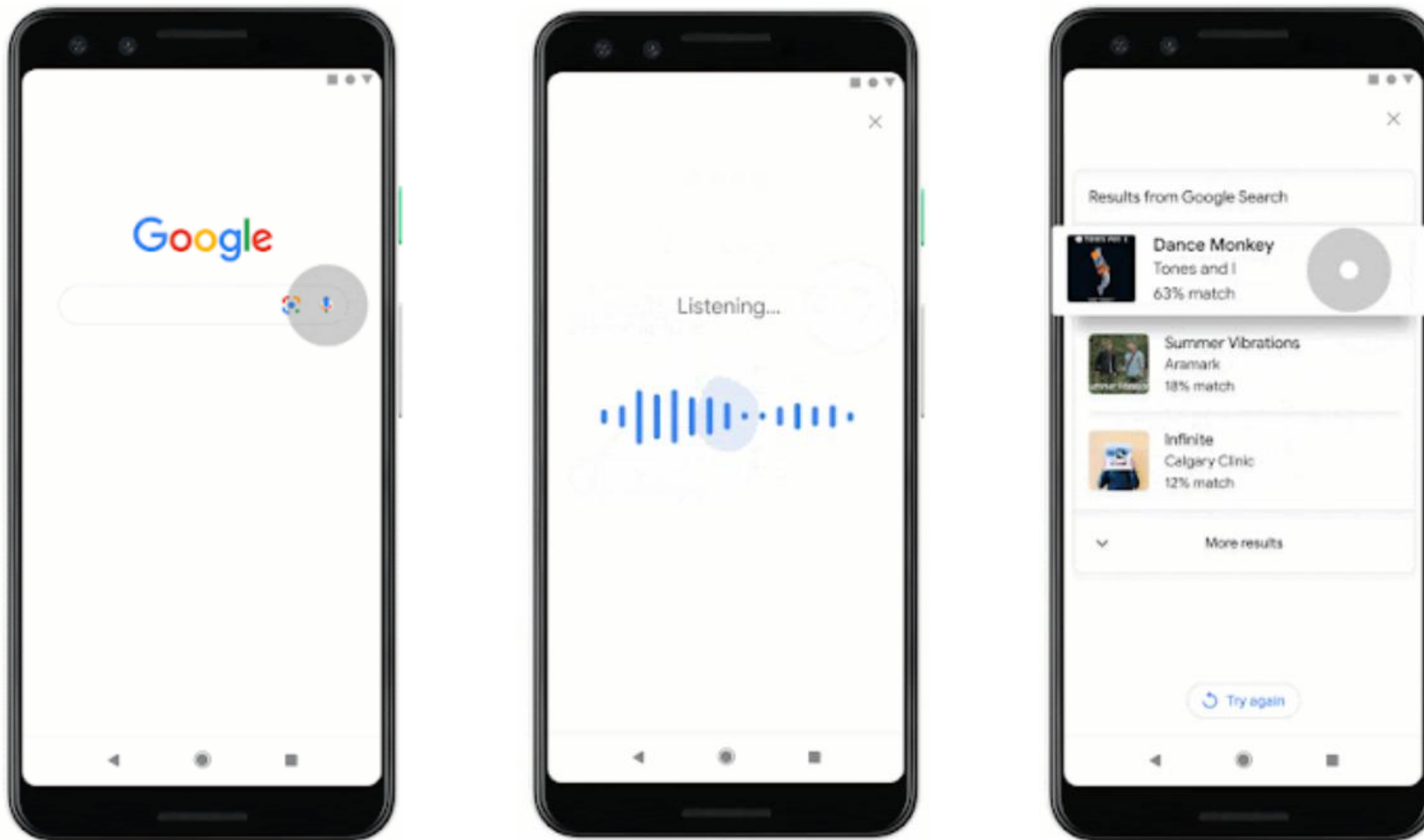


(Source: OSXDaily)

Audio Fingerprinting for Audio Identification

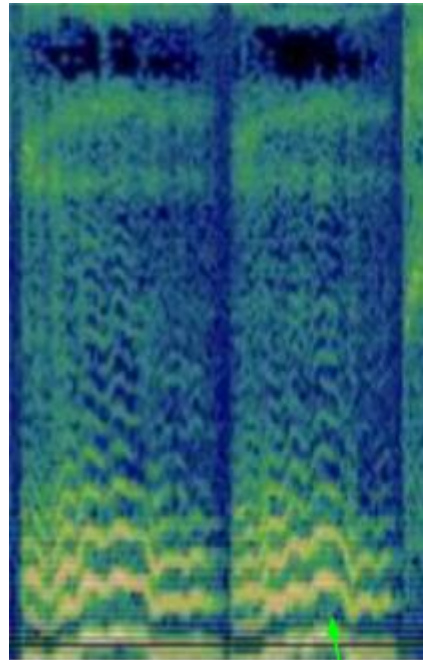


Hum to Search (Google)

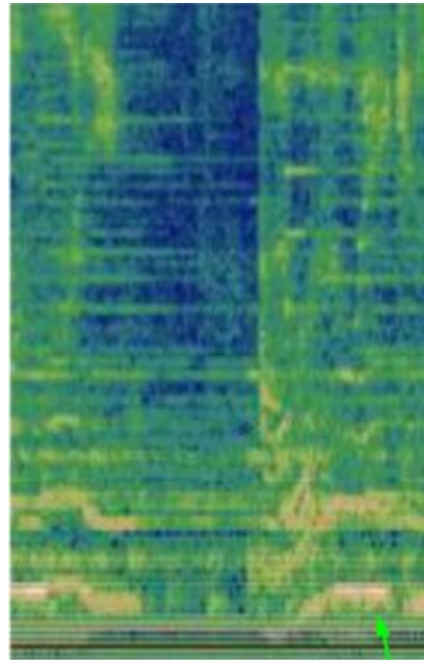


(Source: Google Research Blog)

Hum to Search (Google)



Humming



Studio Recording

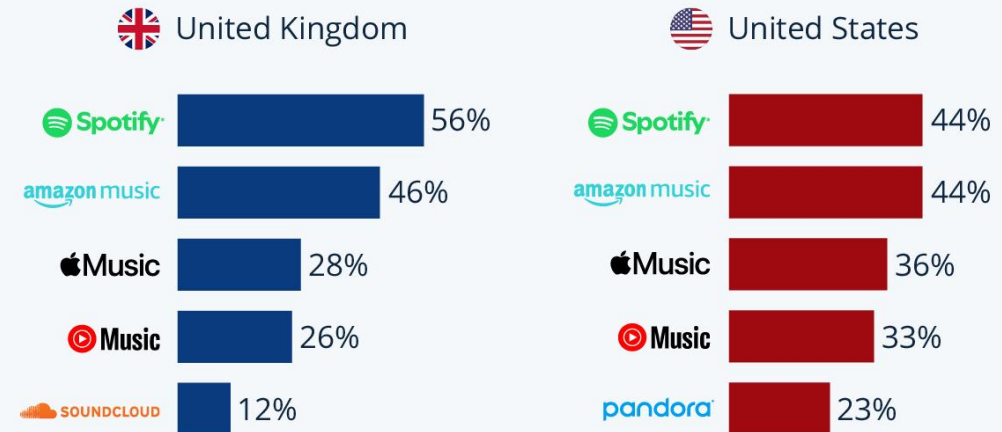
(Source: Google Research Blog)

Music Recommendation



The Most Loved Digital Audio Streaming Platforms

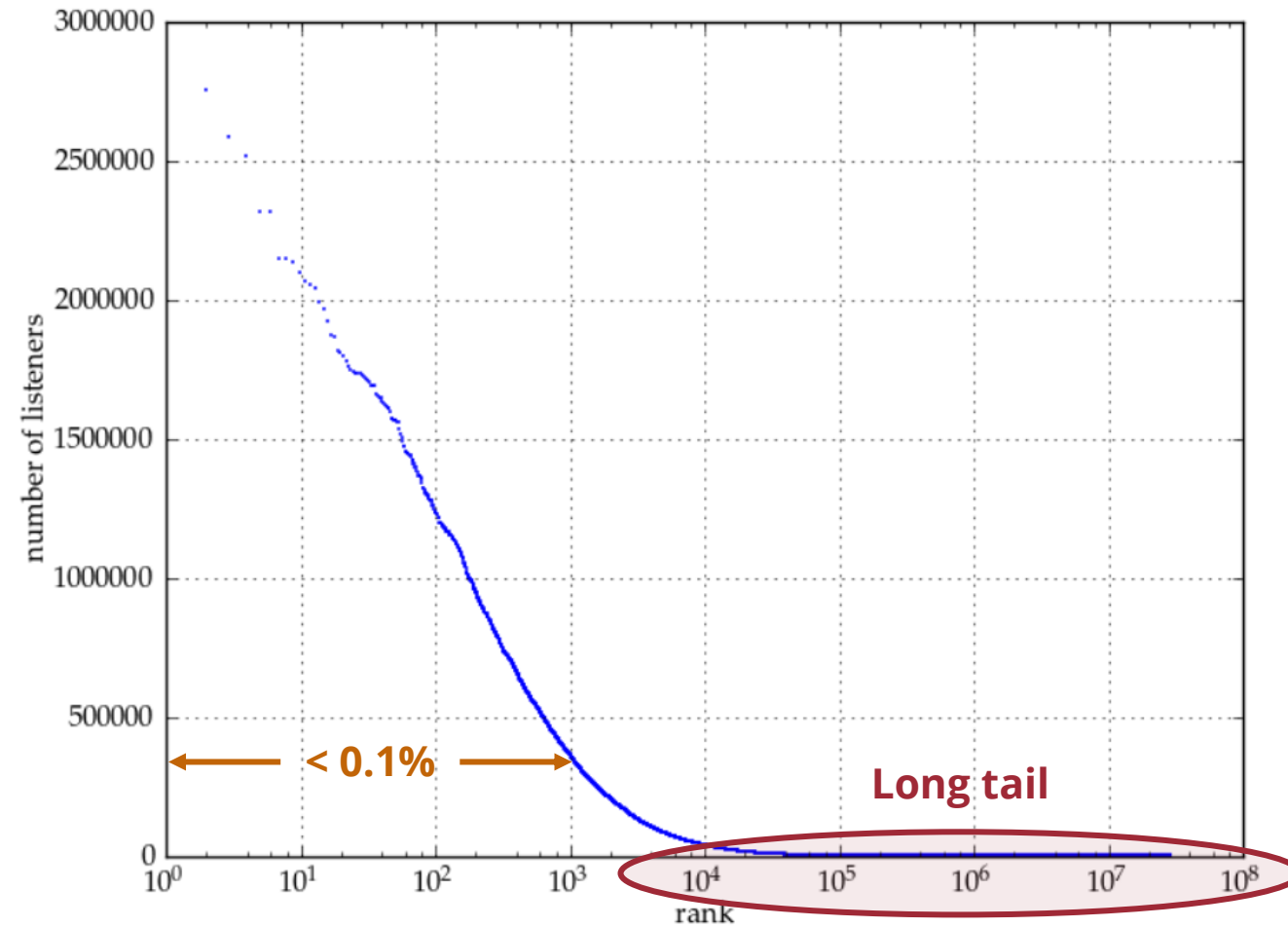
Share of respondents who have paid for audio downloads or streaming services from the following platforms*



* in the 12 months prior to the survey
2,362 (UK)/4,944 (USA) respondents (18-64 y/o) surveyed Jul. 2023-Jun. 2024
Source: Statista Consumer Insights



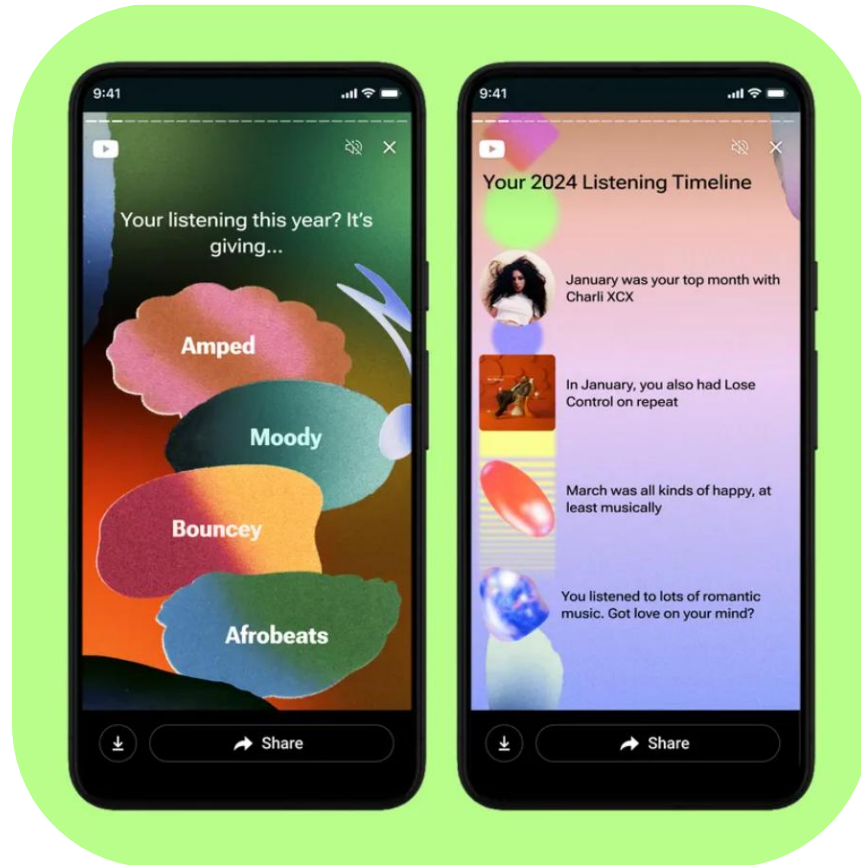
| The Long Tail Problem



(Source: Levy & Bosteels, 2010)

Listening Behavior Analysis

YouTube's Music Recap

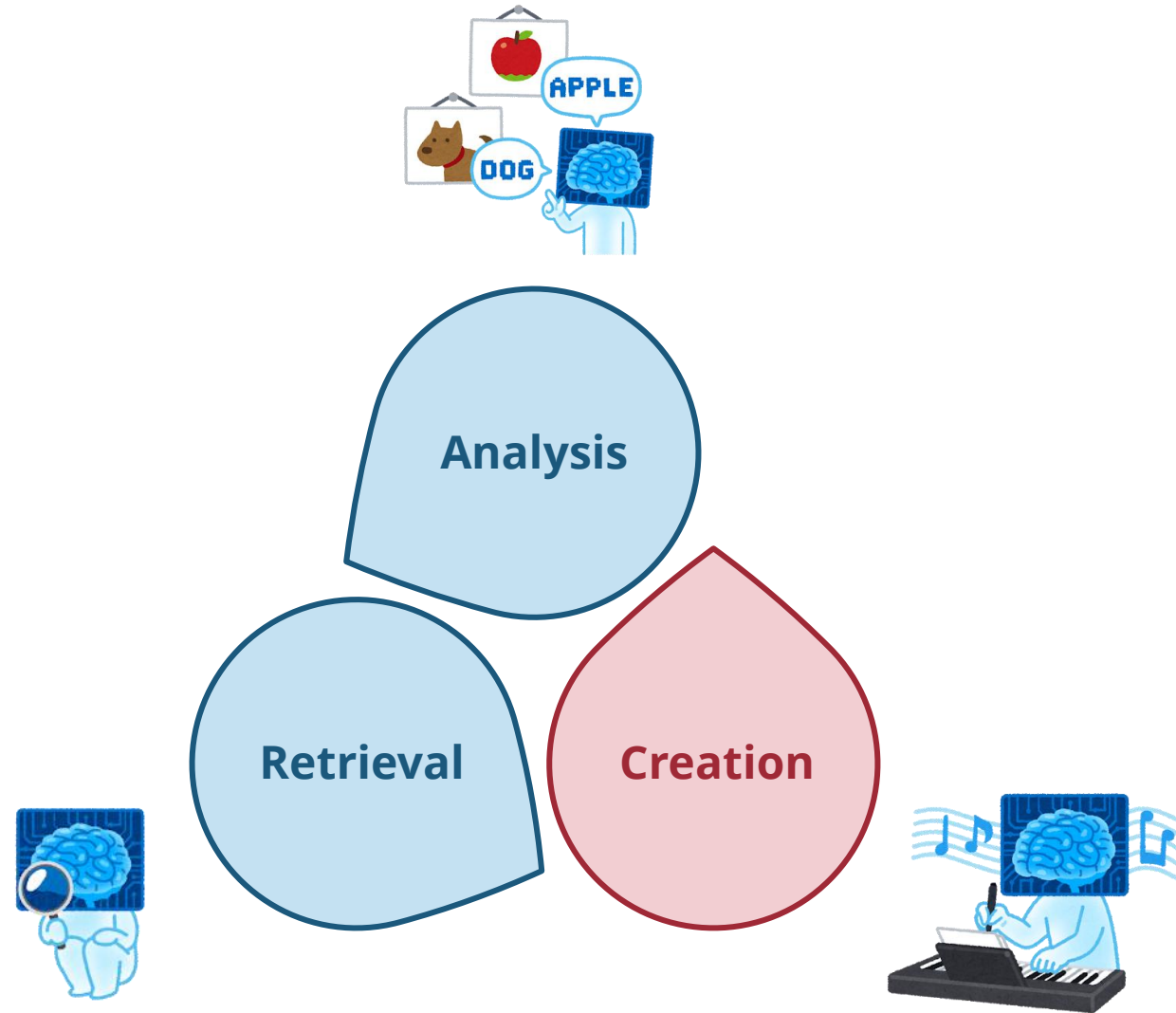


(Source: YouTube)

Spotify's Listening Personality



(Source: Spotify)



Piano Genie (Donahue et al., 2018)

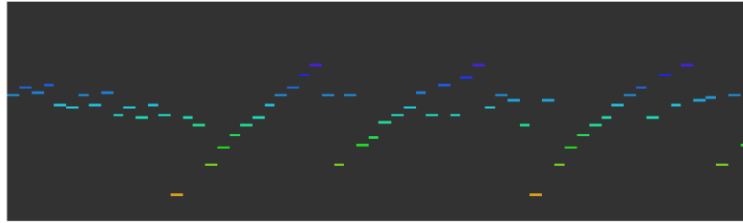


piano-genie.glitch.me/

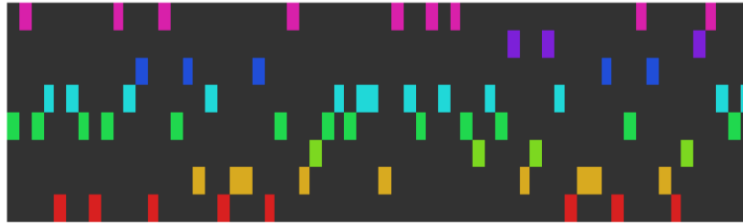
youtu.be/YRb0XAnUpIk & magenta.tensorflow.org/pianogenie

Piano Genie (Donahue et al., 2018)

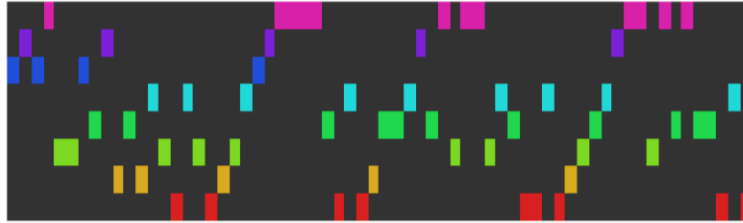
Input melody



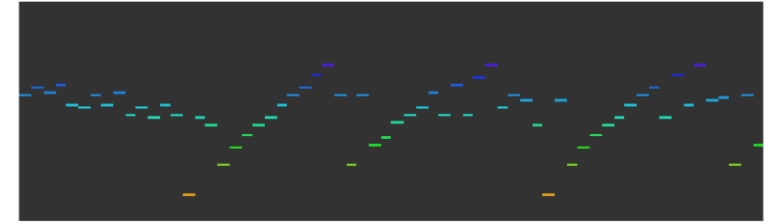
Baseline



Proposed



(Source: Donahue et al., 2019)



| JS Bach Doodle (2019)

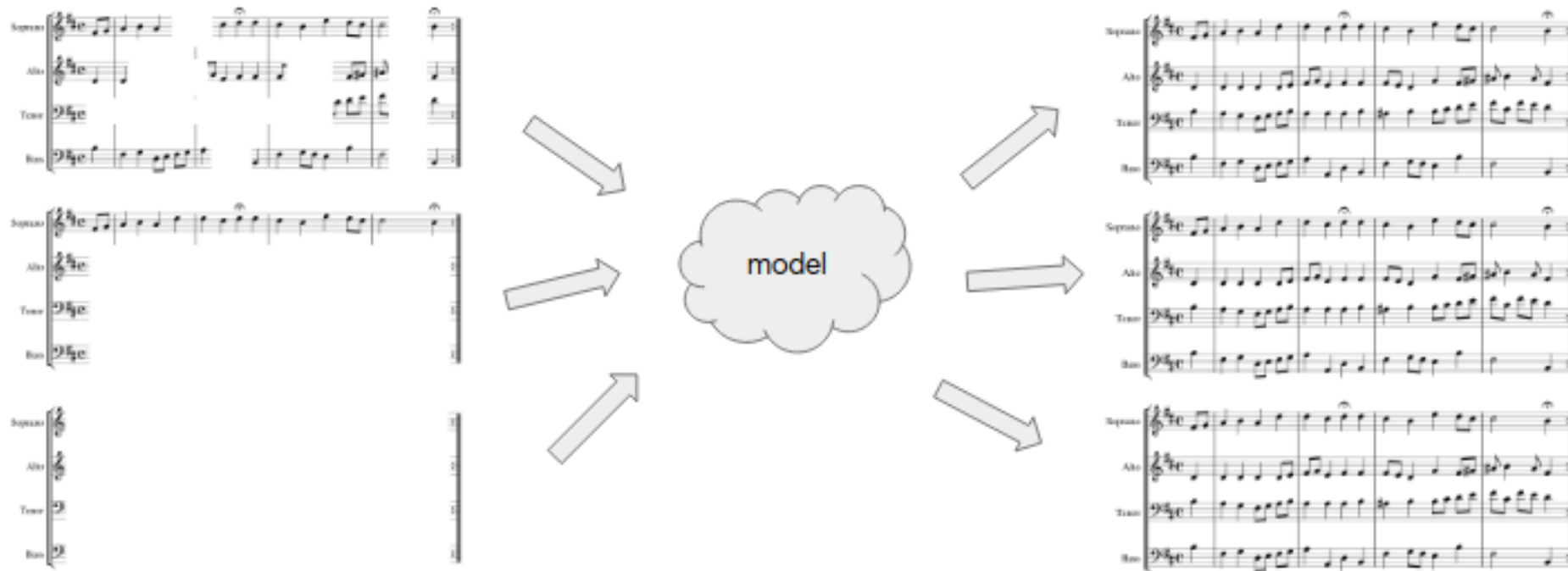


[doodles.google/doodle/
celebrating-johann-
sebastian-bach/](https://doodles.google/doodle/celebrating-johann-sebastian-bach/)

youtu.be/XBfYPp6KF2g & magenta.tensorflow.org/coconet

Coconet (Huang et al., 2017)

- Based on Orderless NADE (Uria et al, 2014)



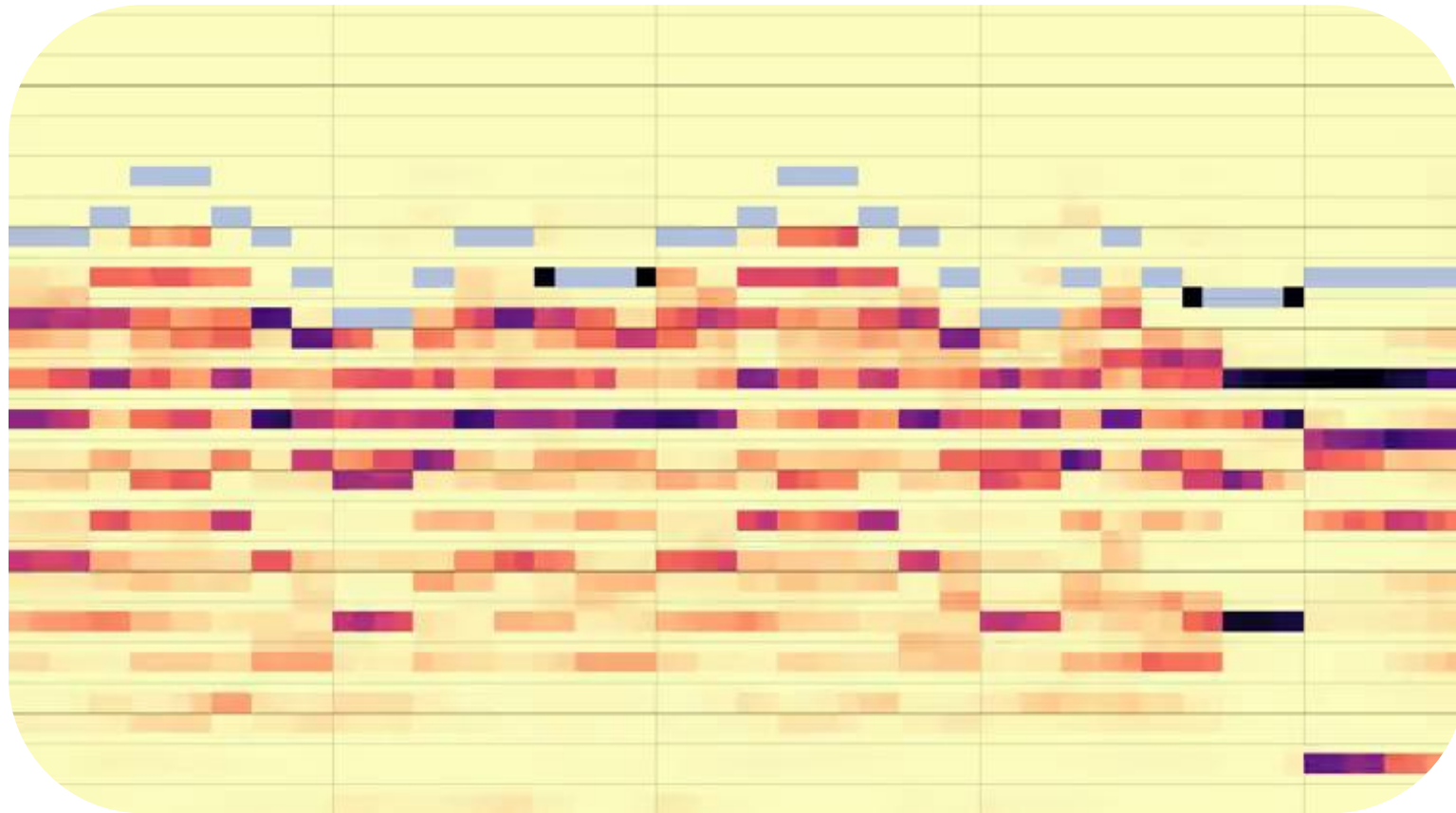
(Source: Huang et al., 2019)

Benigno Uria, Iain Murray, and Hugo Larochelle, "A Deep and Tractable Density Estimator," *ICML*, 2014.

Cheng-Zhi Anna Huang, Tim Cooijmans, Adam Roberts, Aaron Courville, and Douglas Eck, "Counterpoint by Convolution," *ISMIR*, 2017.

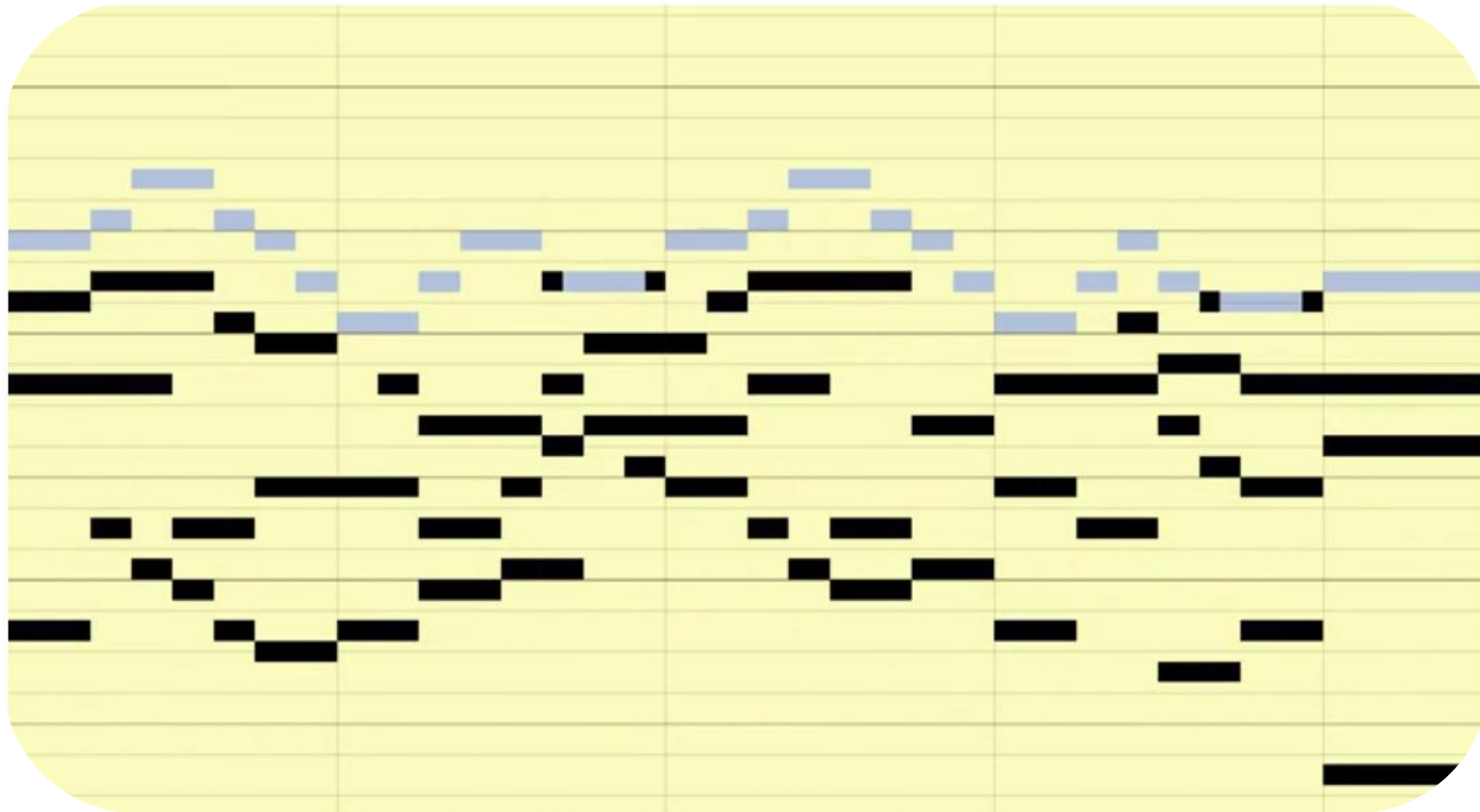
Cheng-Zhi Anna Huang, Tim Cooijmans, Monica Dinulescu, Adam Roberts, and Curtis Hawthorne, "Coconet: the ML model behind today's Bach Doodle," *Magenta Blog*, 2019.

Coconet (Huang et al., 2017)



(Source: Huang et al., 2017)

Coconet (Huang et al., 2017)



(Source: Huang et al., 2017)

unloop (Garcia et al., 2023)



youtu.be/yzBl8Vcjd2s & github.com/hugofloresgarcia/unloop

VampNet (Garcia et al., 2023)



Beat Driven

= predicted
beat mark



Periodic

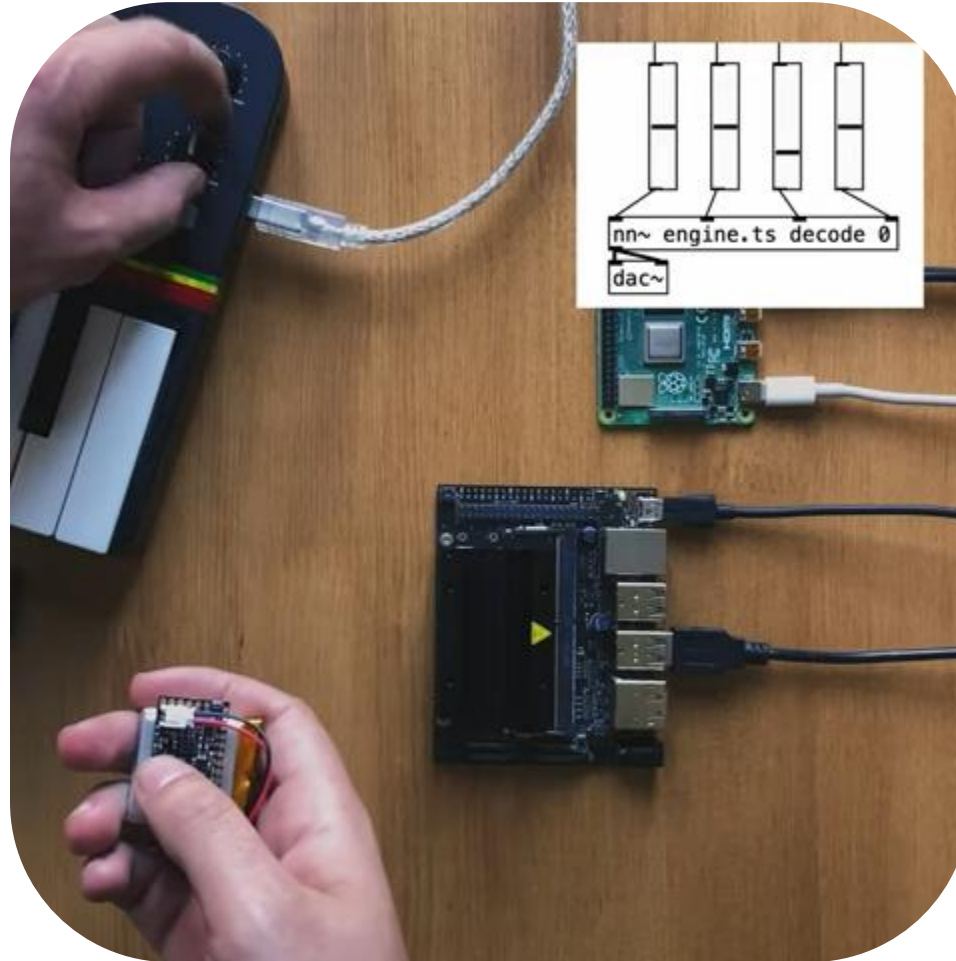


Inpainting



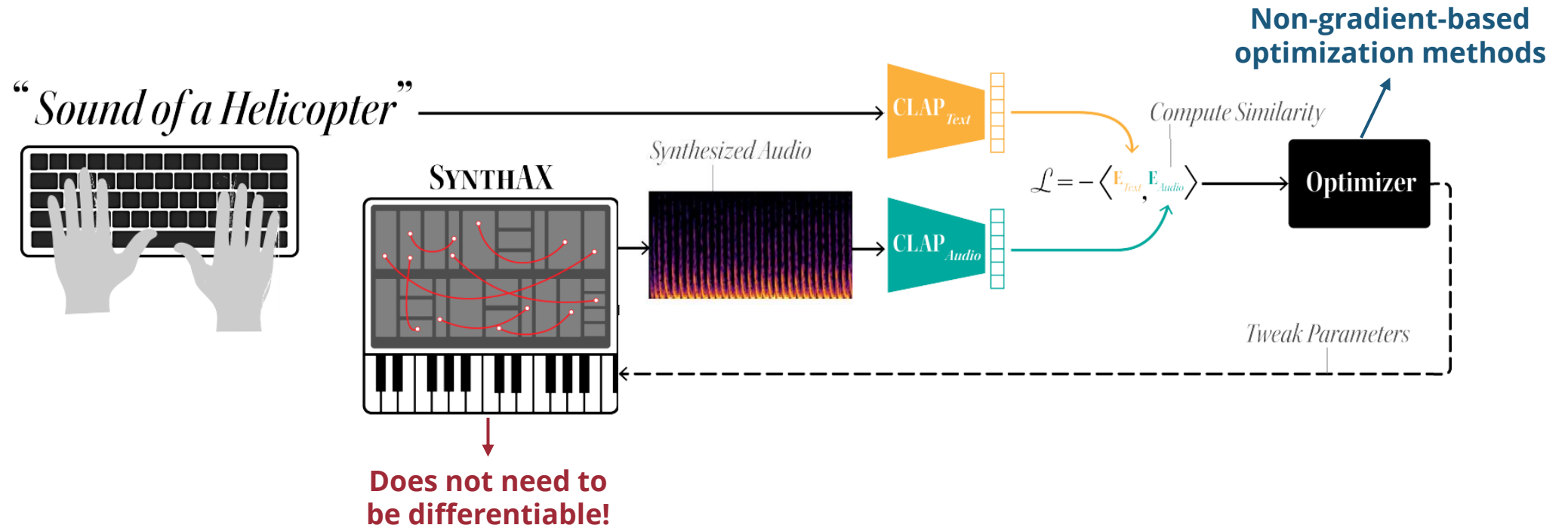
(Source: Garcia et al., 2023)

RAVE: Real-time Audio Synthesis (Caillon & Esling, 2022)



youtu.be/jAlRf4nGgYI

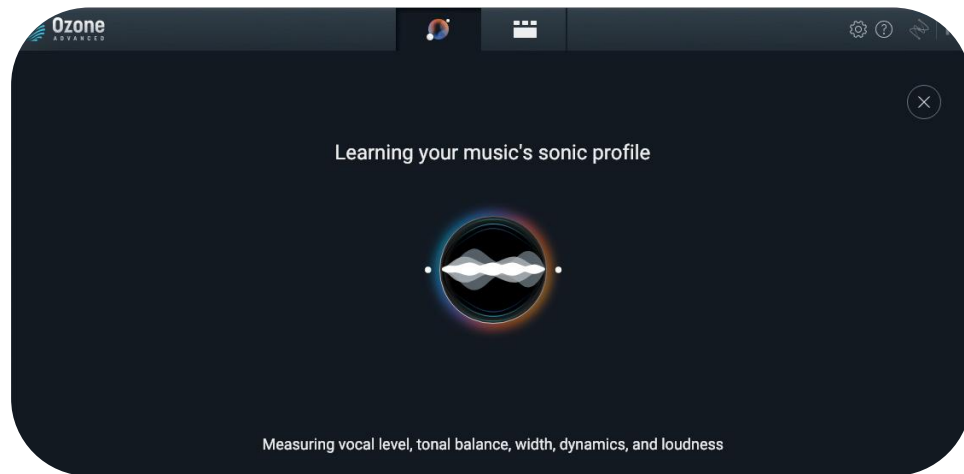
CTAG: Synthesizer Programming (Cherep et al., 2024)



(Source: Cherep et al., 2024)

ctag.media.mit.edu

iZotope Ozone's Master Assistant



(Source: iZotope)



(Source: iZotope)

Moises

Moises

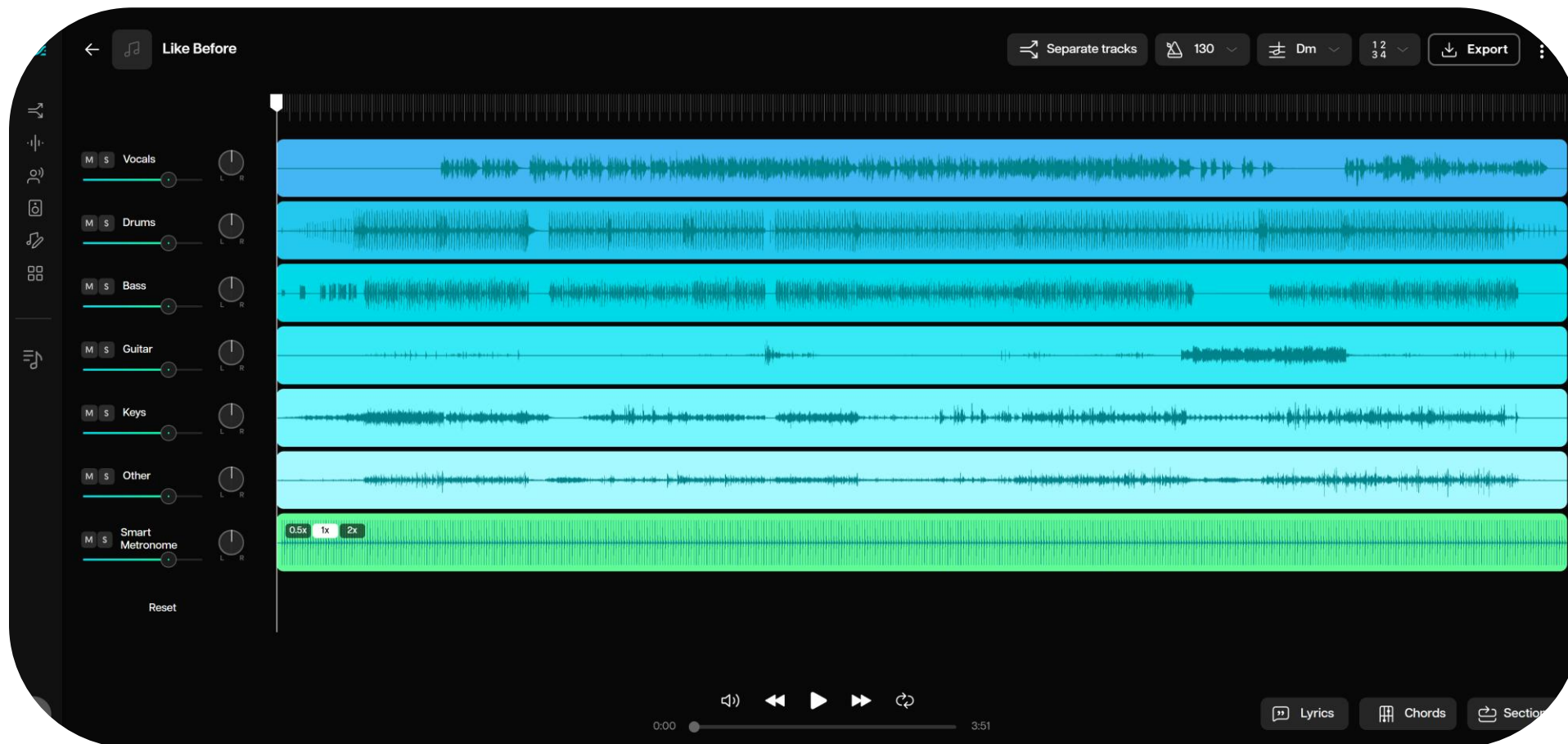
- 🎉 **Free Moises Pro license** until **Summer 2026 (\$180 value)**
- Register [here](#)
 - Use your **U-M email** (@umich.edu)
 - Sign up in your **desktop browser**
 - Ignore the prompt to upgrade your account



Moises Features

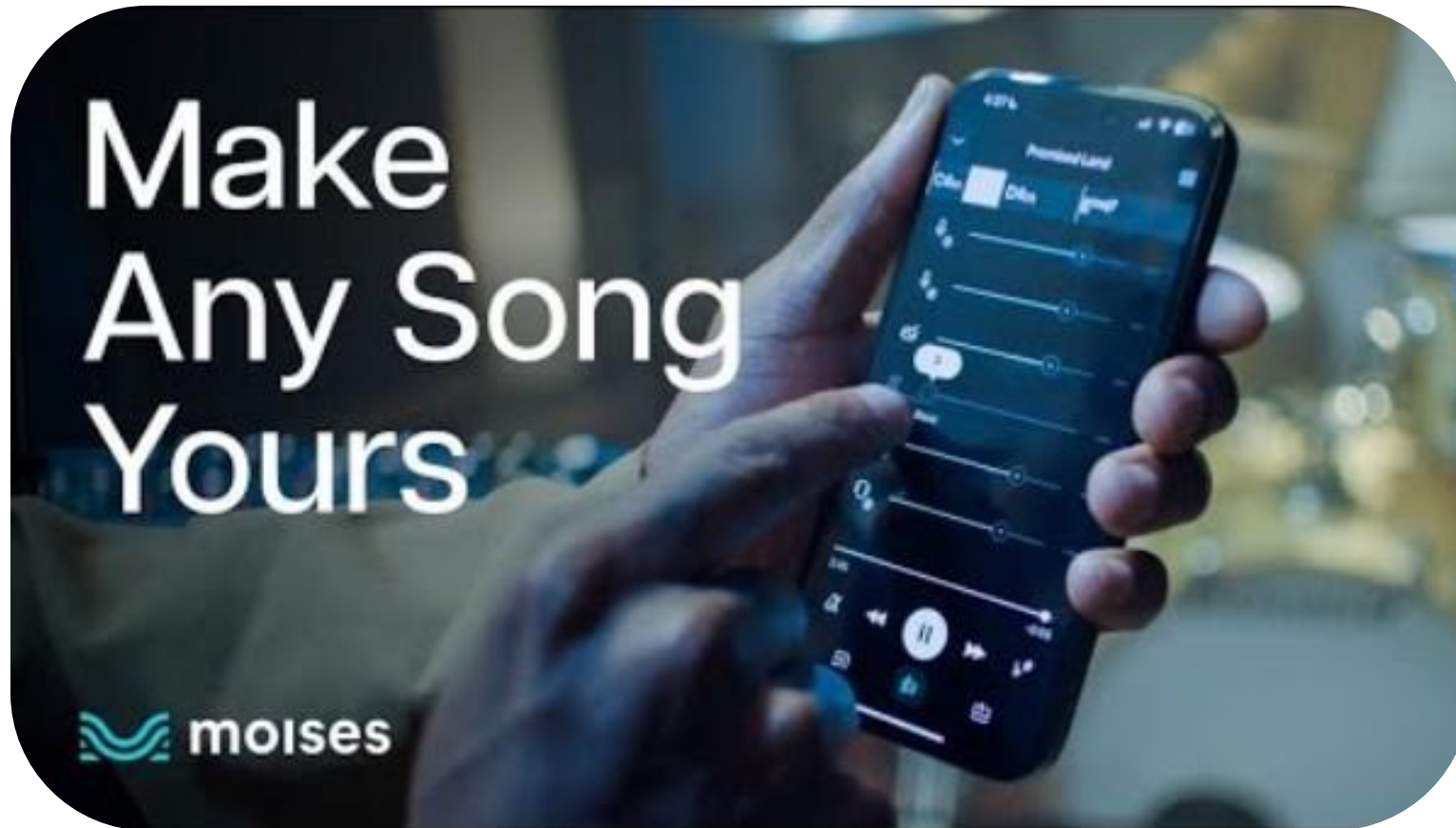
- Stem separation
- Smart metronome & Speed changer
- Pitch changer
- Key & chord detection
- Song section detector
- Voice studio
- Lyric transcription
- AI mastering
- *and more...*

Moises Demo



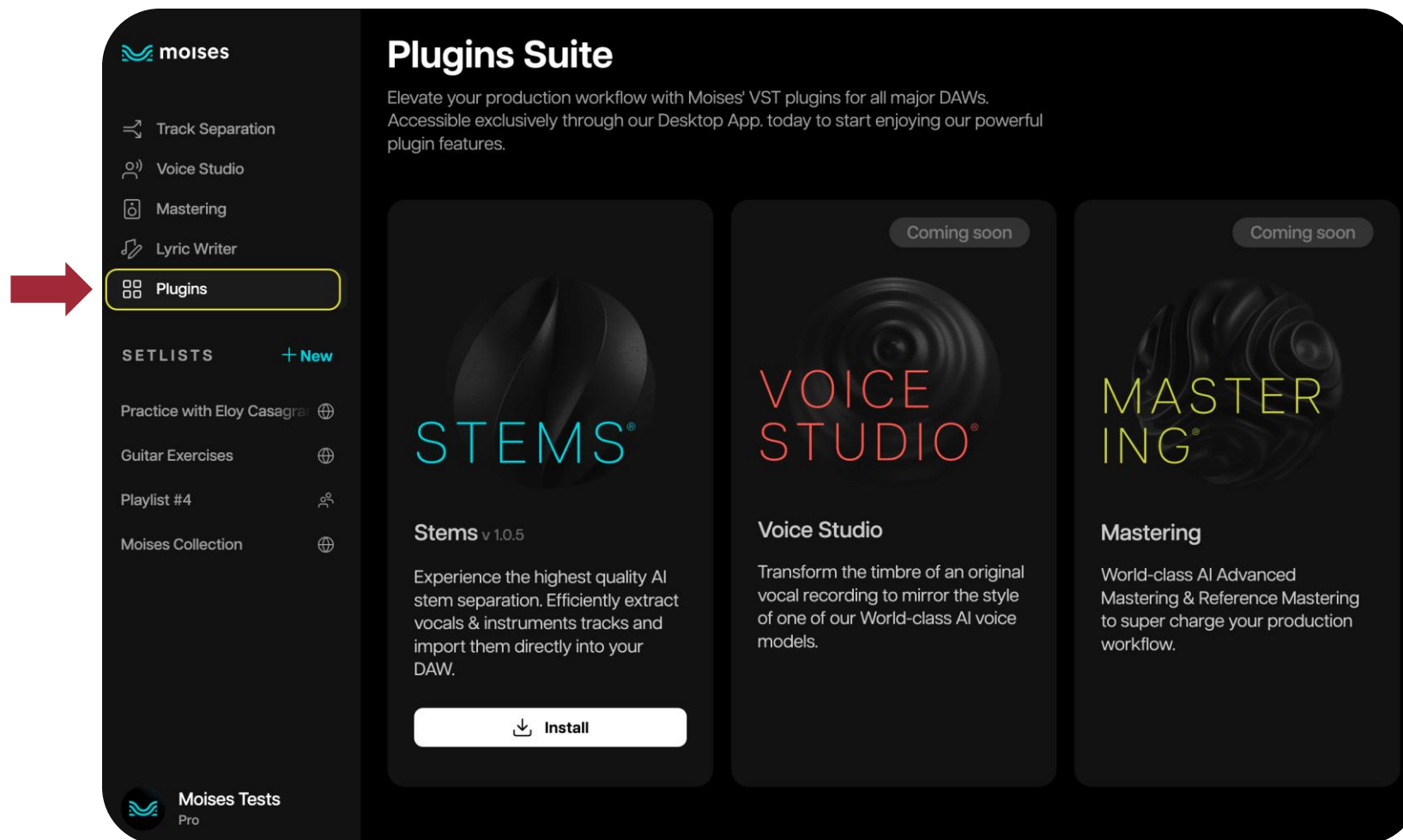
(Source: Moises)

Moises App Demo



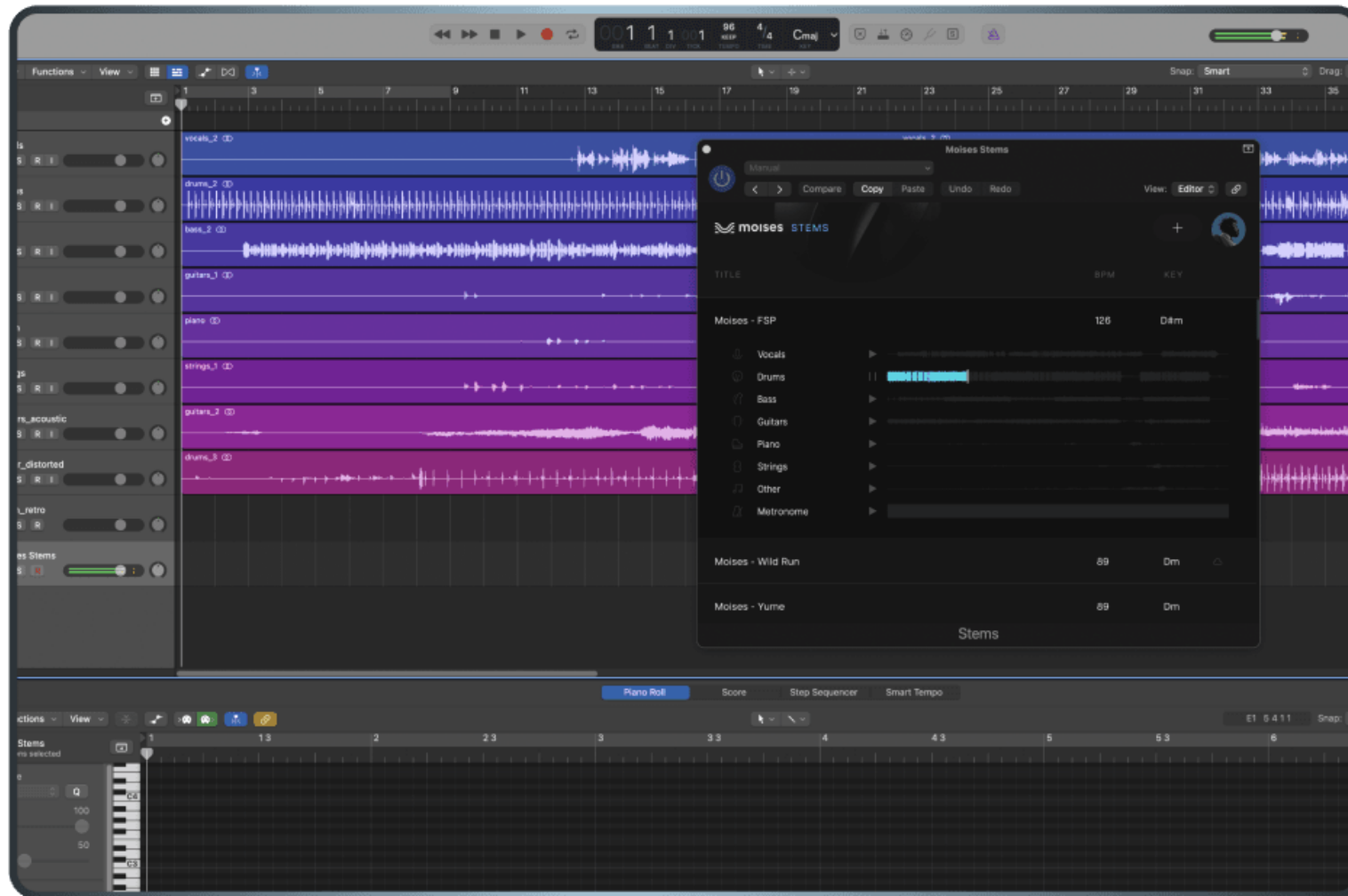
youtu.be/Pyfx95X8d1Q

Moises VST Plugin



(Source: Moises)

Moises VST Plugin



(Source: Moises)

| How to Produce Music with Moises

- Part 1: “This is the way that a lot of tracks start”
- Part 2: Creating backing vocals from scratch
- Part 3: A new way to mix drums

Recap

| The Early Days

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(Source: gbrachetta)

gbrachetta.github.io/Musical-Dice/

ILLIAC Suite (1957)



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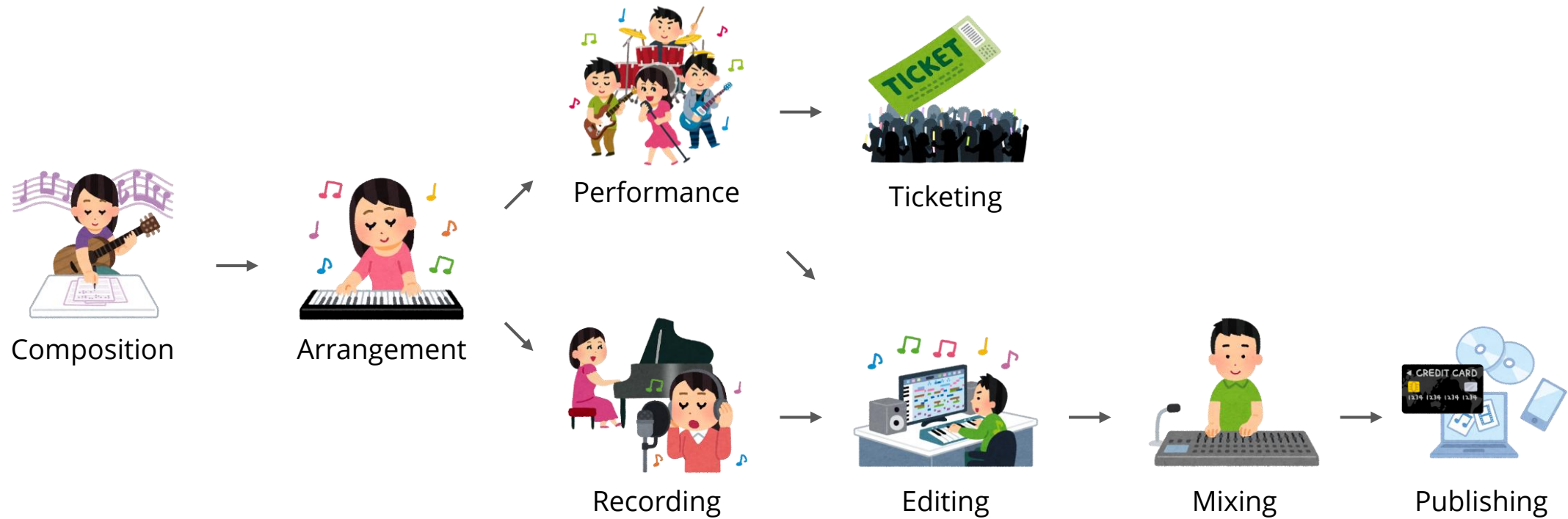
Emily Howell (2003)



(Source: The Guardian)

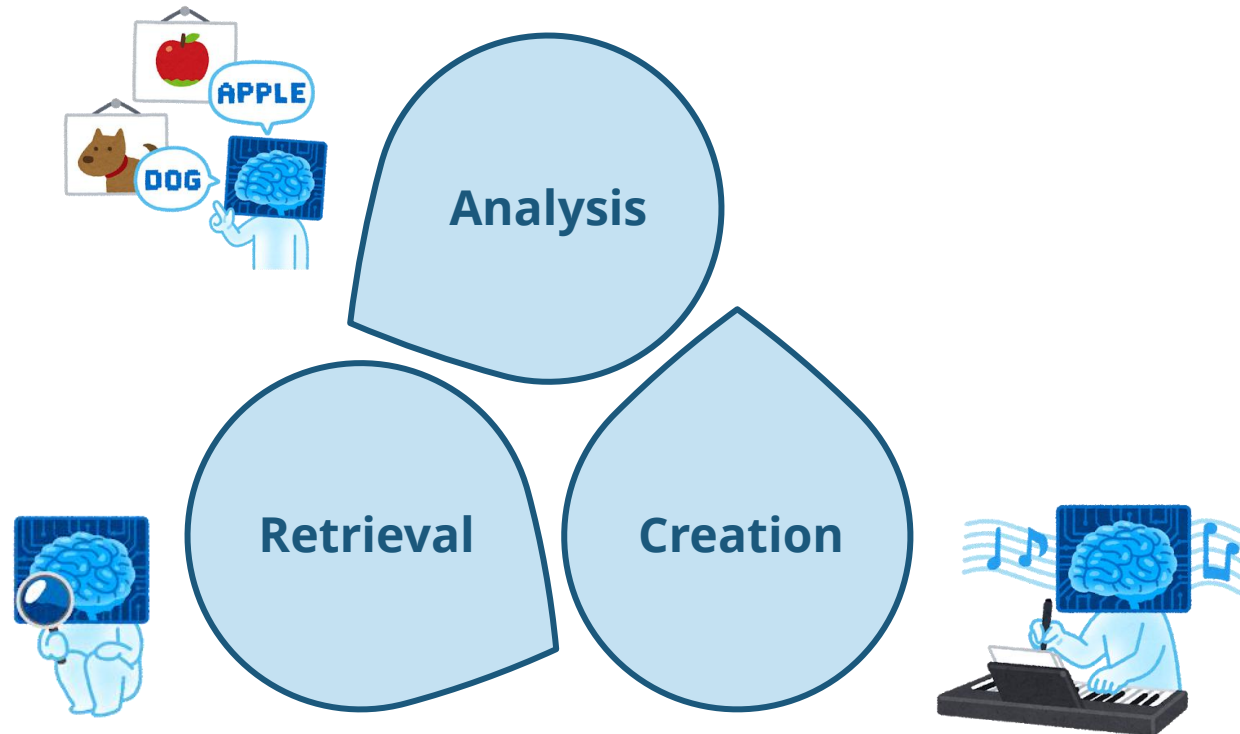
gbrachetta.github.io/Musical-Dice/
distributedmuseum.illinois.edu/exhibit/illiac-suite/
theguardian.com/technology/2010/jul/11/david-cope-computer-composer

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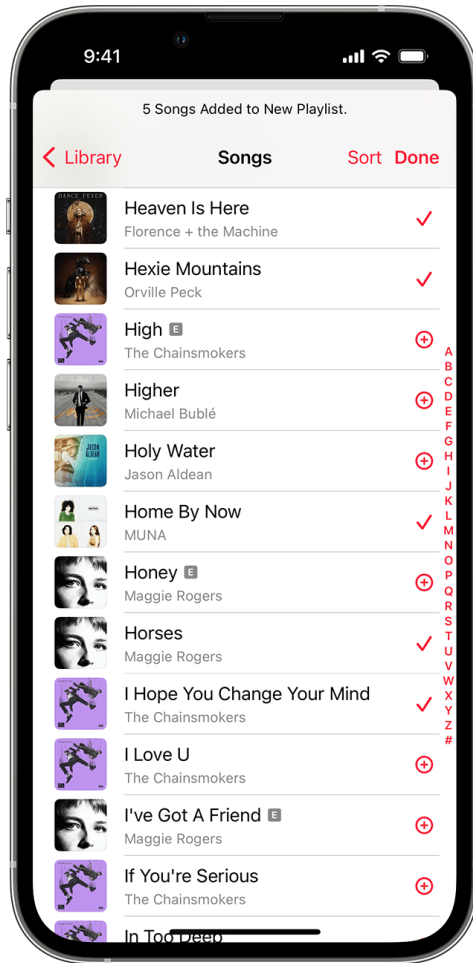


Use Cases of AI for Music & Audio

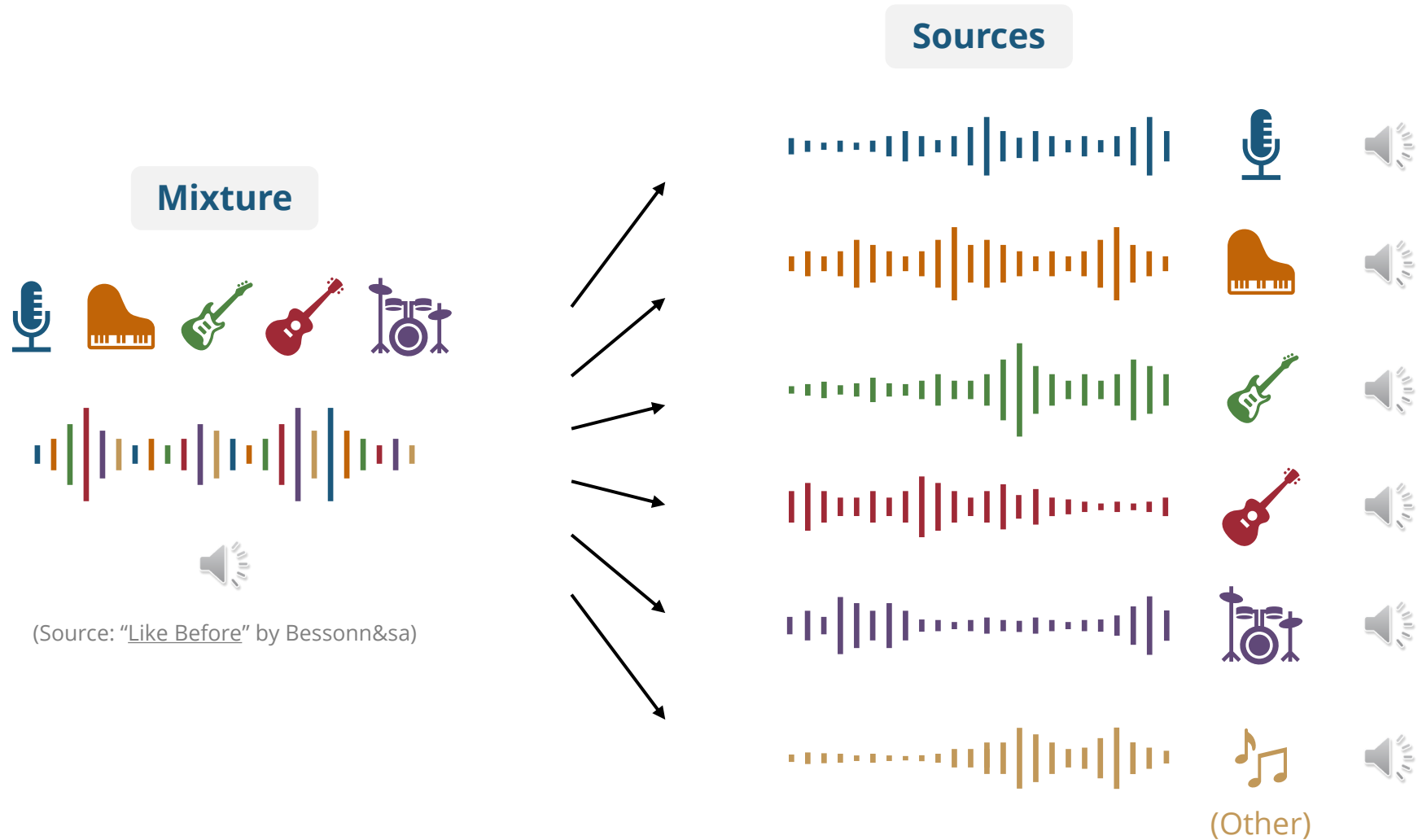


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[uploadvr.com/iron-man-vr-breaks-free-from-cords-load-screens-on-quest-2/](#)
[descript.com/blog/article/what-is-the-best-audio-interface-for-recording-a-podcast](#)
[denverpost.com/2019/08/02/colorado-symphony-movie-scores-harry-potter-star-wars/](#)
[dailybruin.com/2023/04/theater-review-the-musical-les-misrables-offers-stellar-displays-and-impassioned-vocals](#)

Music Classification for Playlist Generation



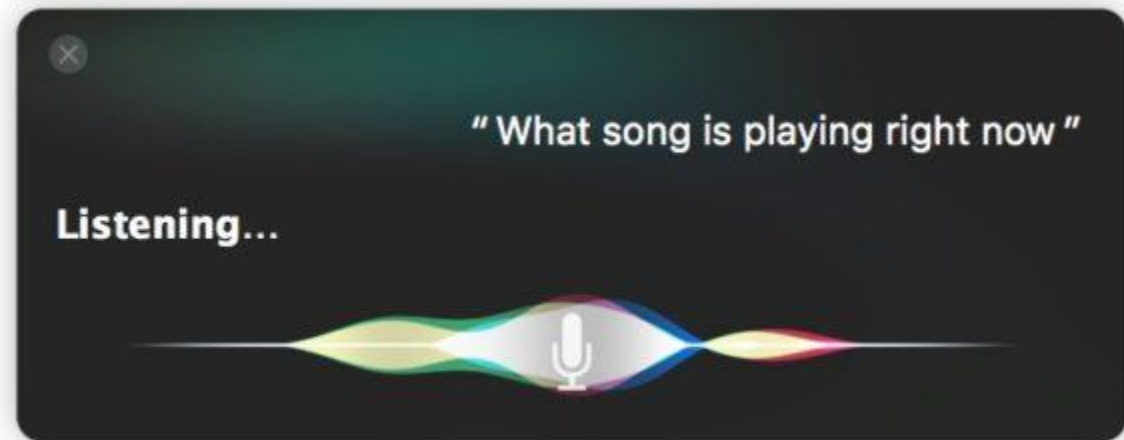
Source Separation



Shazam & Siri



(Source: Shazam User Guide)



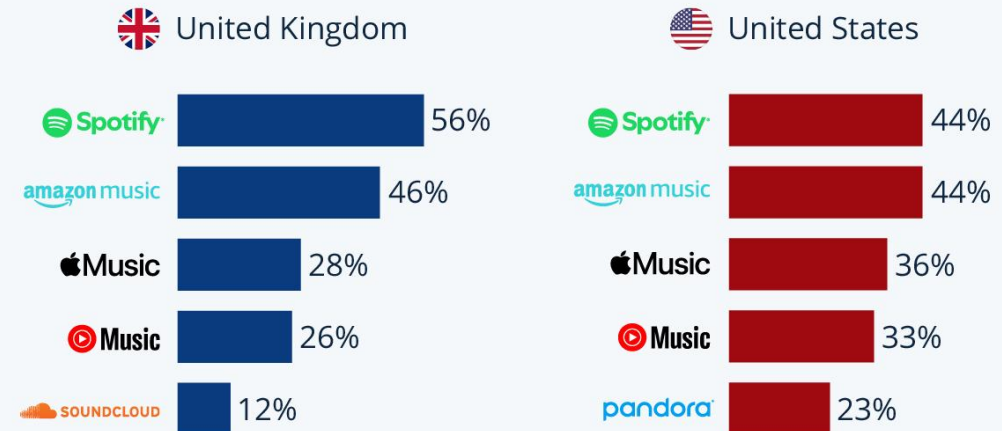
(Source: OSXDaily)

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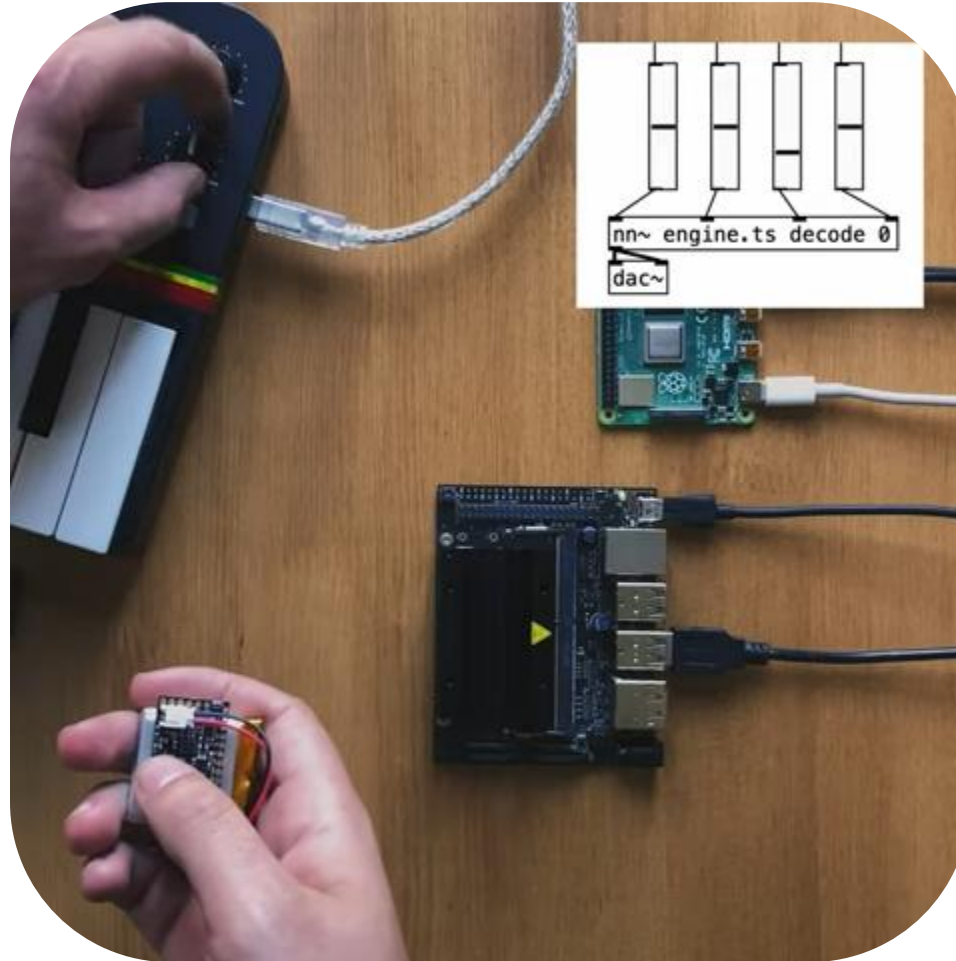
Piano Genie (Donahue et al., 2018)



piano-genie.glitch.me/

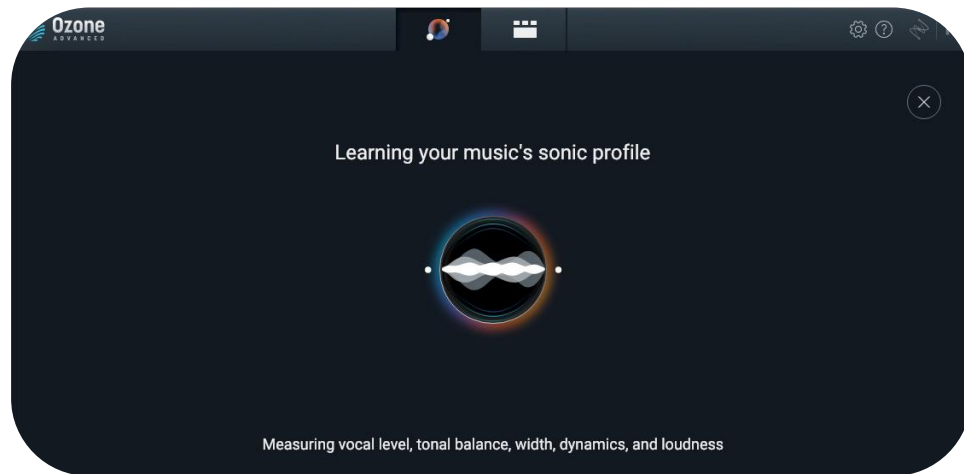
youtu.be/YRb0XAnUpIk & magenta.tensorflow.org/pianogenie

RAVE: Real-time Audio Synthesis (Caillon & Esling, 2022)



youtu.be/jAlRf4nGgYI

iZotope Ozone's Master Assistant



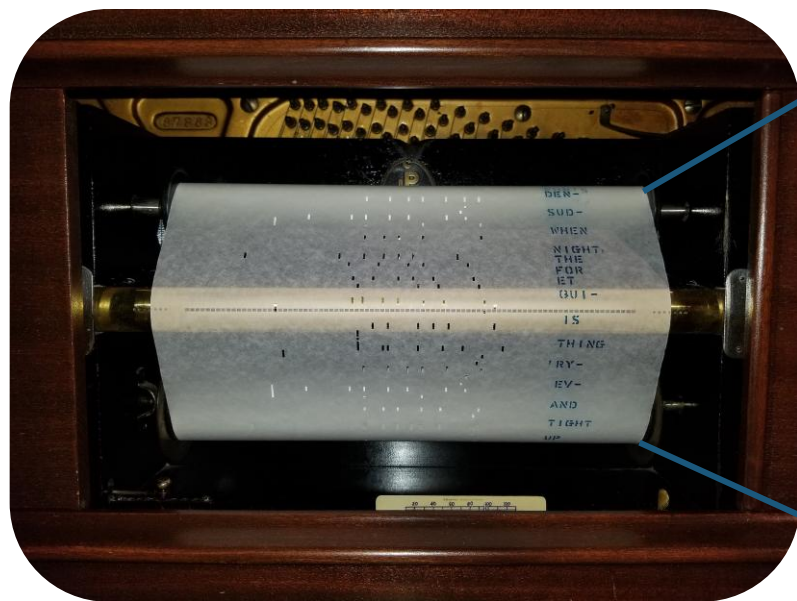
(Source: iZotope)



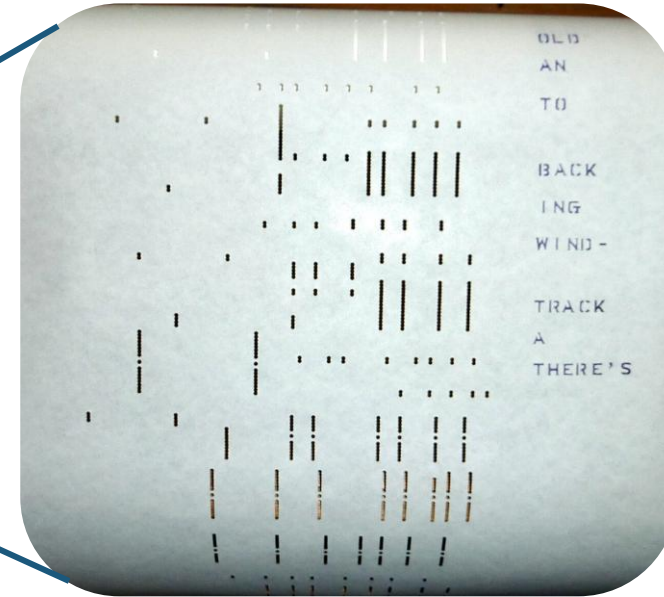
(Source: iZotope)

Next Lecture

Music Processing Fundamentals



(Source: Draconichiaro via [Wikimedia Commons](#))



(Source: Tangerineduel via [Wikimedia Commons](#))