



# Rhythmic Intelligence: AI's Impact on Music and Health

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# Global Observation

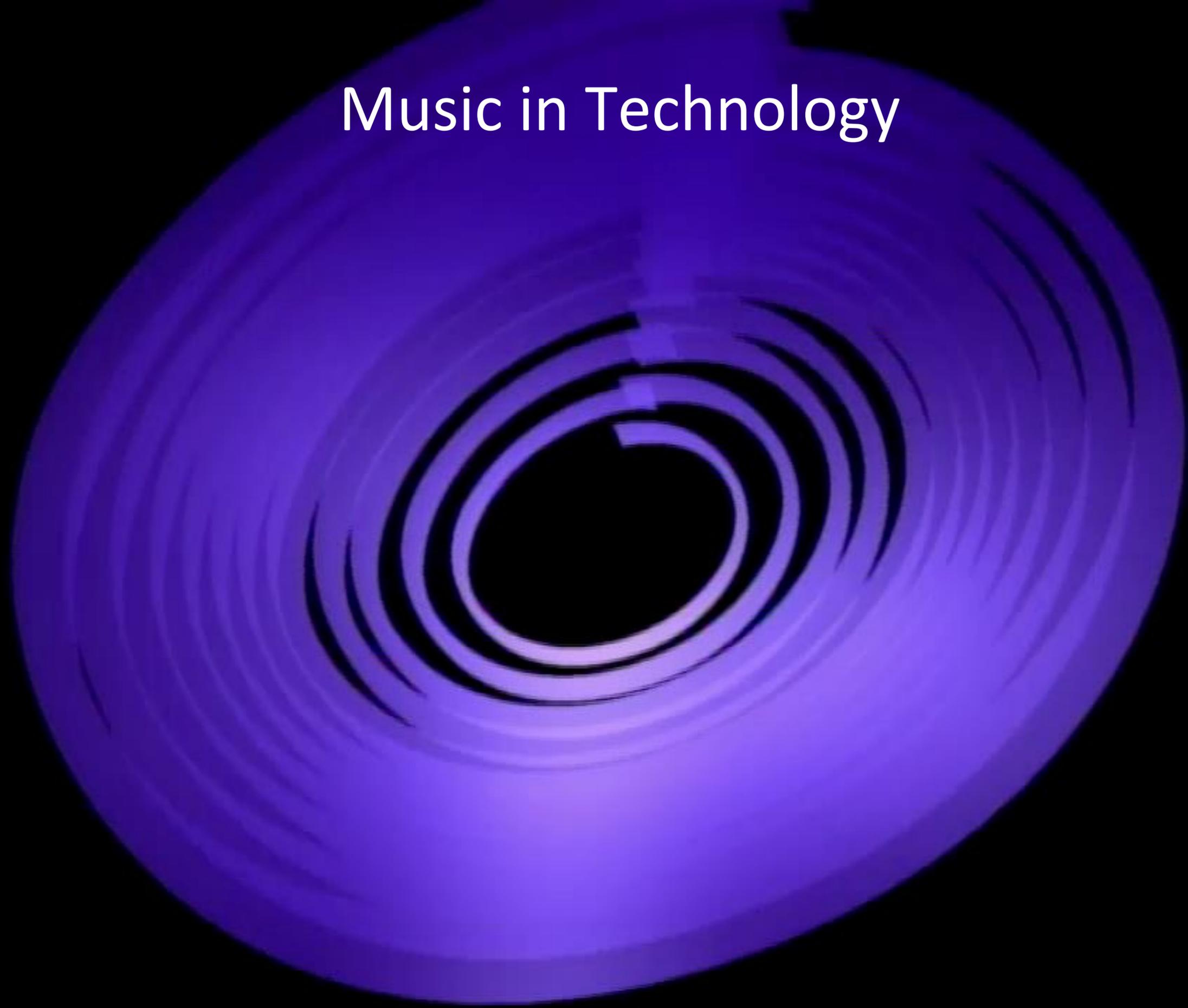


International Journal of  
*Environmental Research  
and Public Health*

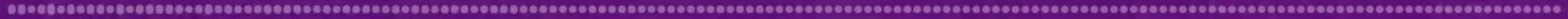
Music listening is the most preferred activity compared to sports, TV, books, movies, radio, and magazines or newspapers (e.g., people spend more money on music than other activities.)

*Int J Environ Res Public Health. 2021 Oct; 18(19): 10463. Published online 2021 Oct 5. doi: 10.3390/ijerph181910463*

# Music in Technology



# Lyria deep mind

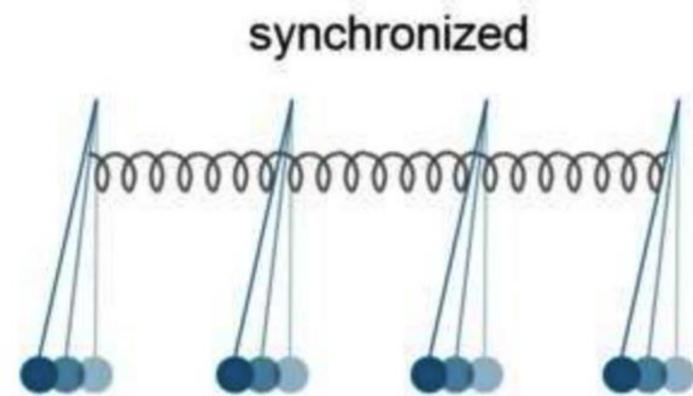
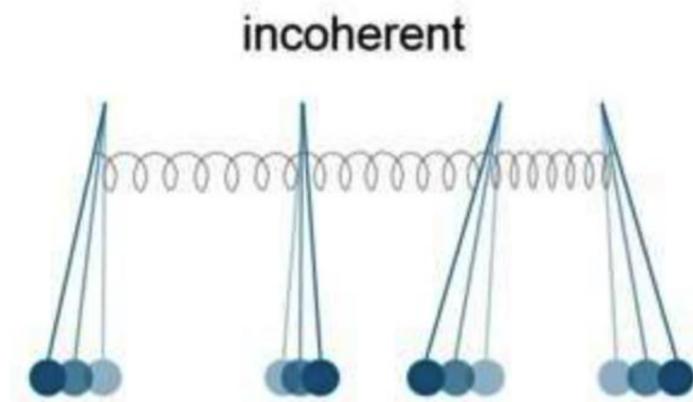


0:00

0:30

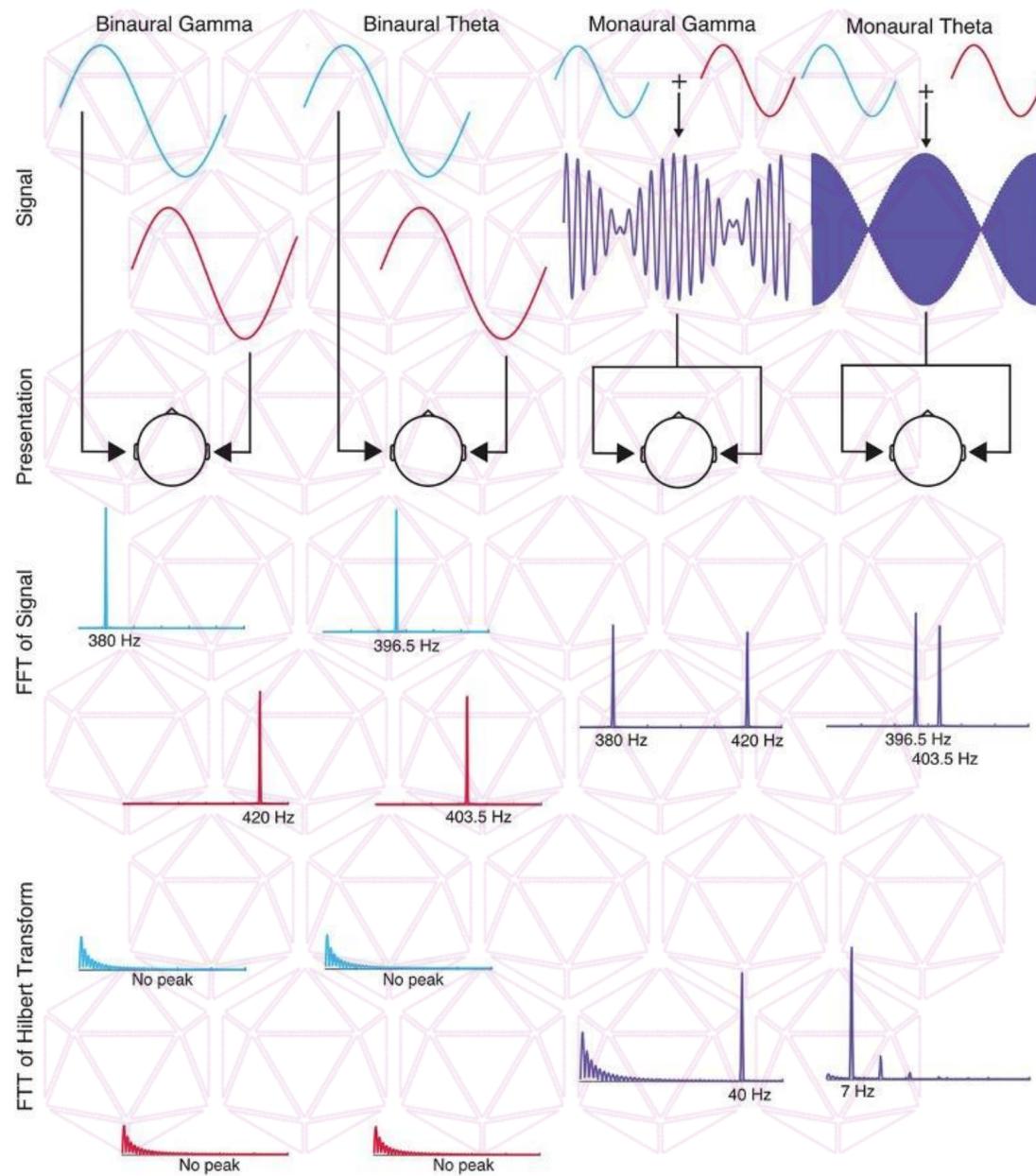
Generate

# Entrainment Overview



Entrainment is a therapeutic approach that uses pulsed frequencies of sound or light to induce the brain to harmonize with the target frequency. Recent studies have shown entrainment can have significant positive effects on neurological and other health conditions (reduce stress and anxiety.)

# Auditory Beat Stimulation



Binaural beats are auditory illusions that occur when you listen to two tones with slightly different frequencies in each ear simultaneously. These beats are not actual sounds but are created by your brain's perception when it processes the two distinct frequencies. The phenomenon is based on the concept of beat frequency, as explained in acoustics.

Binaural beats have been found to synchronize brain activity, which means they can influence the brain's electrical patterns, potentially affecting mental states.

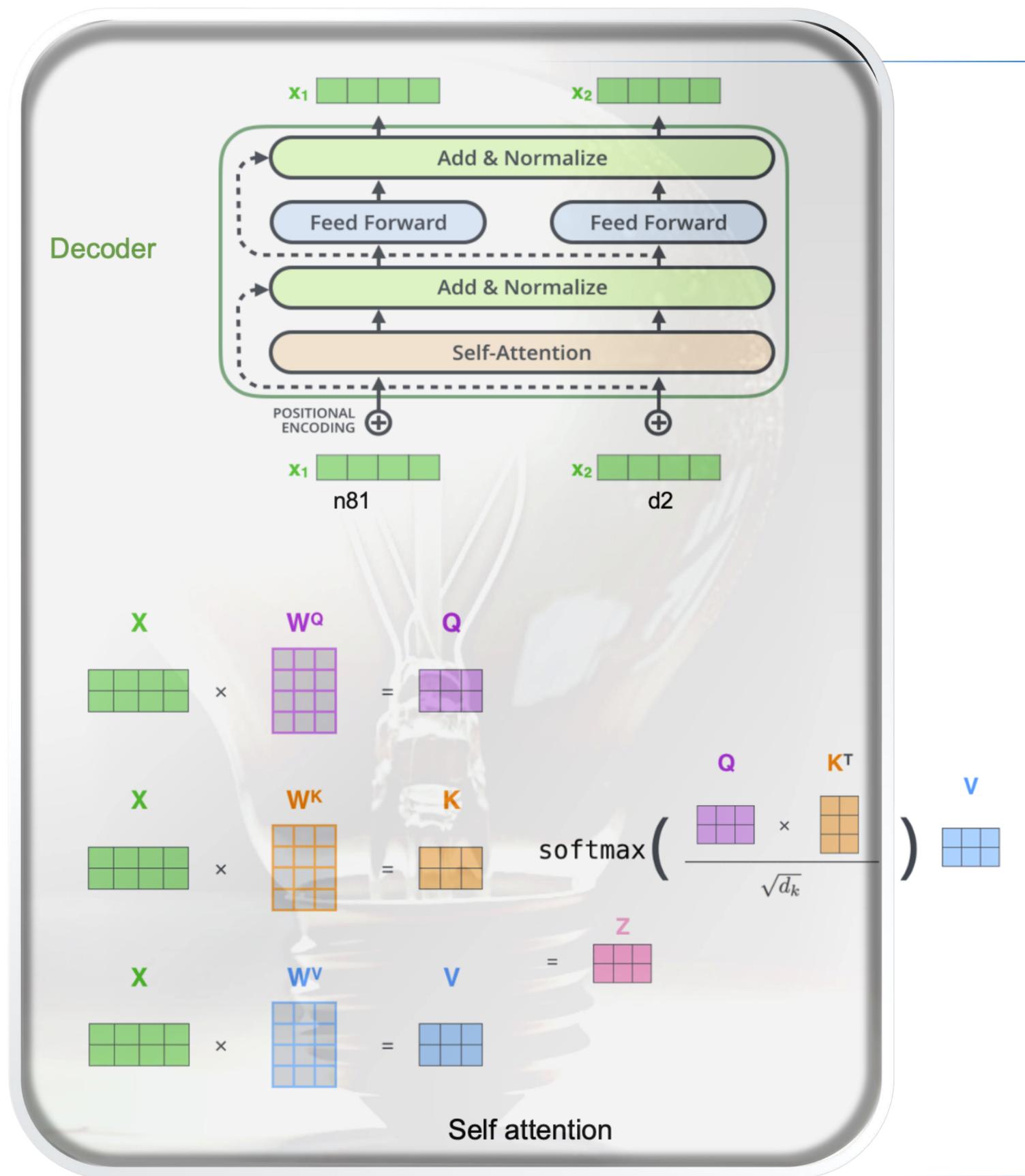
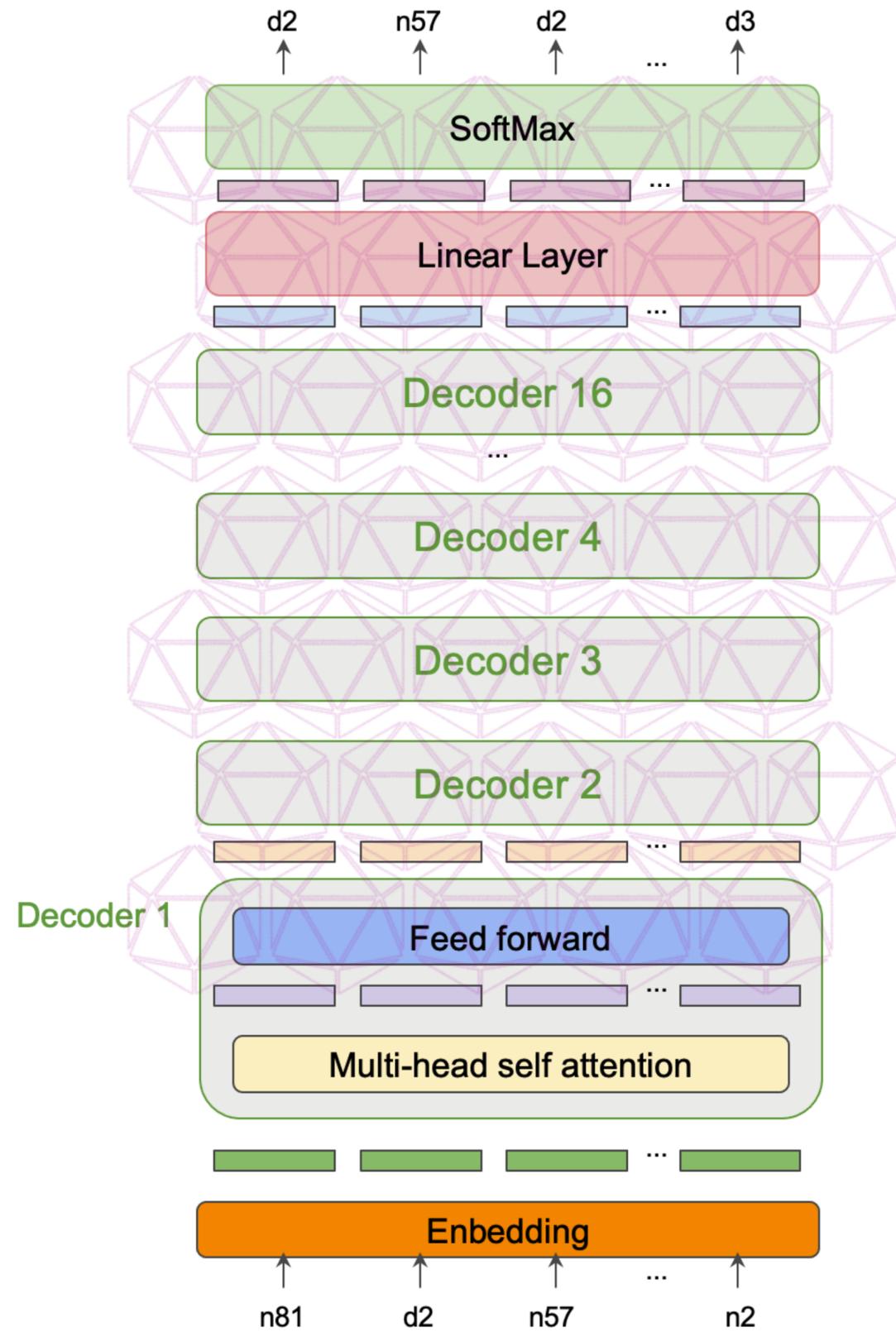
# Beethoven X, AI Project



**CREATING THE 10TH SYMPHONY**

# Beethoven meets Robbie





# Model Structure and Training

## Methodology

Inspired by natural language processing models that are designed to predict the next word, based on previous words, to generate realistic sentences.

We convert piano music into a sequence of music events (notes + duration)

Ask the model to predict the next music event based on previous events

pitch



duration



point in time

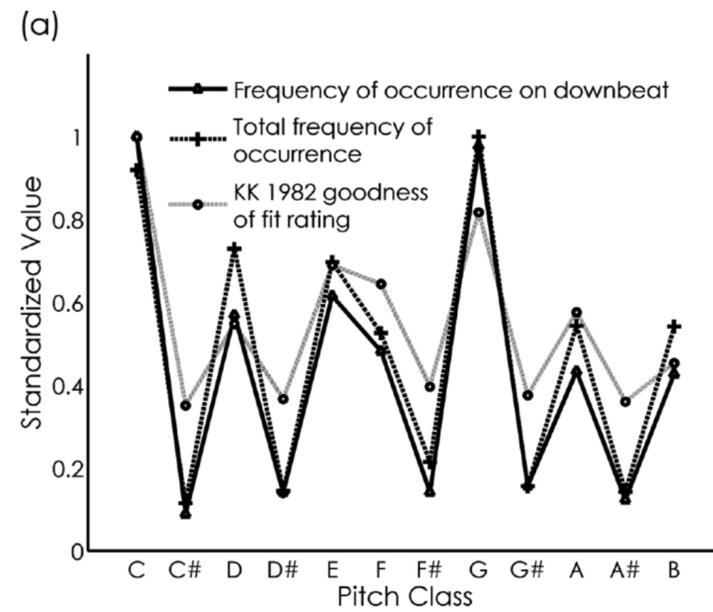
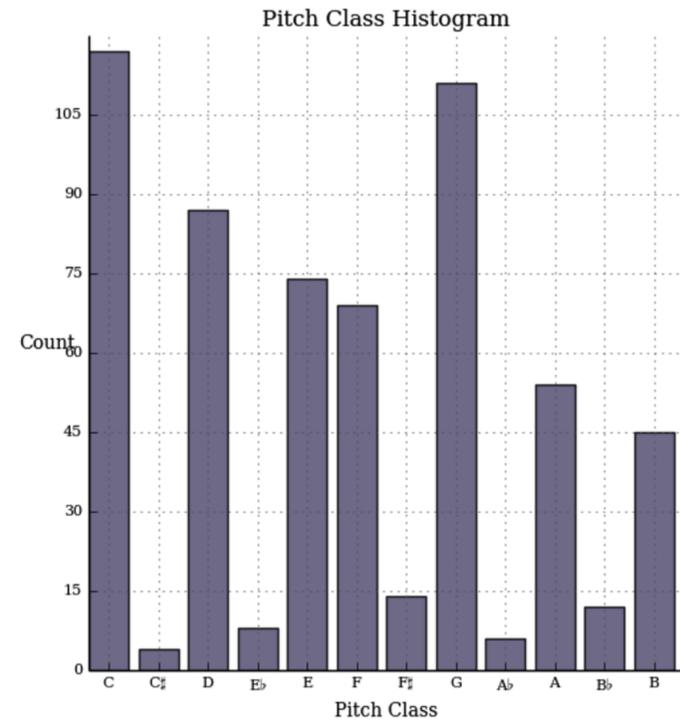


melody - motif

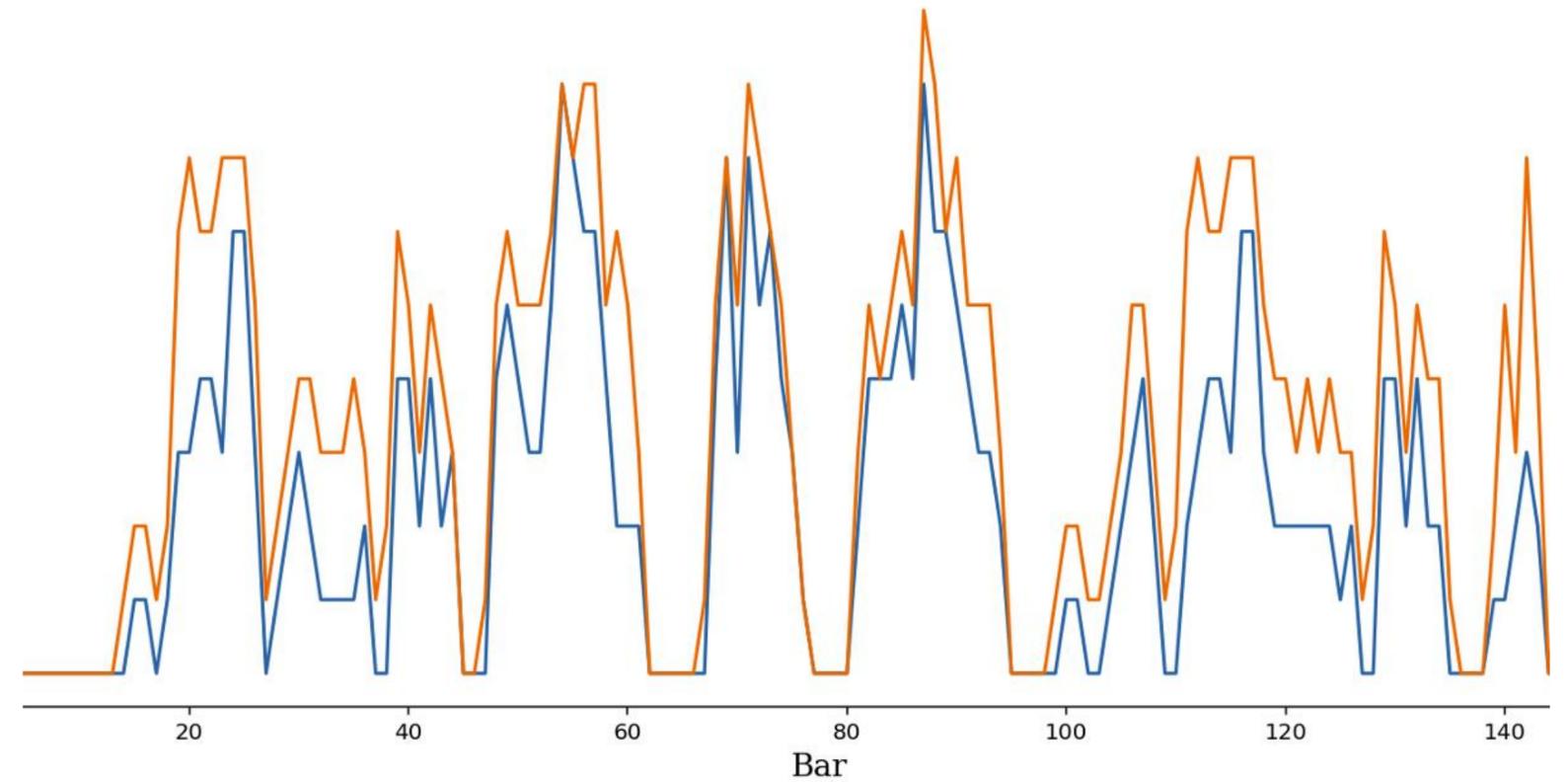
harmony



# Composer's style - Mathematically



Dissimilarity: Interval Step Size (blue), pitch class (orange)



# Beethoven's sketches

Scherzo 24 bars Trio

Fuge

6/8

Herr Gott wir loben Dich

Gratulations Menuett

Pathétique

Letters, scribbles

Corpus

7 bars

Dux, 3 bars

8 bars

preexisting

preexisting

preexisting

raise your hand when...



Scherzo 24 bars  
Trio 7 bars

Ex. 1 [1<sup>v</sup>/1] Presto

[1<sup>v</sup>/2]

[1<sup>v</sup>/3]

[1<sup>v</sup>/4]

etc

etc

etc



*presto Scherzo zum 10<sup>ten</sup> Symphonie.*

# Beethoven 10 – The AI Project III

Komposition/Arrangement:  
Beethoven AI, Walter Werzowa

**Allegro** (♩=96) 2 3 4 5 6 7 8

The musical score shows measures 2 through 8. The tempo is marked **Allegro** with a quarter note equal to 96 beats per minute. The score includes parts for various instruments: Flöte (Flute), Oboe, Klarinette (Bb) (Clarinet in Bb), Fagott (Bassoon), Horn (Es) 1/2 (E-flat Horn), Horn (C) 3/4 (C Horn), Trompete 1/2 (C) (Trumpet in C), Alt/Tenor Posaune (Alto/Tenor Trombone), Bass, Pauken (Drums) with a note for [G und C], Violine I (Violin I), Violine II (Violin II), Viola, Violoncello (Cello), and Kontrabass (Double Bass). Dynamics such as *f* and *sf* are indicated throughout the score.

## Calculate Statistics for All Bars In Current Score

81 Pages  
81 Systems  
19 Staves  
610 Bars per Staff  
11590 Bars in All Staves  
5936 Empty Bars (No Notes)  
11 Non-Bar-Rest Empty Bars  
5654 Bars Containing Notes  
0 Irregular Bars  
14352 Total Noteheads  
12528 Single Notes  
909 Chords  
13437 Single Notes \*or\* Chords  
0 Grace Notes  
0 Tuplets  
8923 Rests (includes bar rests)  
3 Hidden Objects

274 Hairpins  
0 Highlights  
910 Slurs  
0 Other Lines  
2413 Expression Text  
160 Technique Text  
626 Other Staff Text  
25 Tempo Text  
0 Metronome Marks  
8 Other System Text  
0 Lyrics  
0 Legacy Chord Symbols  
0 Chord Symbols

76 Key Signature Changes  
6 Time Signature Changes  
0 Clef Changes  
0 Rehearsal Marks  
0 Bar Number Changes  
0 Instrument Changes  
0 Symbols  
0 Graphics  
9 Special Barlines  
113 Other Objects

'Other' objects by style or type:



# Beethoven 10 – The AI Project IV

Komposition/Arrangement:  
Beethoven AI, Walter Werzowa

Adagio maestoso (♩ = 60) [1] 6 7 8 9 10 11 12 13

Adagio maestoso (♩ = 60) [1]

## Calculate Statistics for All Bars In Current Score

63 Pages  
63 Systems  
26 Staves  
502 Bars per Staff  
13052 Bars in All Staves  
7709 Empty Bars (No Notes)  
8 Non-Bar-Rest Empty Bars  
5836 Bars Containing Notes  
0 Irregular Bars  
19304 Total Noteheads  
**16033 Single Notes**  
1479 Chords  
17512 Single Notes \*or\* Chords  
0 Grace Notes  
38 Tuplets  
10824 Rests (includes bar rests)  
4 Hidden Objects

519 Hairpins  
0 Highlights  
1634 Slurs  
0 Other Lines  
1795 Expression Text  
239 Technique Text  
552 Other Staff Text  
64 Tempo Text  
0 Metronome Marks  
8 Other System Text  
0 Lyrics  
0 Legacy Chord Symbols  
0 Chord Symbols

168 Key Signature Changes  
19 Time Signature Changes  
132 Clef Changes  
0 Rehearsal Marks  
0 Bar Number Changes  
0 Instrument Changes  
0 Symbols  
0 Graphics  
8 Special Barlines  
288 Other Objects

'Other' objects by style or type:



# MYTHOS MOZART!

Refik Anadol

RENDER

MOZART



REFIK ANADOL STUDIO

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