

MUSIC VISUALIZATION

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“Without music, life would be a mistake”

–Friedrich Nietzsche

What do we mean by music viz?

Music related data viz

any data related to music

Sound visualization

pure audio visualization

Data sonification

similar to data viz but for ears



I'll Be Missing You—Puff Daddy And Faith Evans

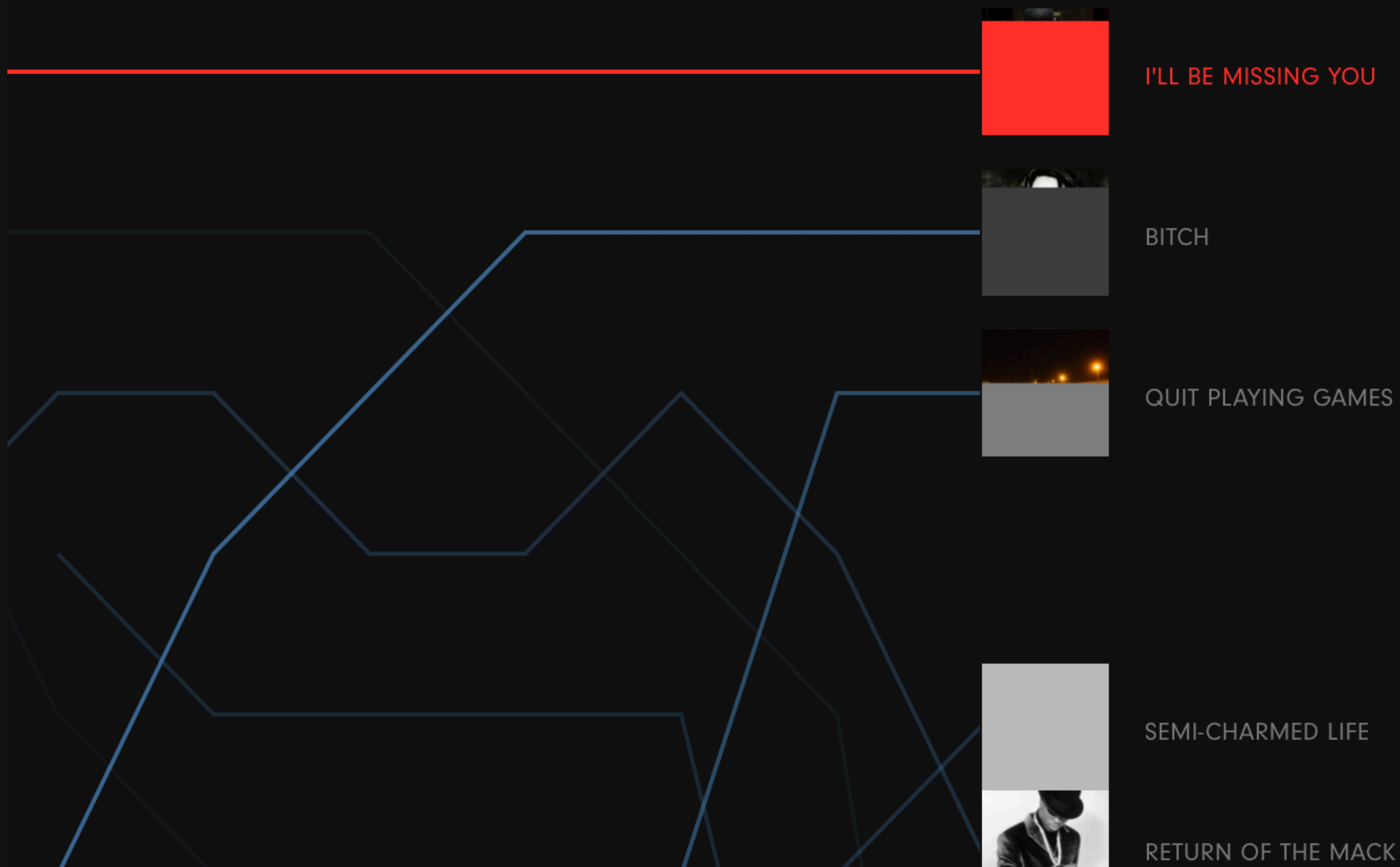
#1 ON AUGUST 01, '97

PAUSE / PLAY

Find an artist...

WEEKS AT #1 (TOP 10)

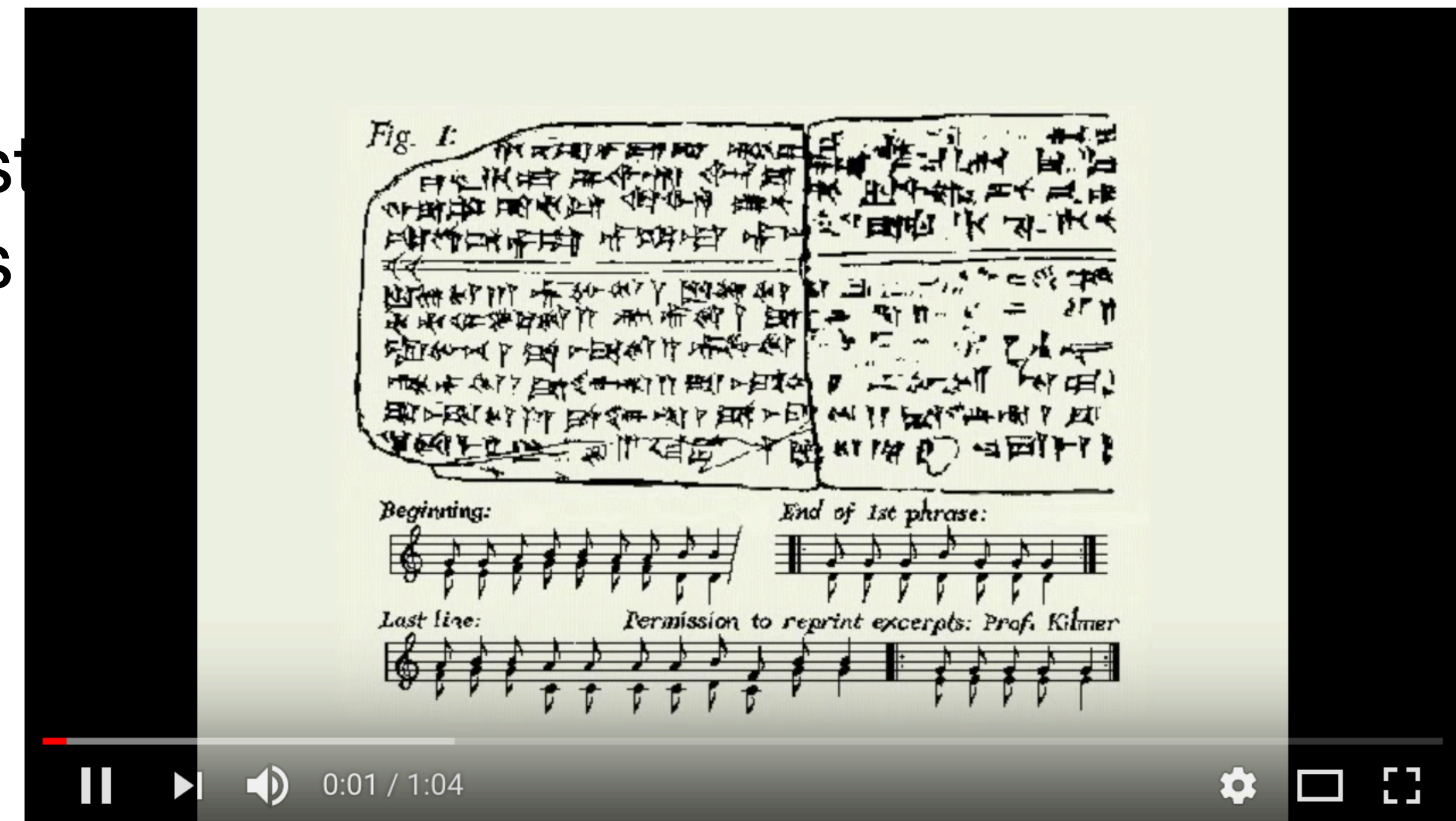
Puff Daddy and Faith Evans:
Hanson:



A bit of history

Music is found in every known culture, past and present, varying widely between times and places.

The "oldest known song" was written in cuneiform, dating to 3400 years ago from Ugarit



[Wikipedia]

Music transcription



Digitizing music

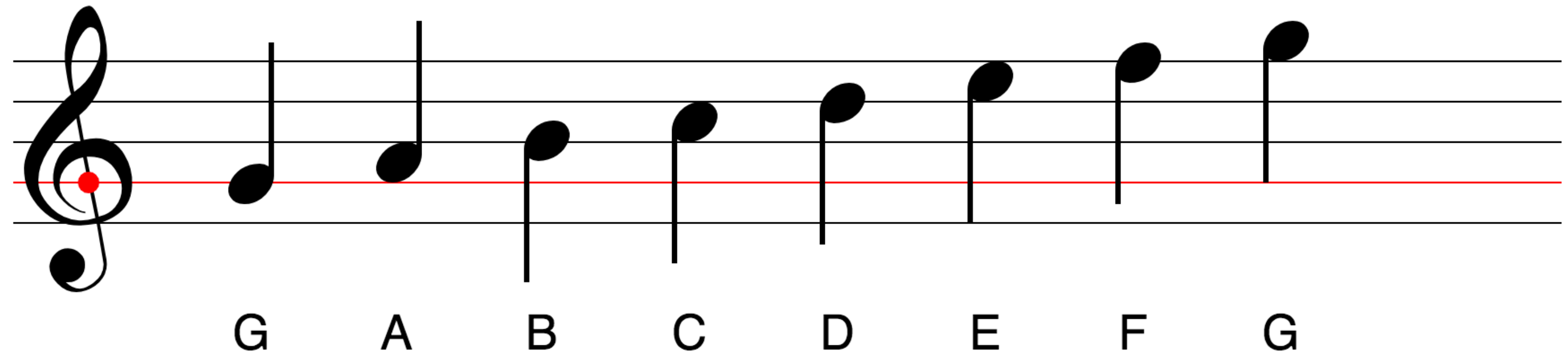
Process of converting information into computer-readable format

Representation of an object, image, sound, document or signal (usually an analog signal) by generating a series of numbers that describe a discrete set of its points or samples.

Involves: **Discretization**, **Quantization**, (optional) **Compression**

Music theory?

- Notes
- Scale
- Chords
- Tempo



THEORYTABS START C



Timbre, pitch, chroma

Timbre: the character or quality of a musical sound or voice as distinct from its pitch and intensity.

Pitch: perceptual property of sounds that allows their ordering on a frequency-related scale, consists of **tone height** and **chroma**

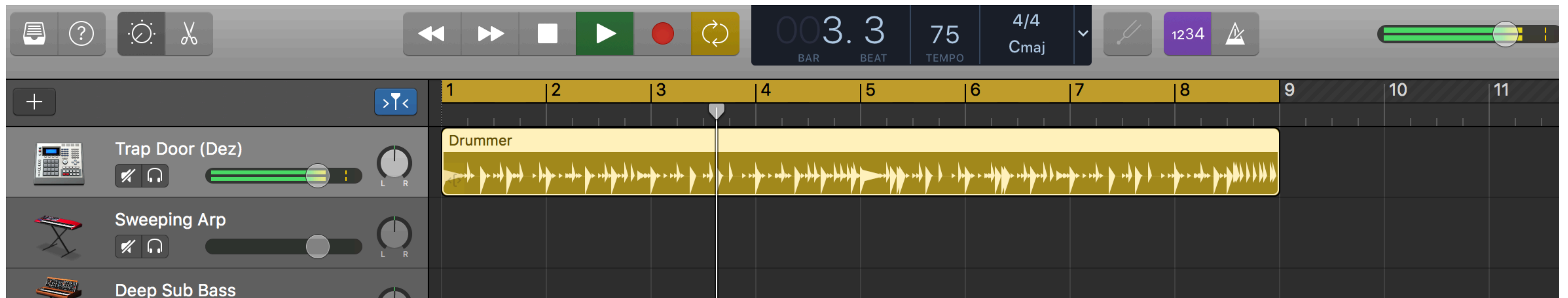
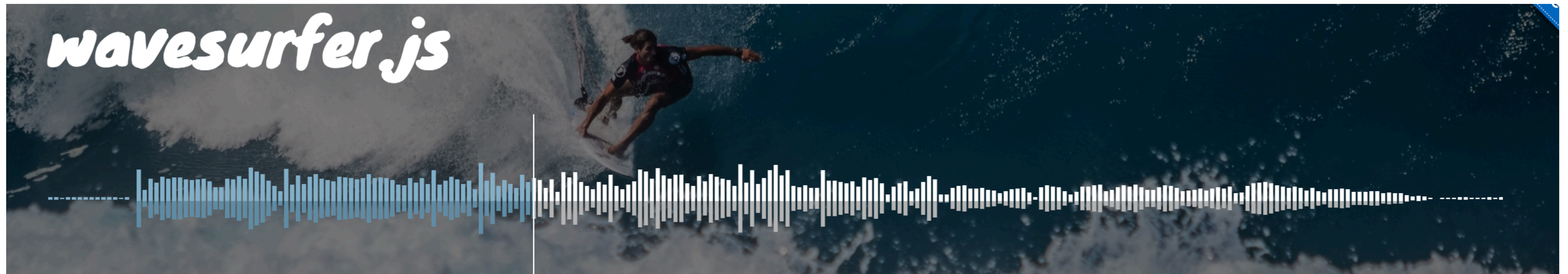
Chroma: {C, C#, D, D#, E, F, F#, G, G#, A, A#, B}

Scientific pitch notation, the pitch class corresponding to the chroma C is the set {..., C−2, C−1, C0, C1, C2, C3 ...} consisting of all pitches separated by an integer number of octaves.

[Wikipedia]

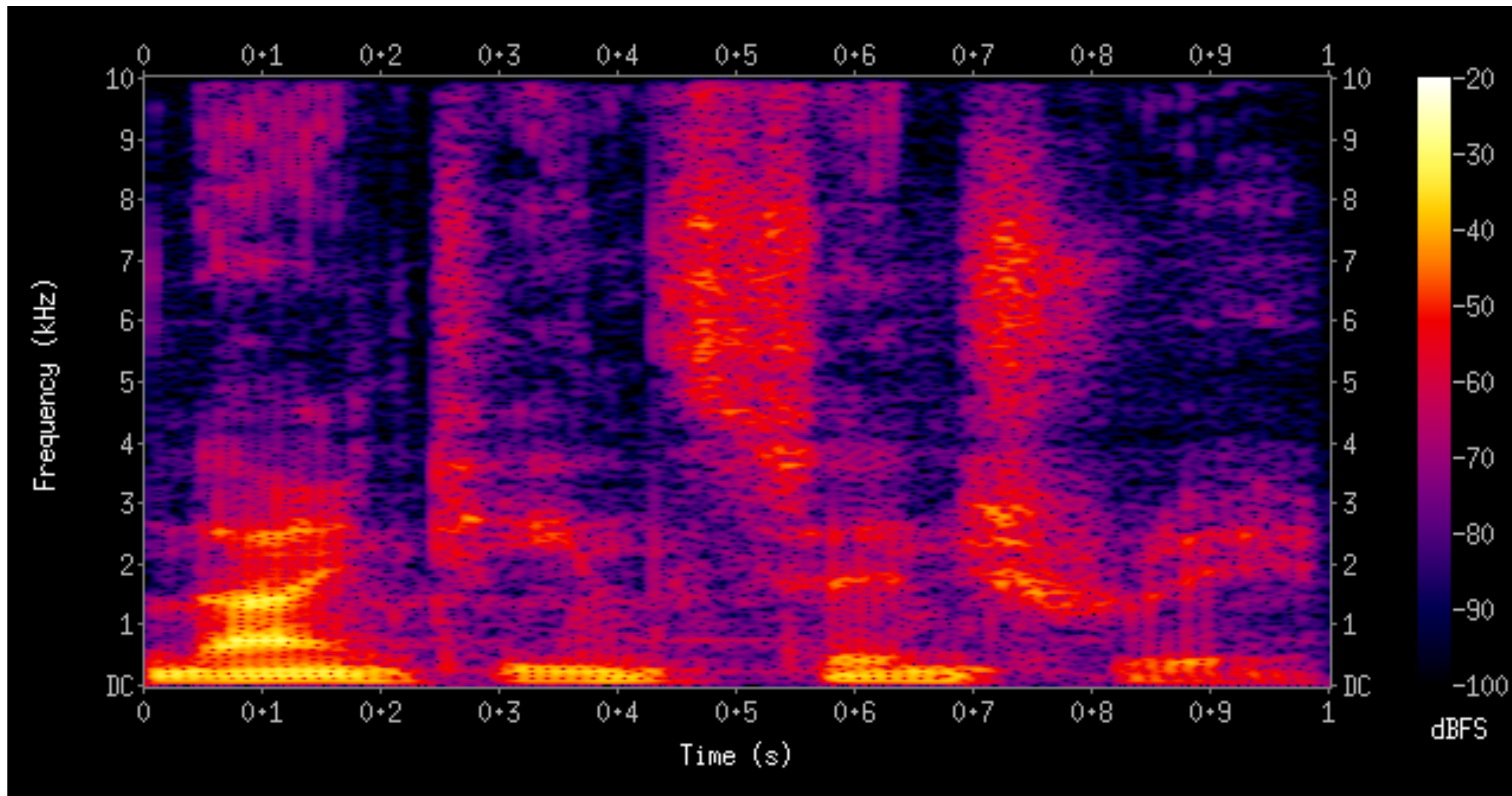
Waveform viz

Waveforms: perceived loudness (sound pressure) over time



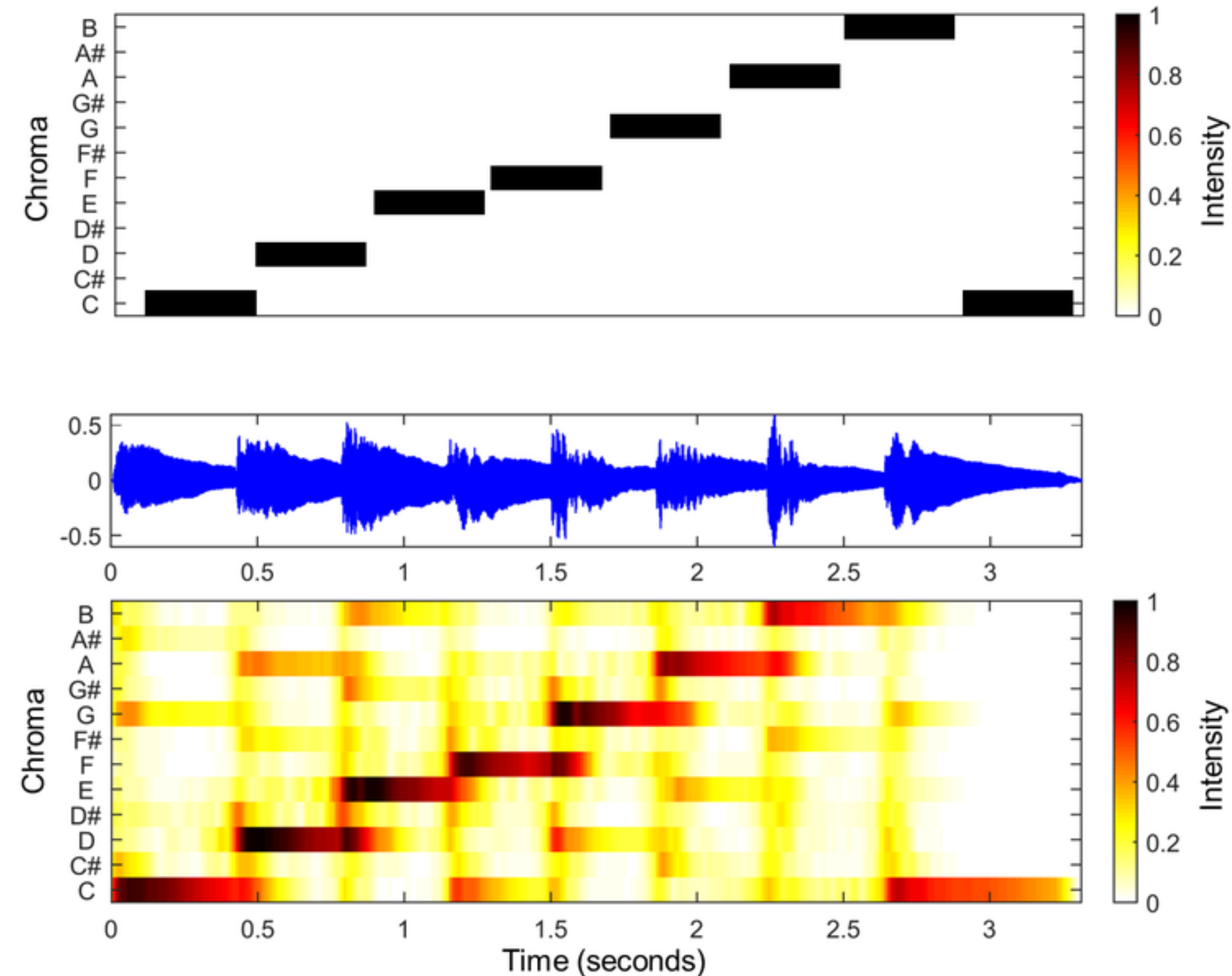
Spectrogram

Visual representation of the spectrum of frequencies of sound as they vary with time.



Chromagram

Projected the entire music spectrum onto 12 bins representing the 12 distinct semitones (or chroma) of the musical octave



MIDI

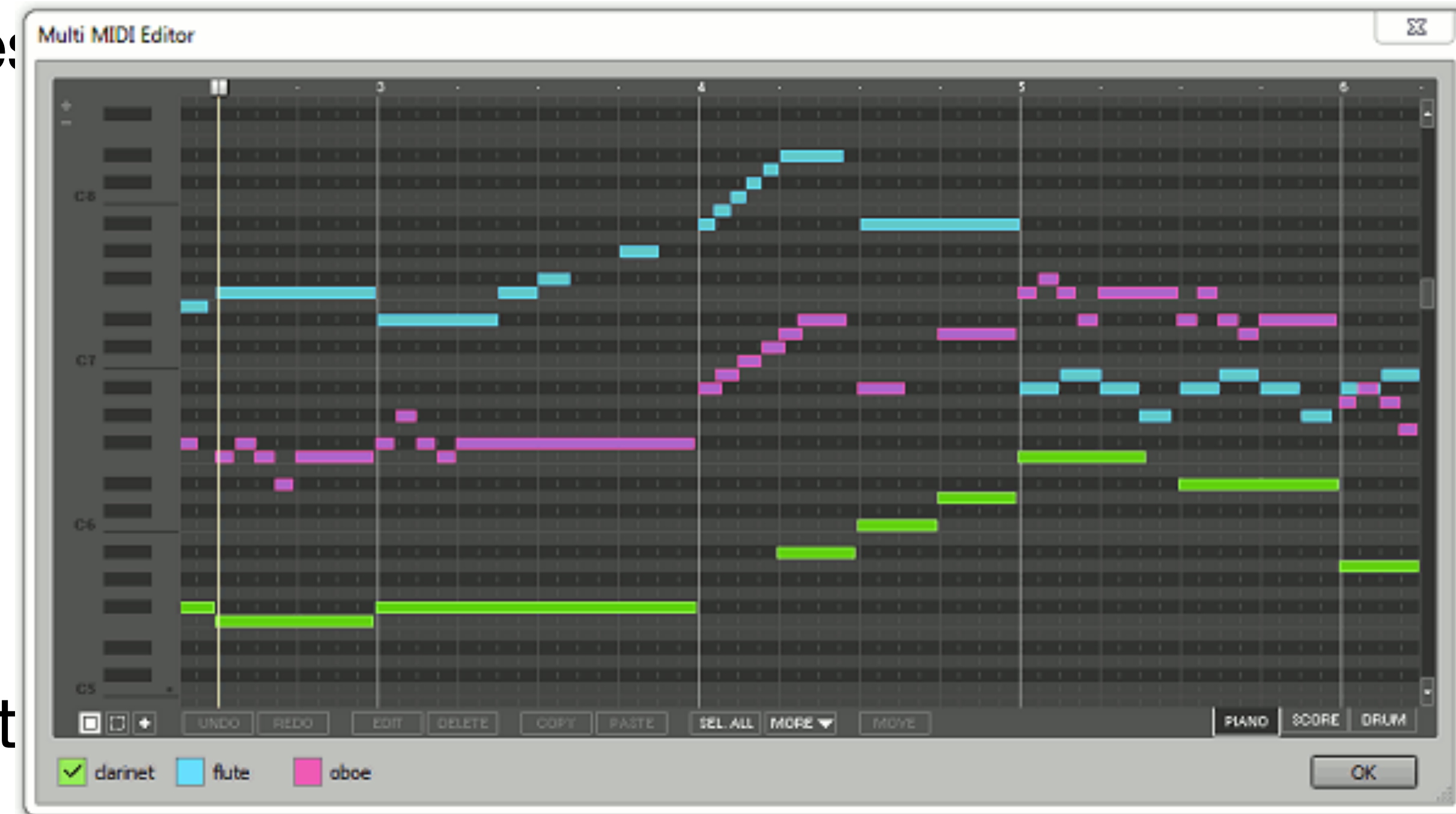
MIDI, (Musical Instrument Digital Interface):
communications protocol between audio devices;
also digital interface and electrical connectors

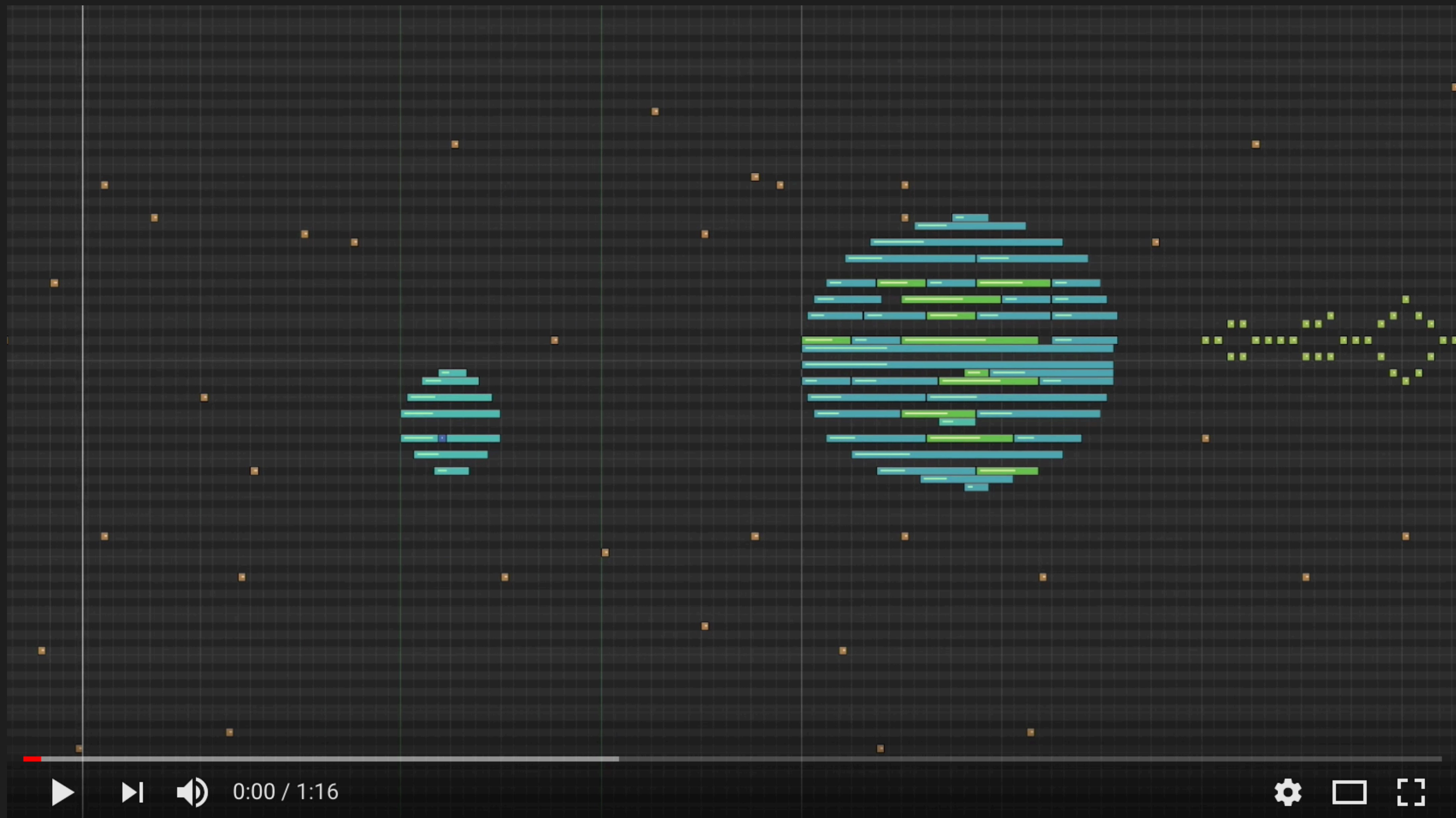
MIDI data structure contains:

notation, pitch and velocity (loudness or softness)

volume, vibrato, audio panning from left to right

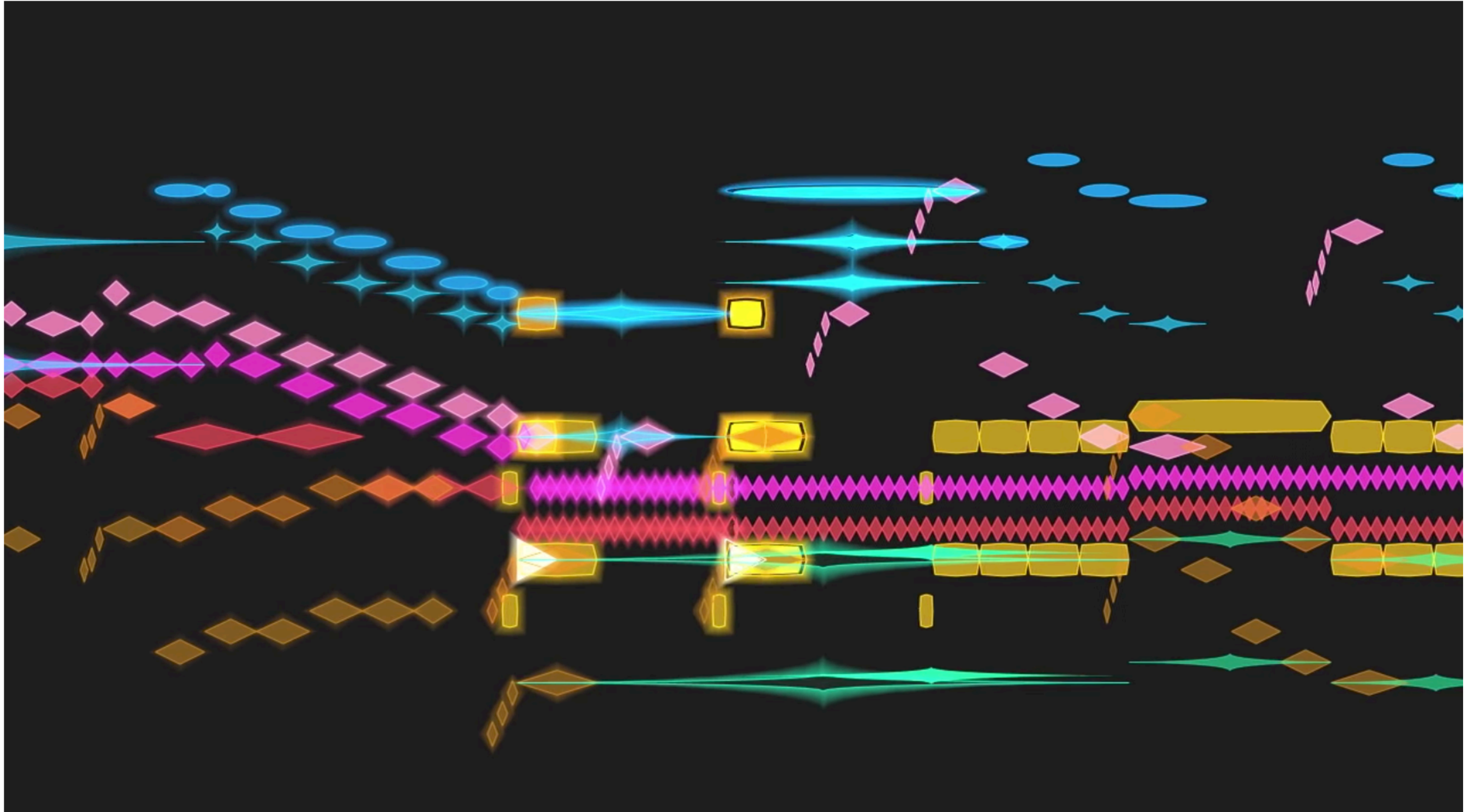
clock signals that set and synchronize tempo
between multiple devices.





Sound visualization

Musicanim

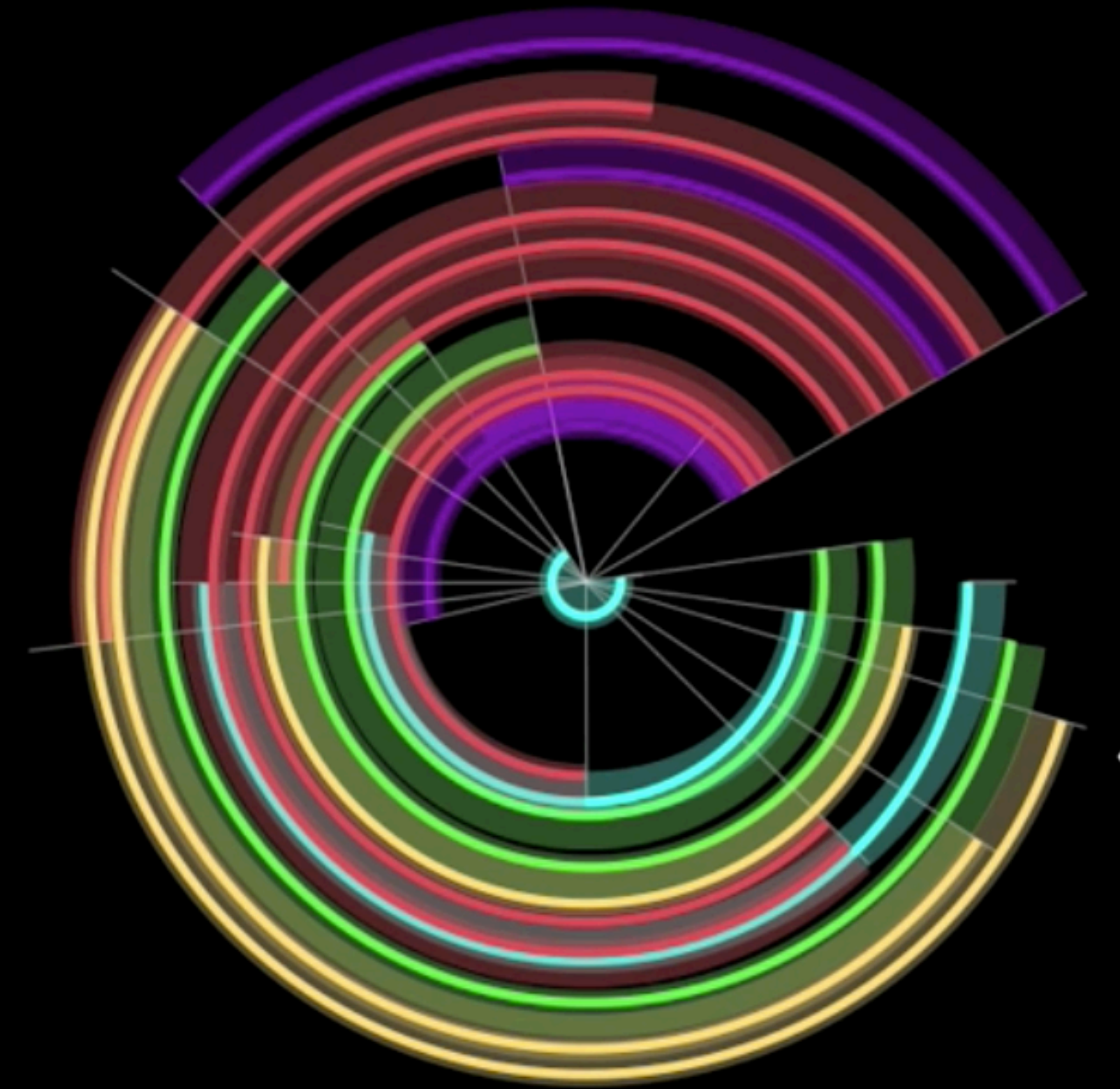
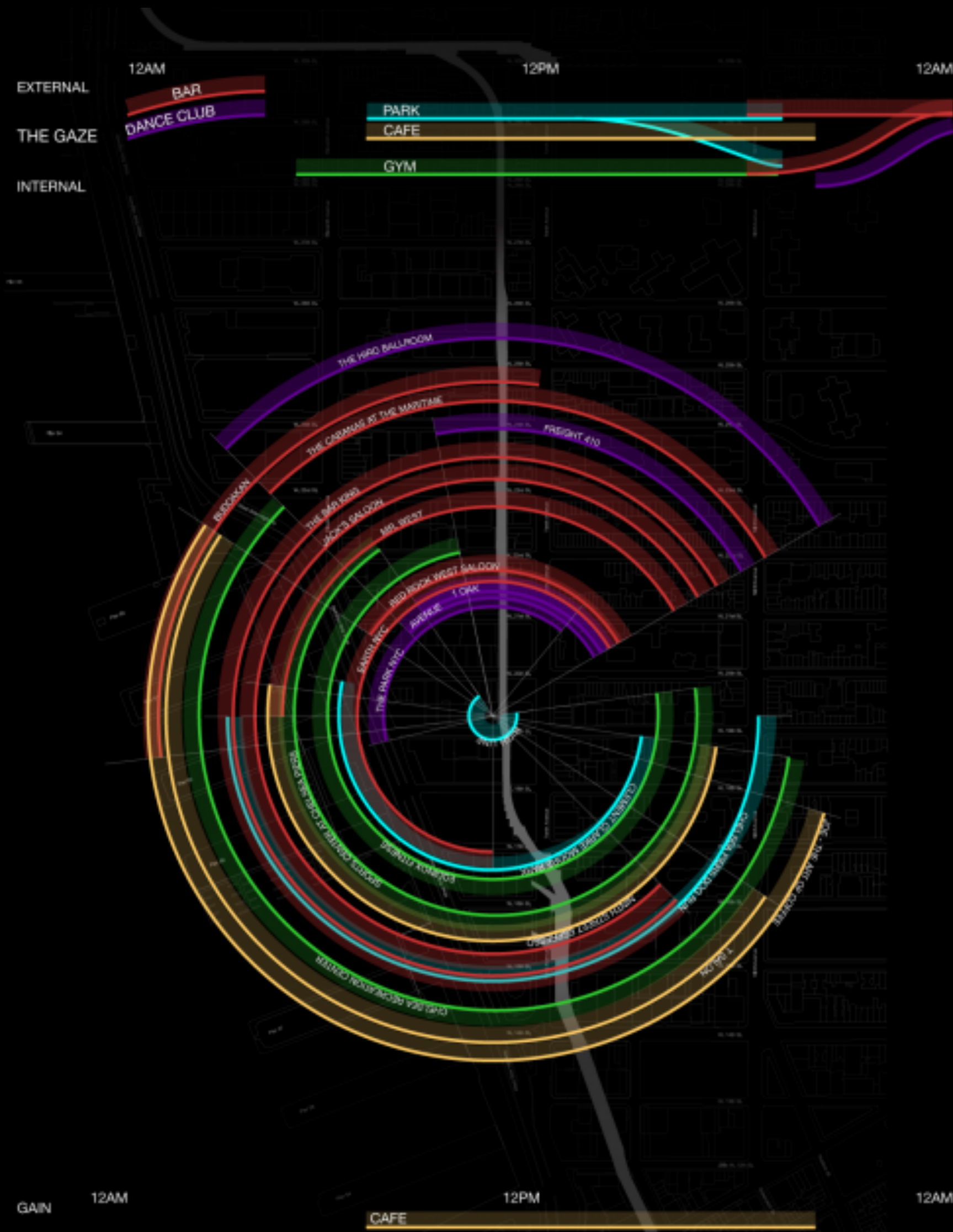


Guitar Hero



RAINING **B**LOOD 🌧️💉 ~ 200% SPEED ~ 100% FC

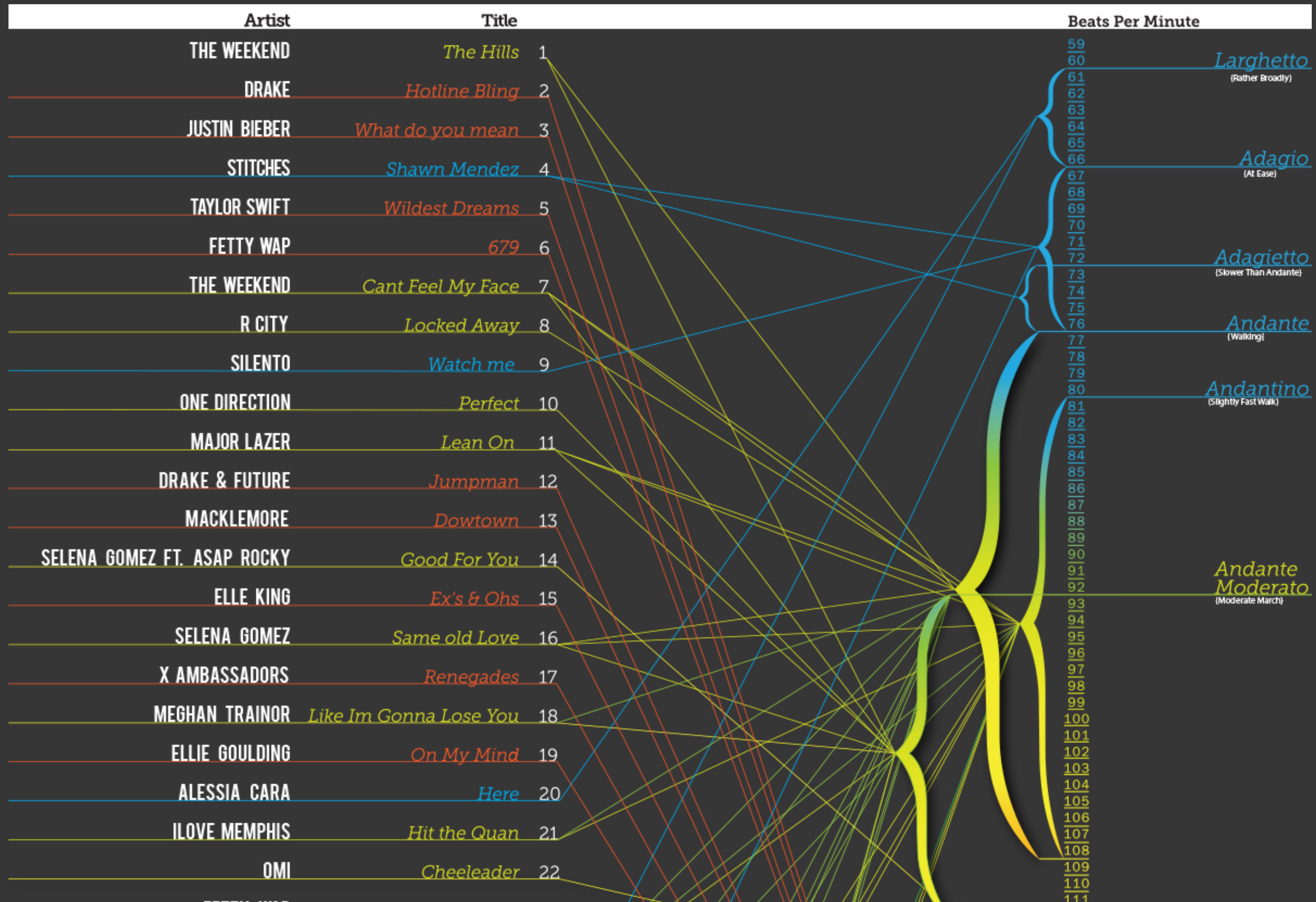
New-York city mapping



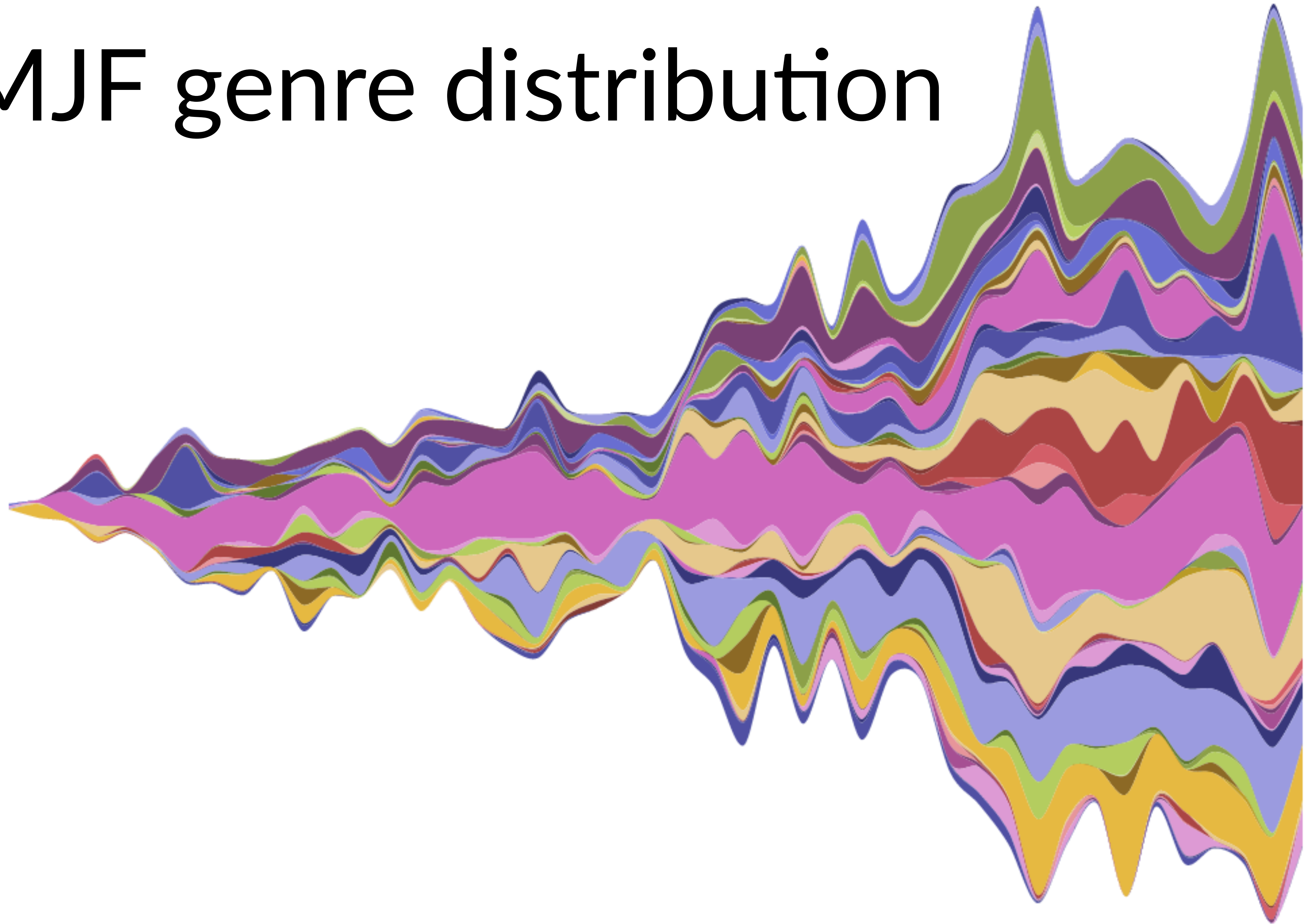
[Mark Edward Campos]

Music related data viz

The Color of Sound



MJF genre distribution



Real-life example

GRAPH-BASED MUSIC RECOMMENDATION



I Can't Be Satisfied [Album Version]

Muddy Waters

Getting started

Library

Discovery

Social

Title	Time	Artist	Album	Year	Genre
Cypress Grove	04:16	Skip James	Today!	1964	Blues
Crow Jane	02:24	Skip James	Skip James Live Vol...	2005	Blues
Sickbed Blues	04:04	Skip James	Devil Got My Woman	1968	Blues
Catfish Blues	04:37	Skip James	Devil Got My Woman	1968	Blues
Come & Get It	03:51	Selena Gomez	Top 100 2013 USA	2013	Hit Single
Brave	03:40	Sara Bareilles	Top 100 2013 USA	2013	Hit Single
Travelling Riverside Blues	02:32	Sam Mitchell	The Art Of Bottlenec...	2013	Blues
Pile Driver	02:54	Sam Mitchell	The Art Of Bottlenec...	2013	Blues
(Baby, Let Me) Follow You Down	02:31	Sam Mitchell	The Art Of Bottlenec...	2013	Blues
Rainy Day Blues	02:41	Sam Mitchell	Bottleneck / Slide G...	2009	Blues
Motherless Children	02:38	Sam Mitchell	Bottleneck / Slide G...	2009	Blues
Crossroad Blues	03:07	Sam Mitchell	Bottleneck / Slide G...	2009	Blues
Avalon	05:14	Rory Block	Avalon: A Tribute To ...	2013	Blues
I'm So Glad	02:44	Rory Block, Stefan ...	Country Blues Guitar	2009	Blues
U.O.E.N.O.	04:20	Rocko ft. Future & R...	Top 100 2013 USA	2013	Hit Single
Blurred Lines	04:23	Robin Thicke	Top 100 2013 USA	2013	Hit Single
Come On In My Kitchen	02:52	Robert Johnson	Robert Johnson - 34...	1937	Blues

View:

Basic

Expert

03:07

05:44

09:12

Discovery

Work

Shake

Relax

Party

Crossroad Blues

Sam Mitchell

If You Haven't Got An...

Stefan Grossman

I Can't Be Satisfied [Album Ver...

Muddy Waters

Death Com

Bob Bro

00:49

Genezik

“The ultimate playlist generator”

- Personalized distributed playlist recommender system
- Global song recommender system



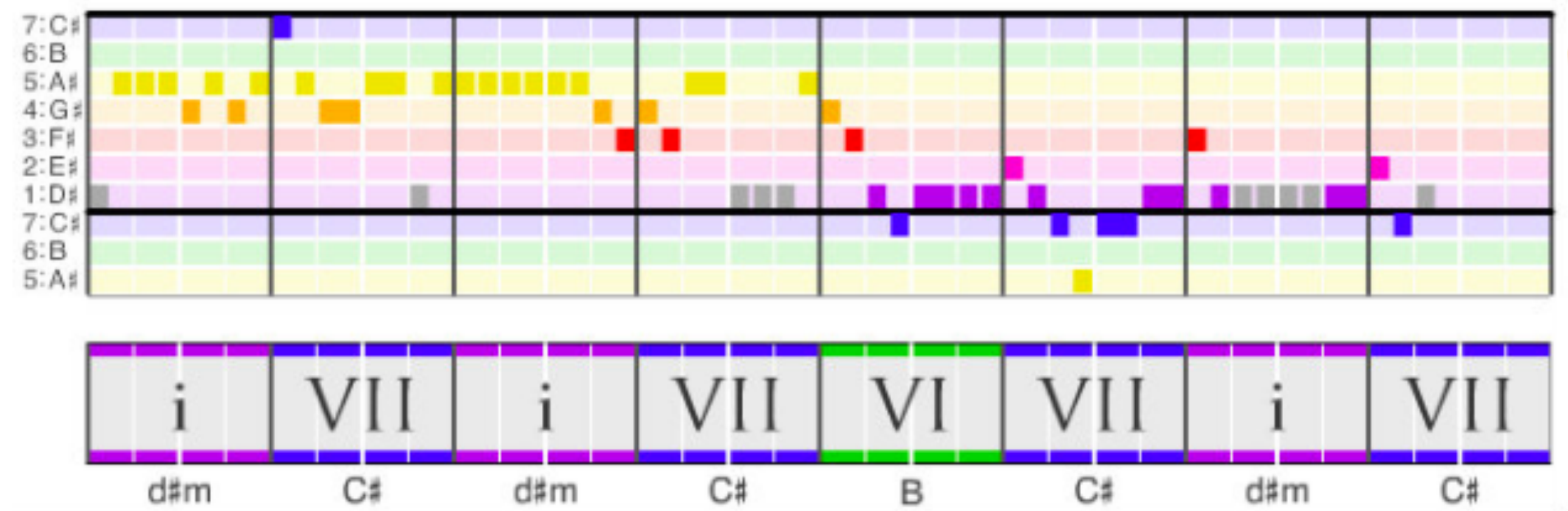
FEATURE EXTRACTION

➤ Audio: notes, timbre, rhythm

➤ Social: popularity, hotness

➤ Metadata: genre, mood, tags

Michael Jackson - Beat It



207,924,774 views



816,658

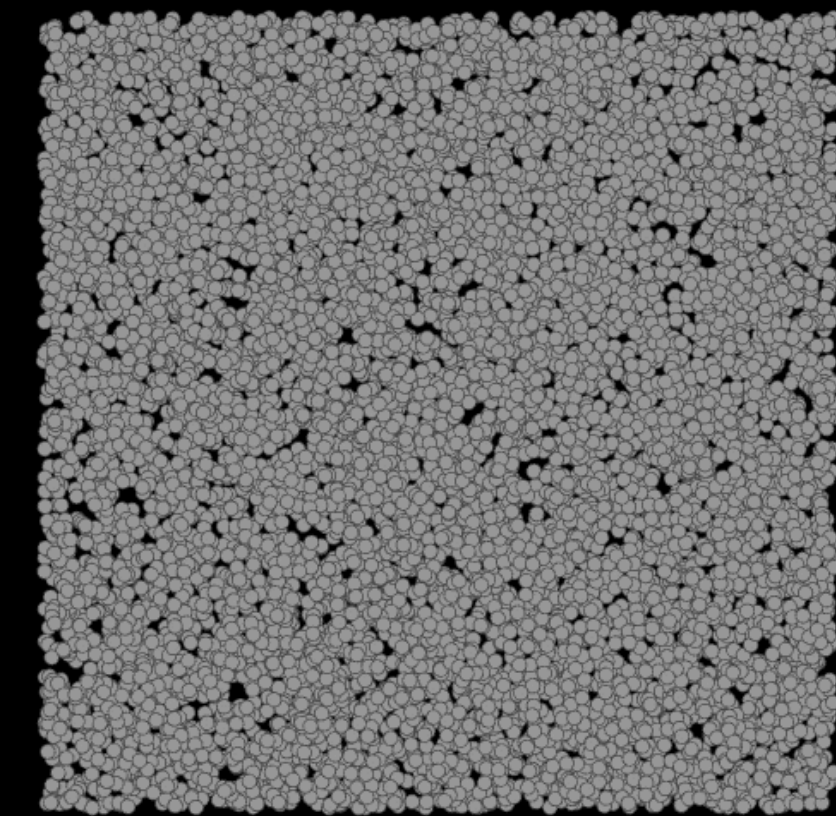
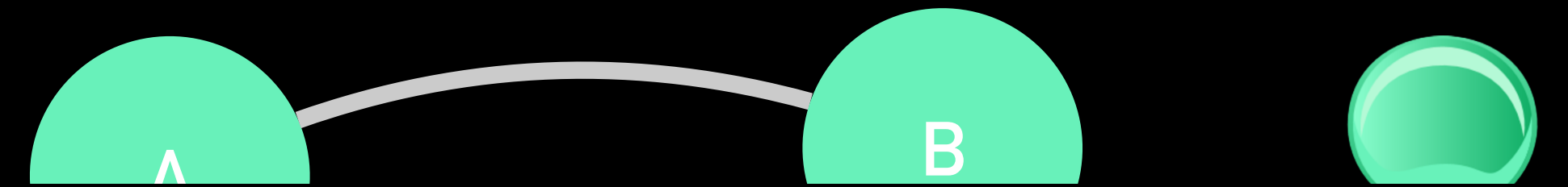
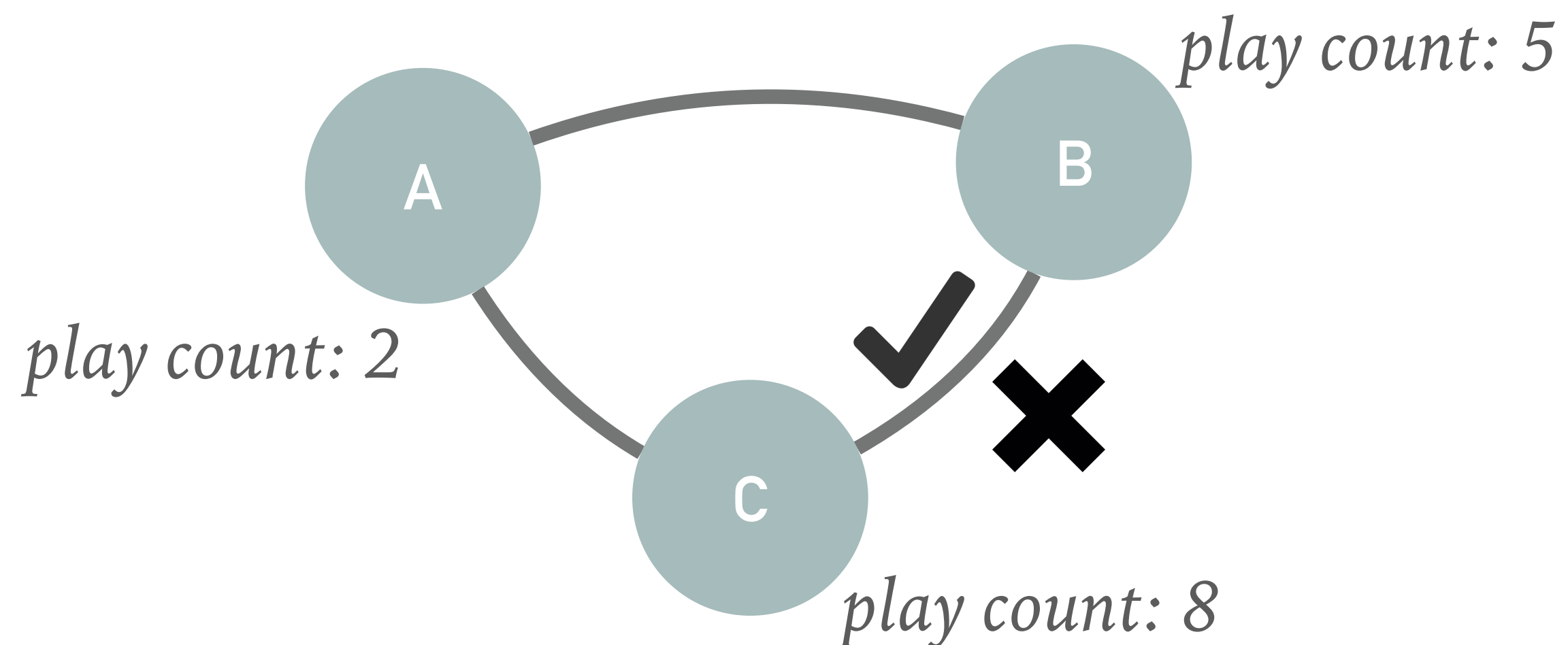


30,675

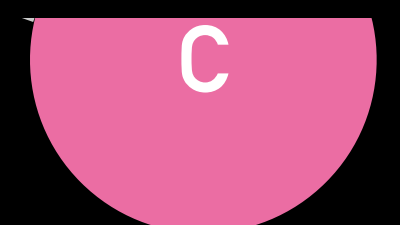
Recorded	1982
Genre	Hard rock ^{[1][2]} • dance-rock ^[3]
Length	4:18
Label	Epic
Writer(s)	Michael Jackson
Producer(s)	Quincy Jones • Michael Jackson (co-producer)

DEFINING MUSICAL DISTANCE

- We create the graph of songs by comparing features together
- Learn an “optimal” mathematical distance to weight the different features
- Ultimately, we want to learn the actual taste of each user but how?



melody



Around The World

Red Hot Chili Peppers - Californication



The Meaning Of Soul

Oasis - Don't Believe The Truth



Misty Mountain Hop

Led Zeppelin - Led Zeppelin IV



Baptized

Lenny Kravitz - Baptism



:17 04:24

h Do is Write about it(acoustic)

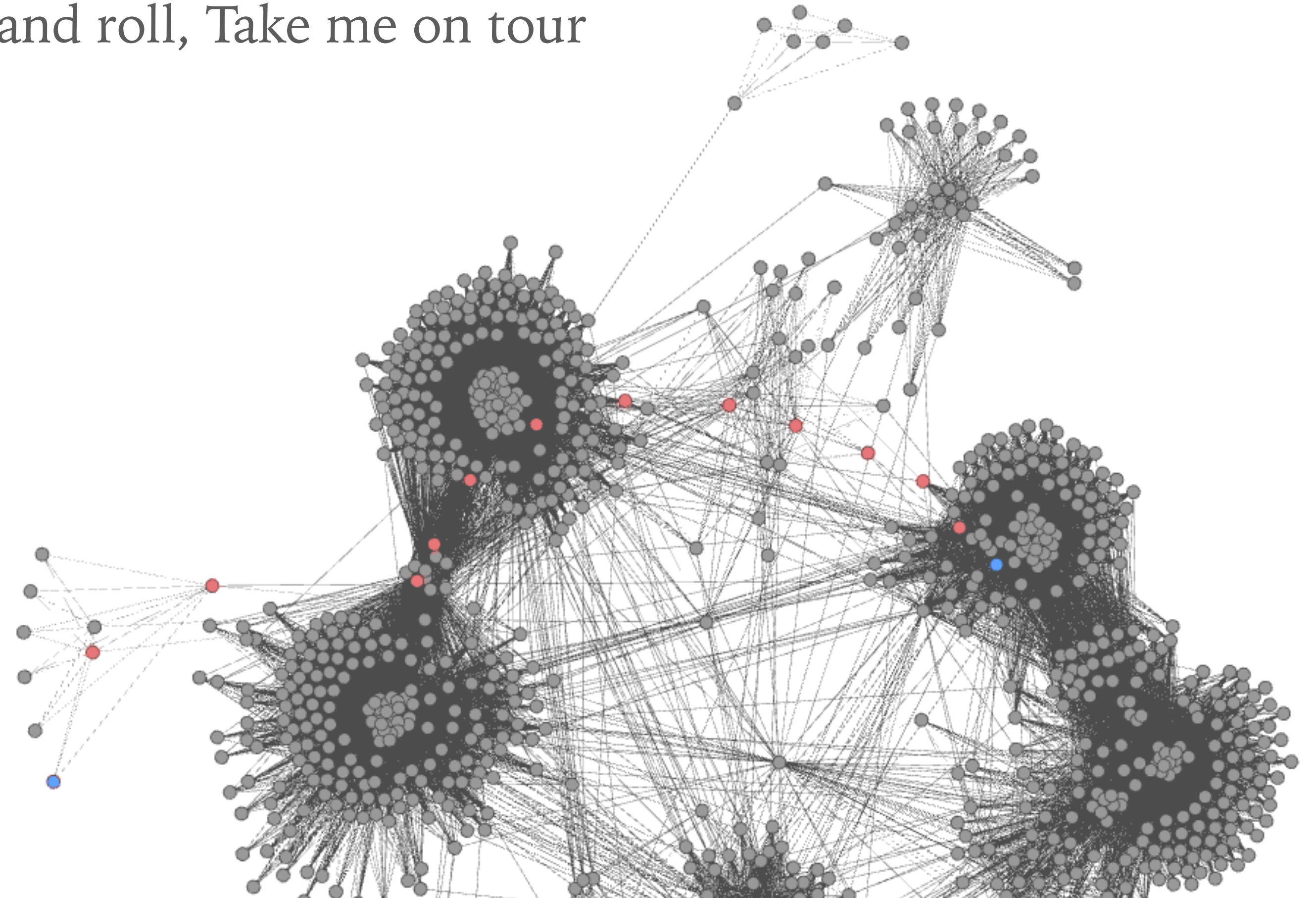


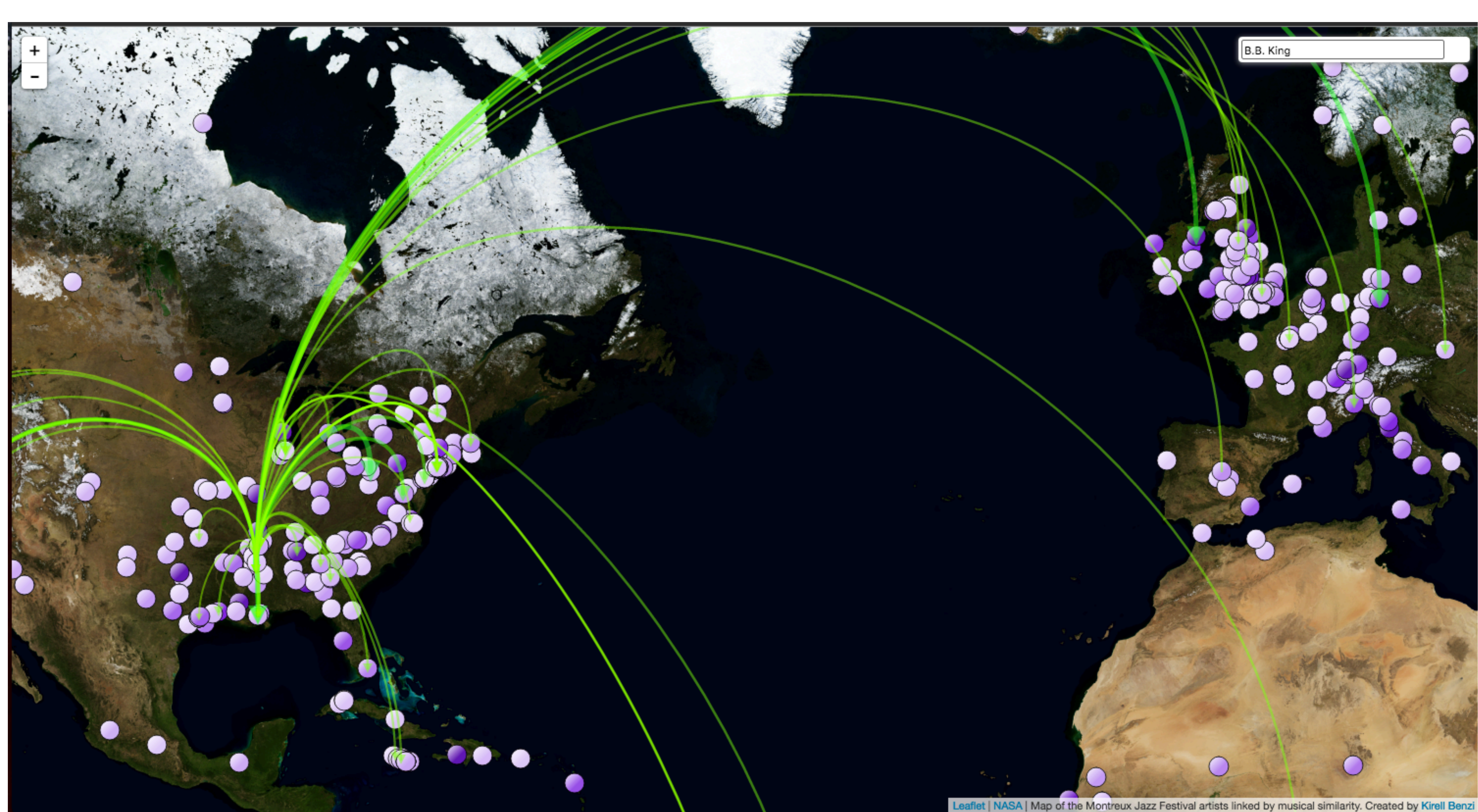
Skynyrd - Greatest Hits Album



PLAYLIST GENERATION

- Follow the links of the graph according to our adaptive algorithms
- Different modes such as Lead me on, Ride and roll, Take me on tour





Data sonification

Data sonification

Pros

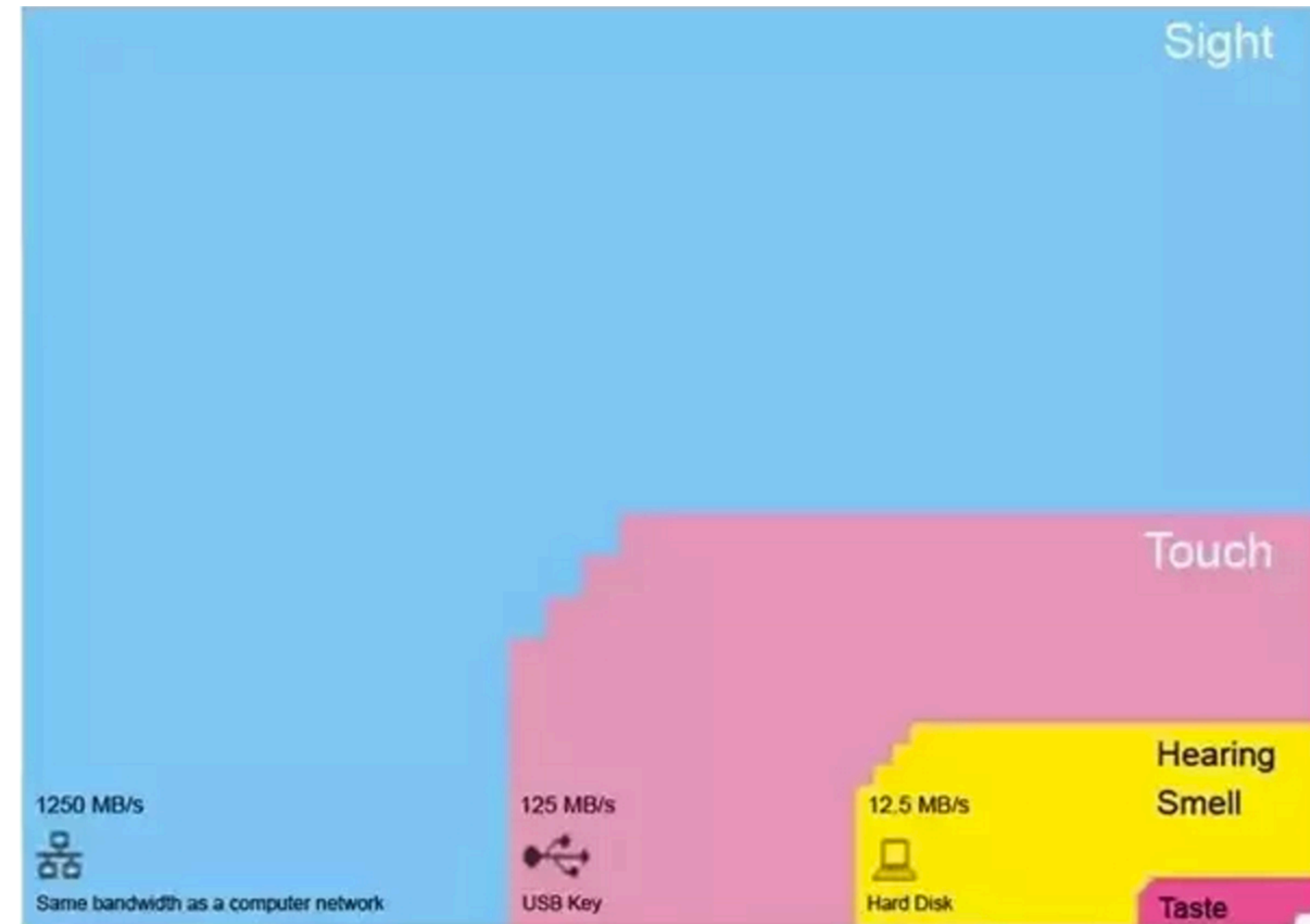
Useful for visually-impaired users

Well suited to representing temporal or sequential data.

Cons

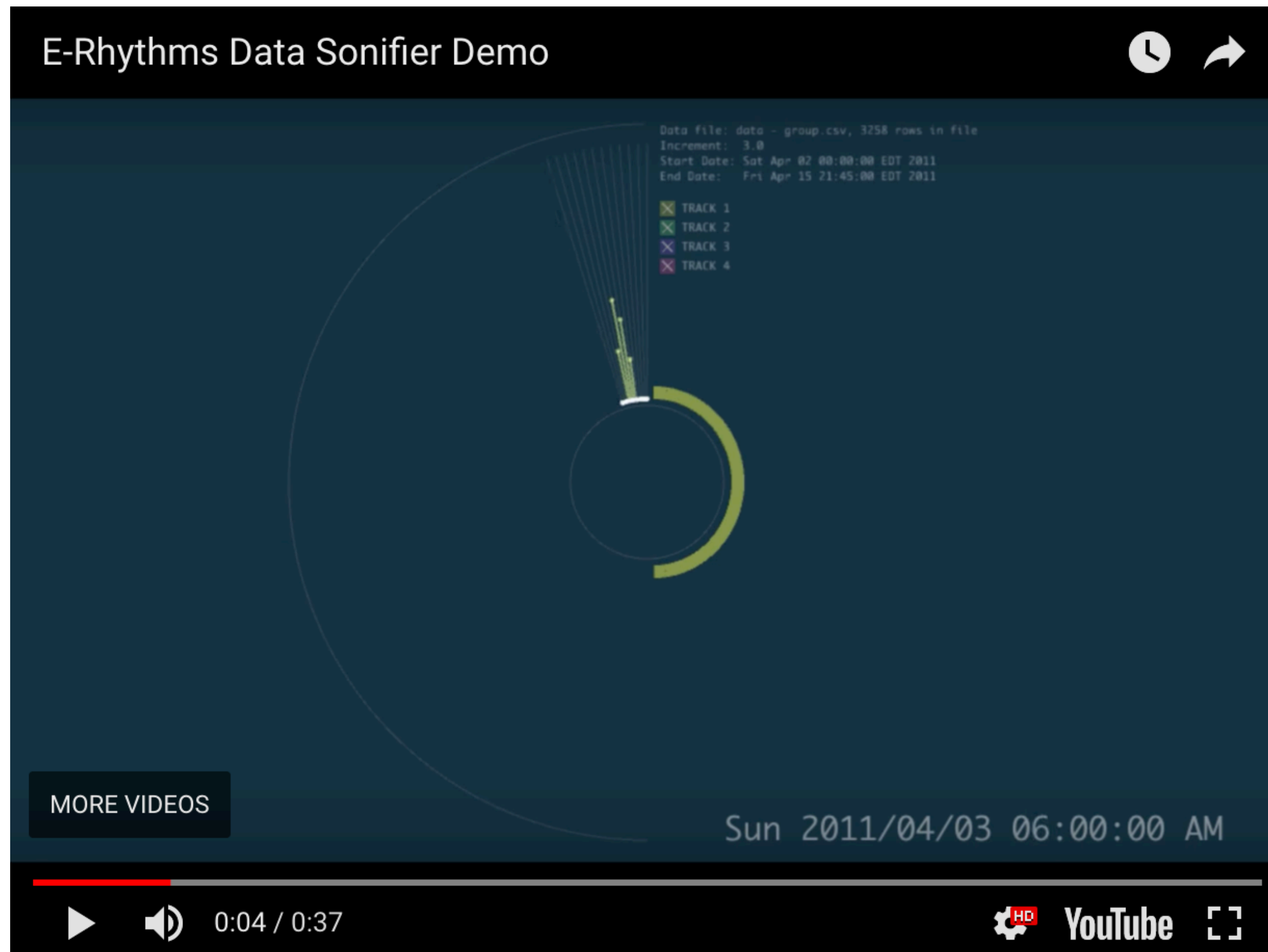
Cannot be used to represent complex datasets

Hearing bandwidth is low

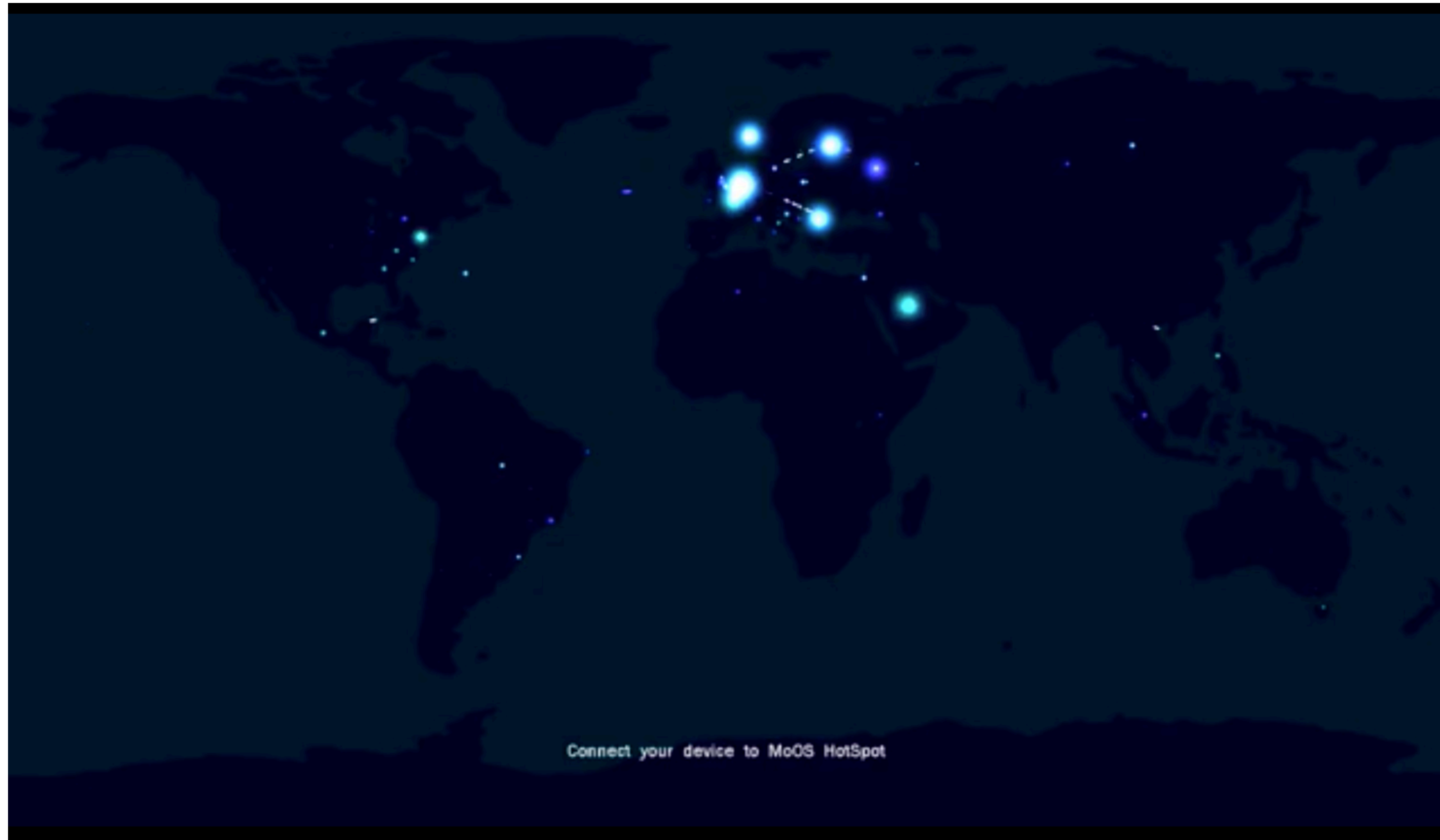


Tor Nørretranders

E-Rhythms Data Sonifier



Network Activity Renderer



Listen to solar wind

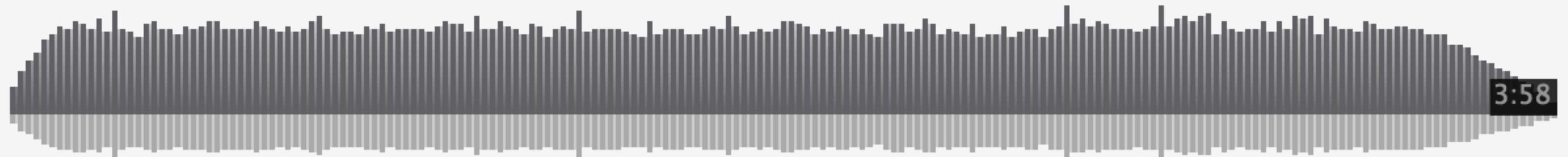


Follow



SciFri
Sun Song

 SOUNDCLLOUD



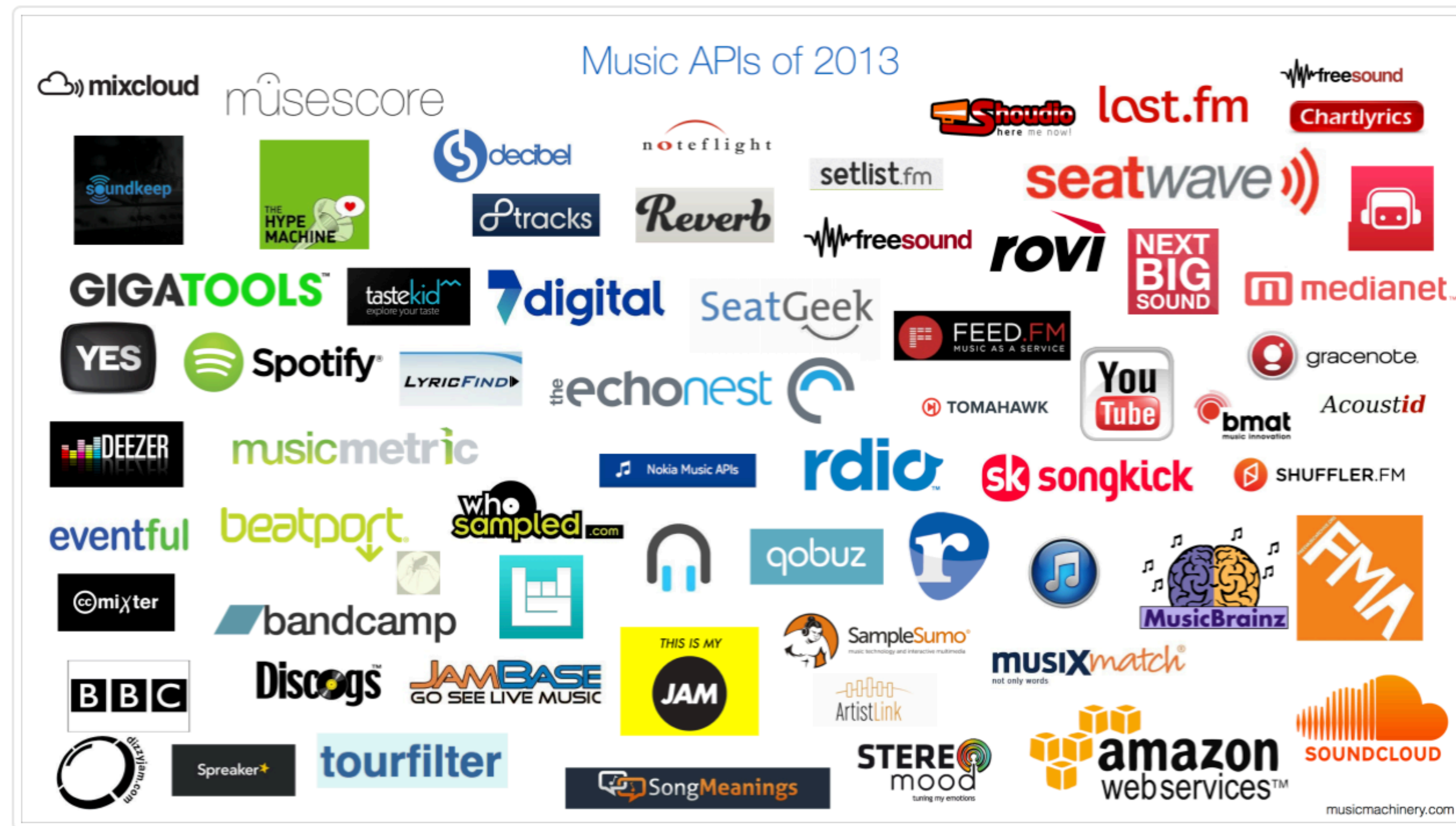
3:58

▶ 1.1K

Cookie policy

Music APIs

Here's a categorized list of all the Music APIs. Notice one that is missing or miscategorized? Let me know.



Homework

Read Visualization Analysis and Design
Chapter 7

Read Making sense of streamgraphs

