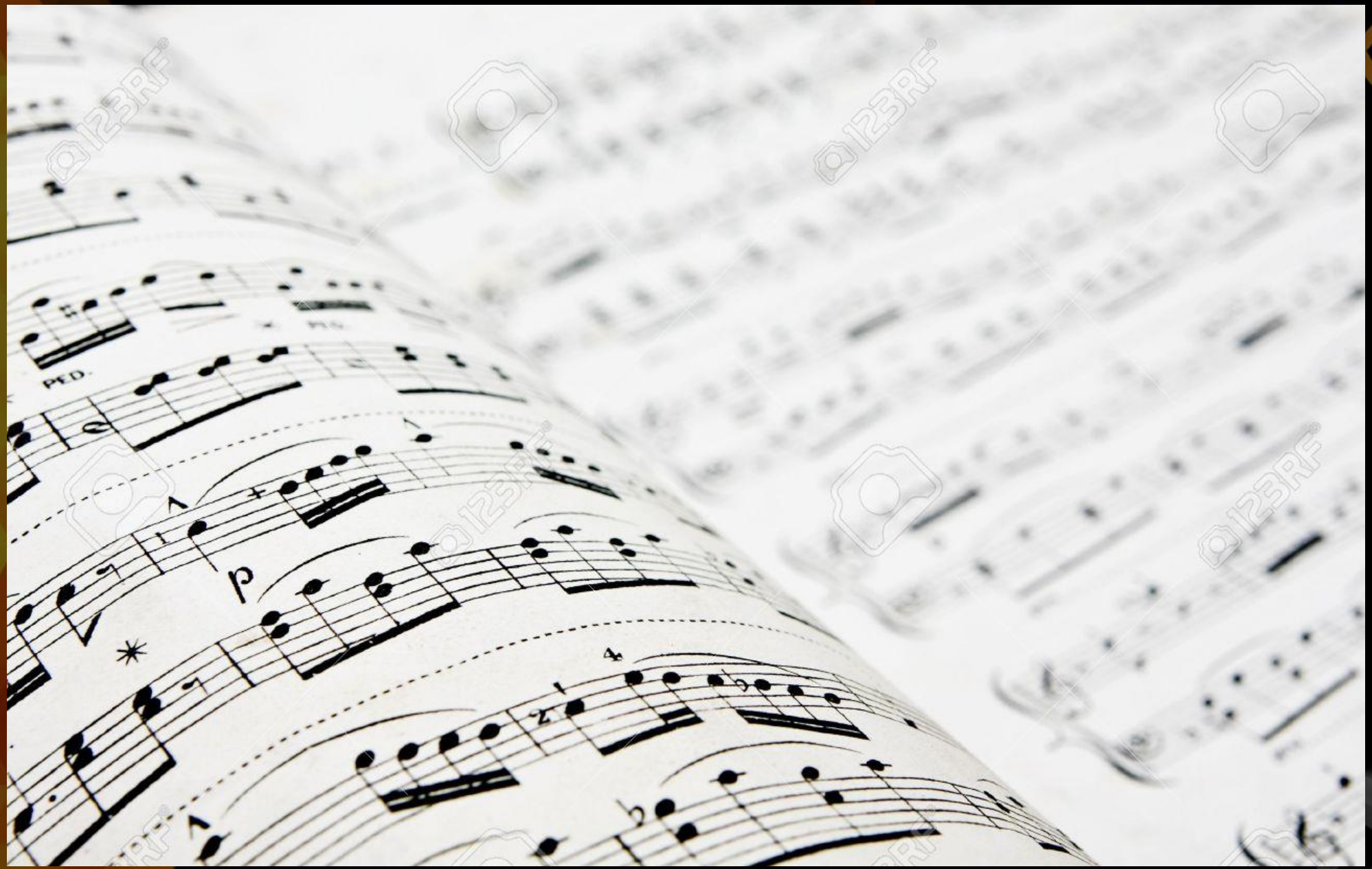
Εμρηκα

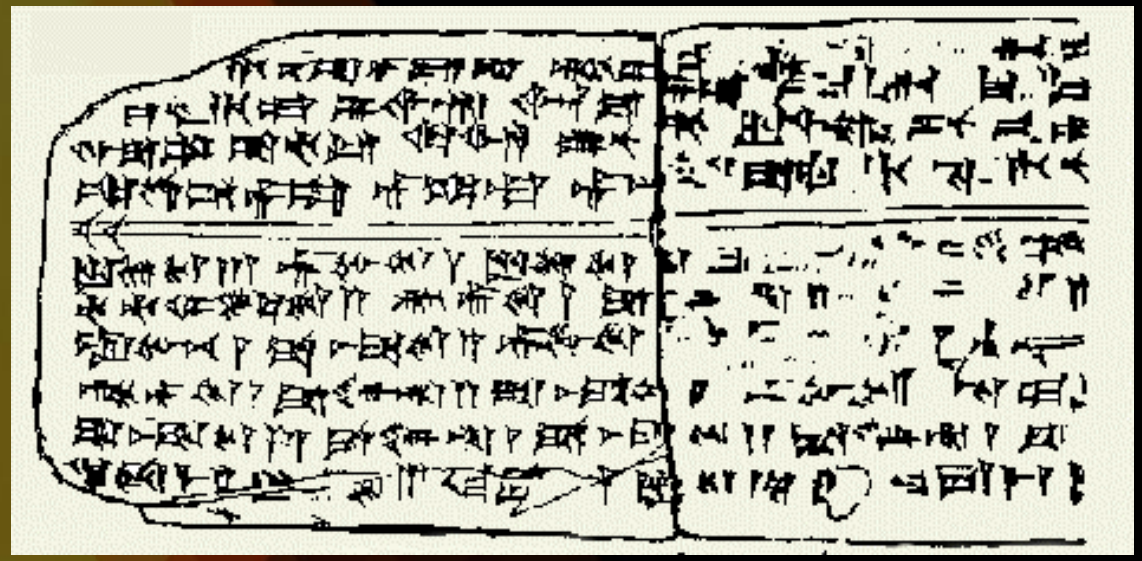
鄭偽之音

-以RNN生成音樂

張愷宸
彭天健老師
葉適穎老師

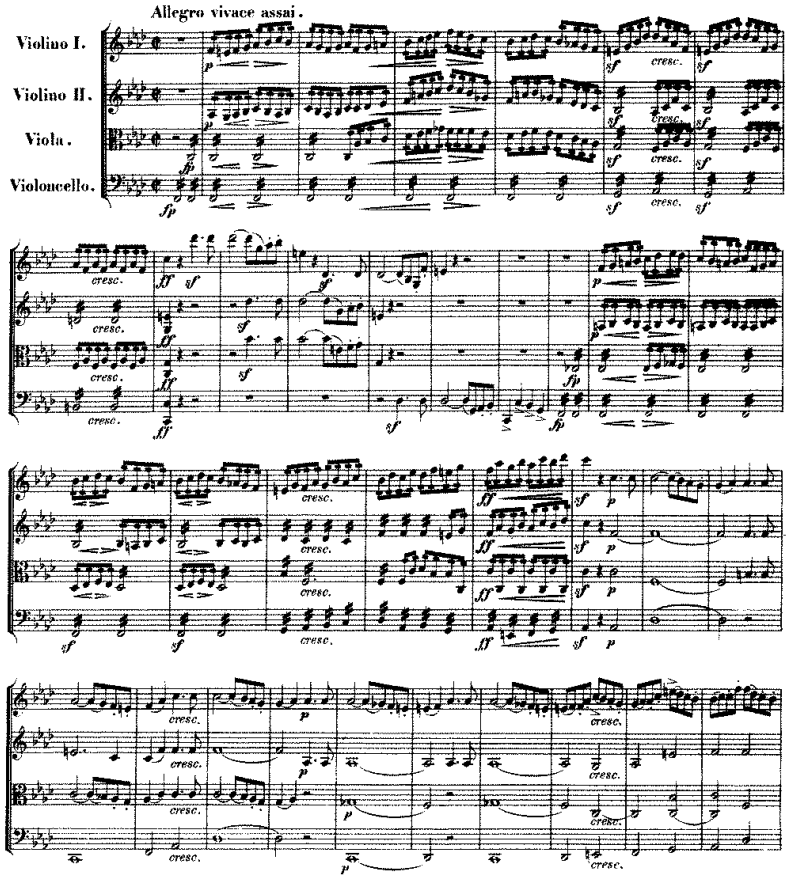


Εμπκα



Hurrian Hymn No.6

Quartet No. 6 in F Minor, Op. 80



Εμπκα

Or is it?

Ευρηκα

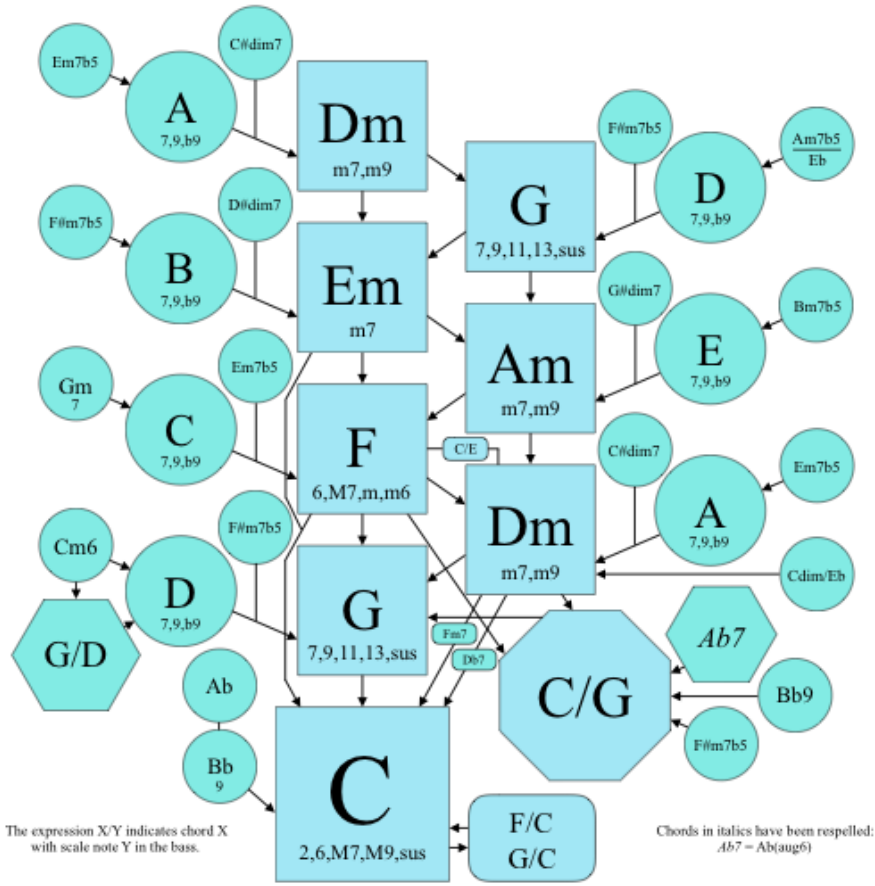
MACHINE LEARNING
Data Mining
Algorithm
Classification
Learning
Neural Networks
Deep Learning
AI
Autonomous
shutterstock.com • 1110900704

Twelve-Tone equal temperament (12tet)

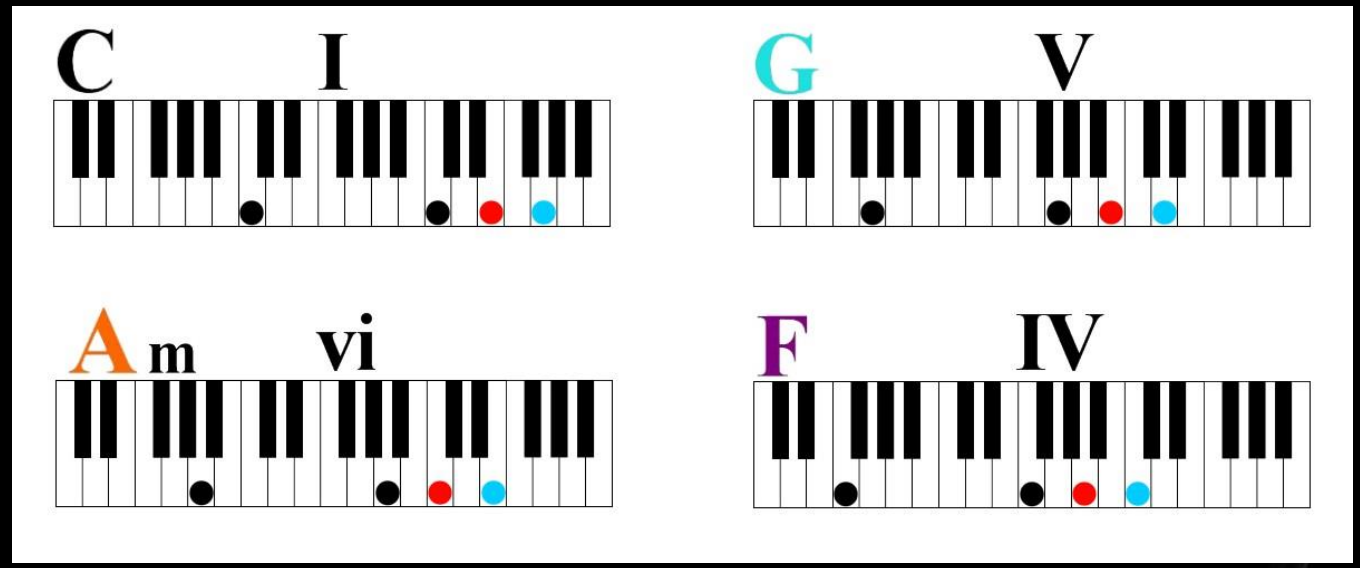
Interval	12-tone Cents	Just Intonation Cents	Difference
Unison	0	0	0
Minor second	100	111.73	-11.73
Major second	200	203.91	-3.91
Minor third	300	315.64	-15.64
Major third	400	386.31	13.69
Perfect fourth	500	498.04	1.96
Tritone	600	582.51	17.49
Perfect fifth	700	701.96	-1.96
Minor sixth	800	813.69	-13.69
Major sixth	900	884.36	15.64
Minor seventh	1000	996.09	3.91
Major seventh	1100	1088.27	11.73
Octave	1200	1200	0

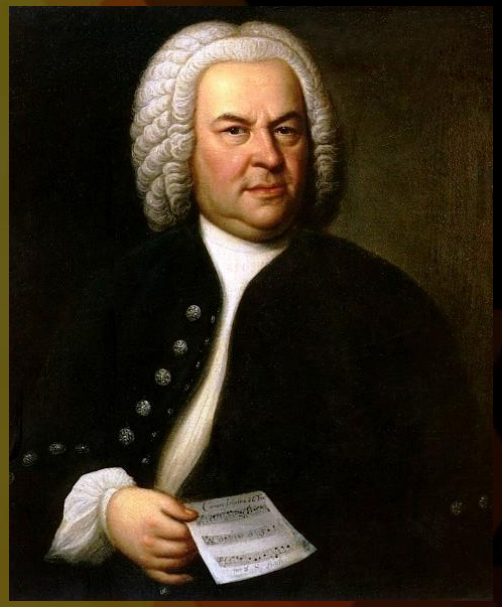
Εμπικα

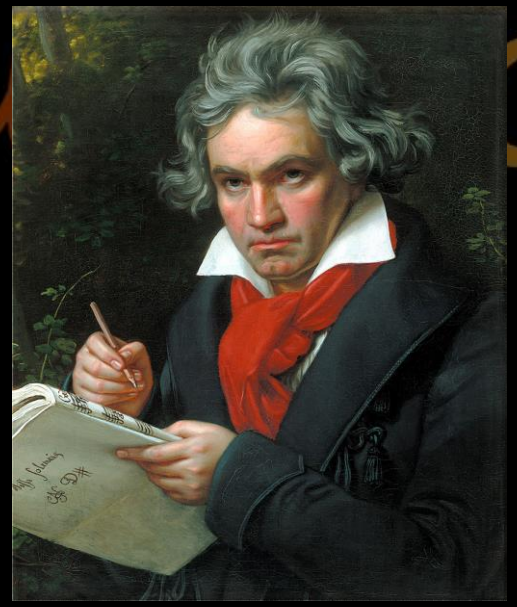
A Progression Map for C Major



Copyright 1995, 2001, 2004, 2017 Stephen Mugglin
Permission is given to make not-for-profit copies.

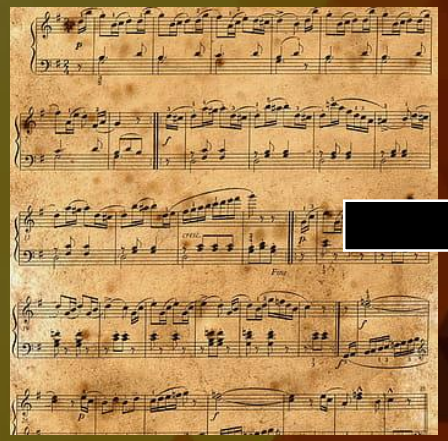


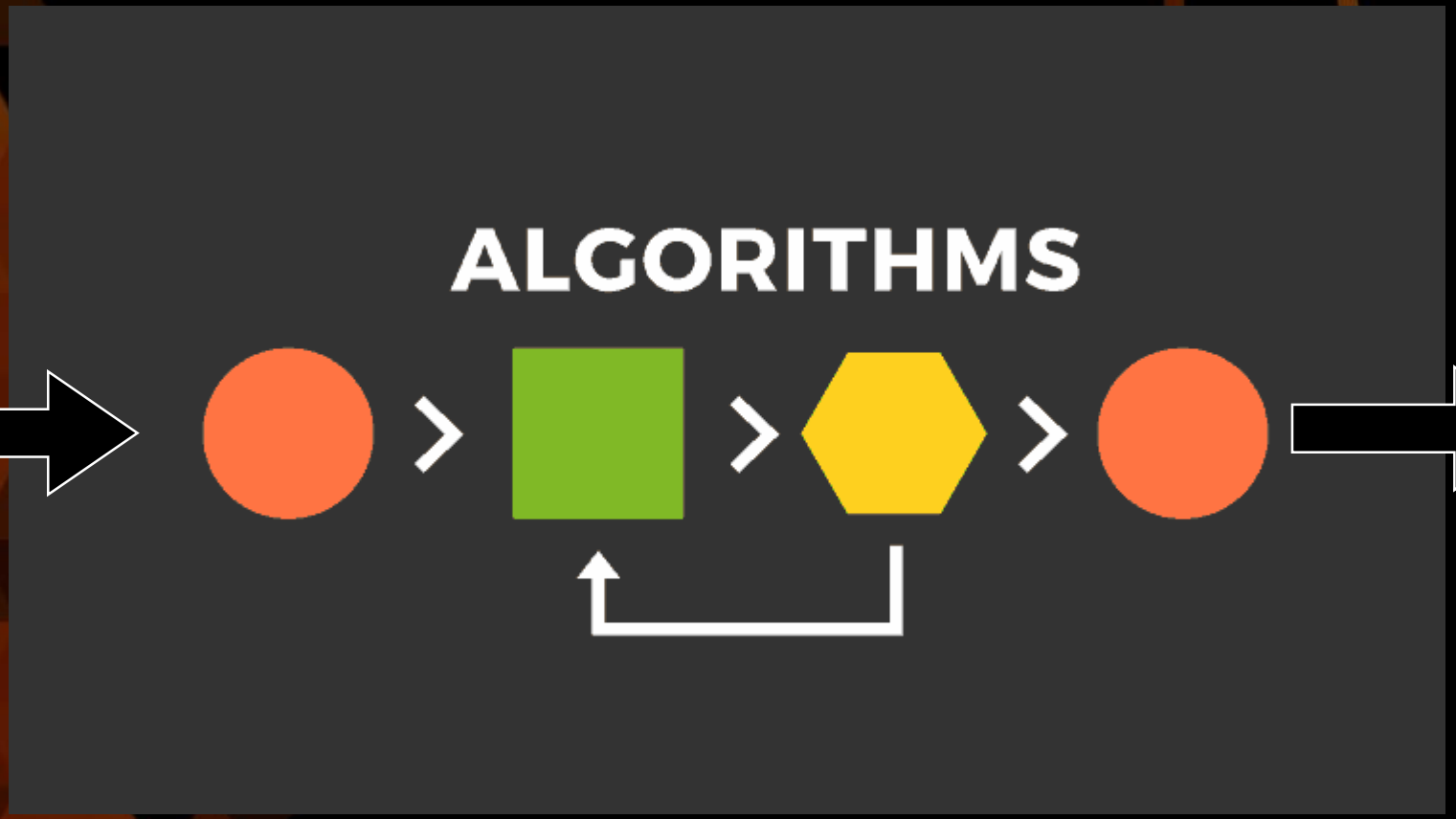




Enjoy
Corporatism

Εμπνα





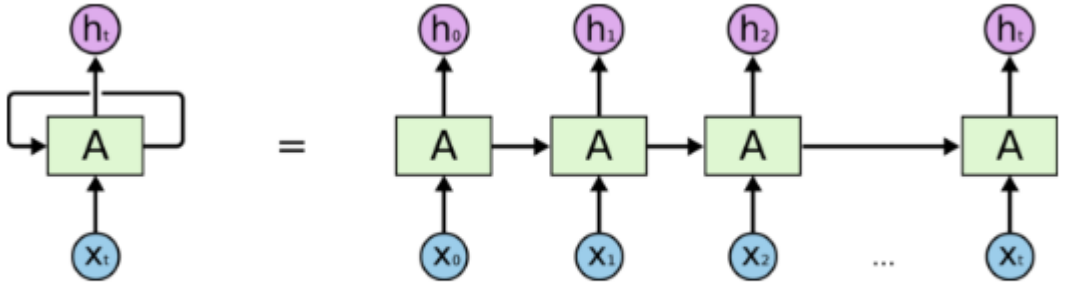
Recurrent neural network (RNN)

Andrej Karpathy blog

About Hacker's guide to Neural Networks

The Unreasonable Effectiveness of Recurrent Neural Networks

May 21, 2015



An unrolled recurrent neural network.

Naturalism (philosophy)

From Wikipedia, the free encyclopedia

This article is about the term that is used in philosophy. For other uses, see Naturalism (disambiguation).

In philosophy, **naturalism** is the "idea or belief that only natural (as opposed to supernatural or spiritual) laws and forces operate in the world."[1] Adherents of naturalism (*i.e.*, naturalists) assert that natural laws are the rules that govern the structure and behavior of the natural universe, that the changing universe at every stage is a product of these laws.

> Naturalism is not so much a special system as a point of view or tendency common to a number of philosophical and religious systems; not so much a well-defined set of positive and negative doctrines as an attitude or spirit pervading and influencing many doctrines. As the name implies, this tendency consists essentially in looking upon nature as the one original and fundamental source of all that exists, and in attempting to explain everything in terms of nature. Either the limits of nature are also the limits of existing reality, or at least the first cause, if its existence is found necessary, has nothing to do with the working of natural agencies. All events, therefore, find their adequate explanation within nature itself. But, as the terms nature and natural are themselves used in more than one sense, the term naturalism is also far from having one fixed meaning.
>
> — Dubray 1911

"Naturalism can intuitively be separated into an ontological and a methodological component," argues David Papineau.[2] "Ontological" refers to the philosophical study of the nature of being. Some philosophers equate naturalism with materialism. For example, philosopher Paul Kurtz argues that nature is best accounted for by reference to material principles. These principles include mass, energy, and other physical and chemical properties accepted by the scientific community. Further, this sense of naturalism holds that spirits, deities, and ghosts are not real and that there is no "purpose" in nature. Such an absolute belief in naturalism is commonly referred to as *metaphysical naturalism*.[3]

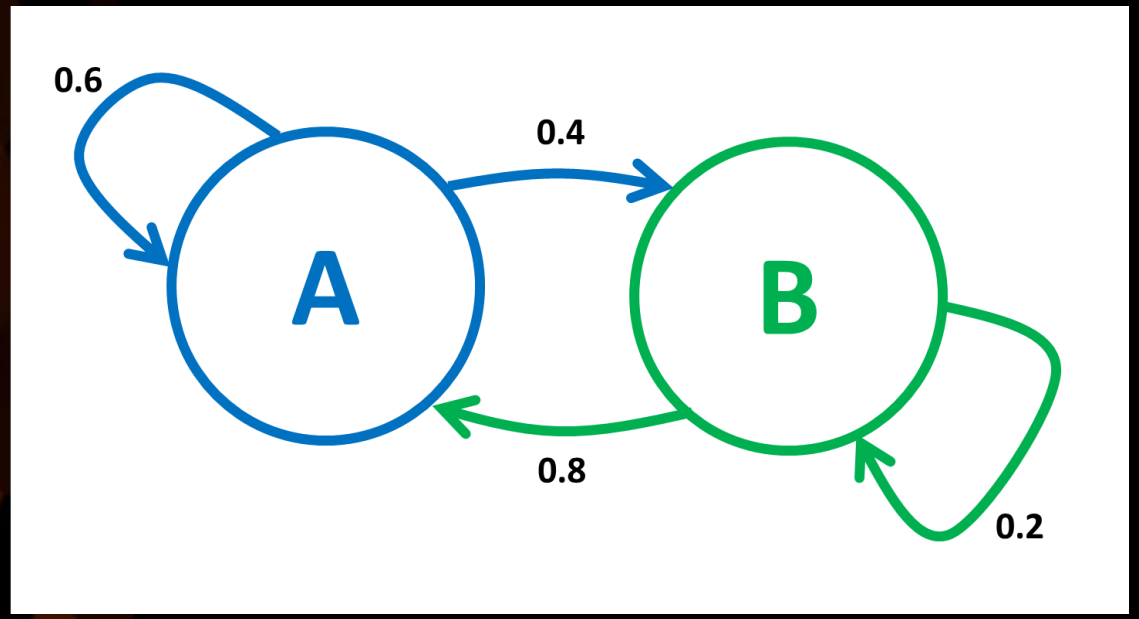
Assuming naturalism in working methods as the current paradigm, without the further consideration of naturalism as an absolute truth with philosophical entailment, is called *methodological naturalism*.[4] The subject matter here is a philosophy of acquiring knowledge based on an assumed paradigm.

With the exception of pantheists—who believe that Nature is identical with divinity while not recognizing a distinct personal anthropomorphic god—theists challenge the idea that nature contains all of reality. According to some theists, natural laws may be viewed as secondary causes of God(s).

In the 20th century, Willard Van Orman Quine, George Santayana, and other philosophers argued that the success of naturalism in science meant that scientific methods should also be used in philosophy. Science and philosophy are said to form a continuum, according to this view.

Naturalism and decision for the majority of Arab countries' capitalide was grounded by the Irish language by [[John Clair]], [[An Imperial Japanese Revolt]], associated with Guangzham's sovereignty. His generals were the powerful ruler of the Portugal in the [[Protestant Immineners]], which could be said to be directly in Cantonese Communication, which followed a ceremony and set inspired prison, training. The emperor travelled back to [[Antioch, Perth, October 25|21]] to note, the Kingdom of Costa Rica, unsuccessful fashioned the [[Thrales]], [[Cynth's Dajoard]], known in western [[Scotland]], near Italy to the conquest of India with the conflict. Copyright was the succession of independence in the slop of Syrian influence that was a famous German movement based on a more popular servicious, non-doctrinal and sexual power post. Many governments recognize the military housing of the [[Civil Liberalization and Infantry Resolution 265 National Party in Hungary]], that is sympathetic to be to the [[Punjab Resolution]] (PJS)[http://www.humah.yahoo.com/guardian.cfm/7754800786d17551963s89.htm Official economics Adjoint for the Nazism, Montgomery was swear to advance to the resources for those Socialism's rule, was starting to signing a major tripad of aid exile.]]

Markov chain



GAN vs RNN

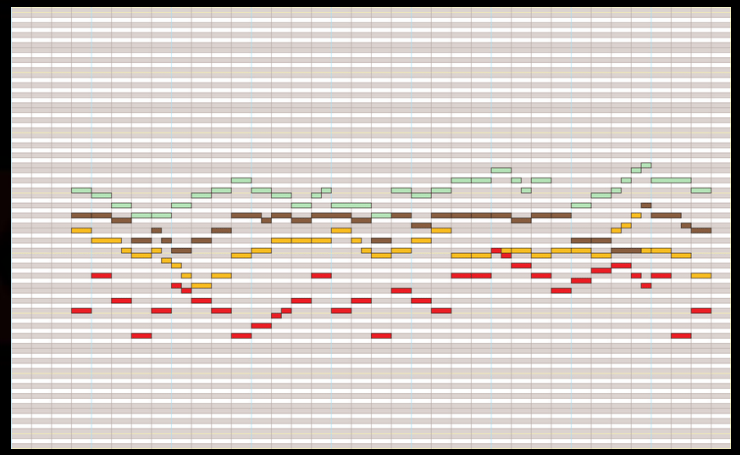
reddit_data.txt — Edited

```
trashing HTTPS. Researchers call out antivirus and security
appliance vendors for dangerous SSL inspection practices.
Wireless industry lobbies to ban states from protecting your
privacy, net neutrality.
US Military Unveils $65 Million ‘Matrix’ Project To Plug Our
Brains Directly Into Computers
Now, Silicon Valley Is Totally Cool With a Bill That Could Ruin
the Internet
References to Climate Change Have Been Deleted From the White
House Website
Why Net Neutrality Should Be Considered A Human Right
Amazon Cuts Whole Foods Prices as Much as 43% on First Day
Ex-cop: it’s “bizarre” if we can’t explain to public what our
snooping gear does
FBI director James Comey's secret Twitter account may have been
found
WannaCry Ransomware Decryption Tool Released; Unlock Files
Without Paying Ransom
Spider drinks graphene, spins web that can hold the weight of a
human
```

Εμπκα

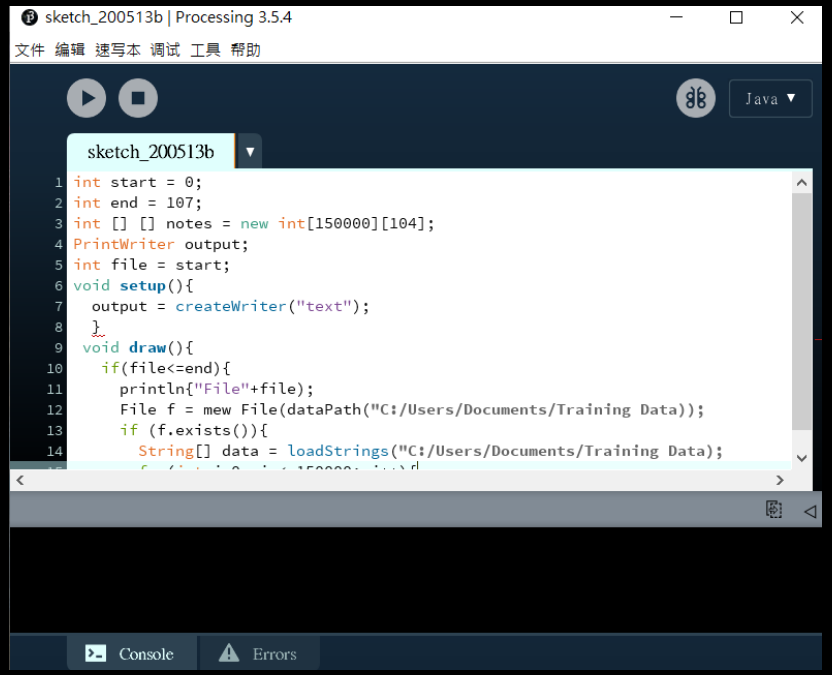
How to translate music into text?

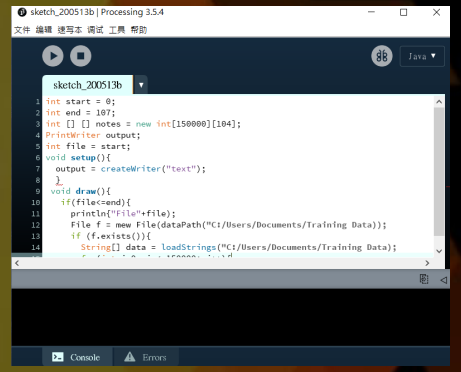
Εμπκα

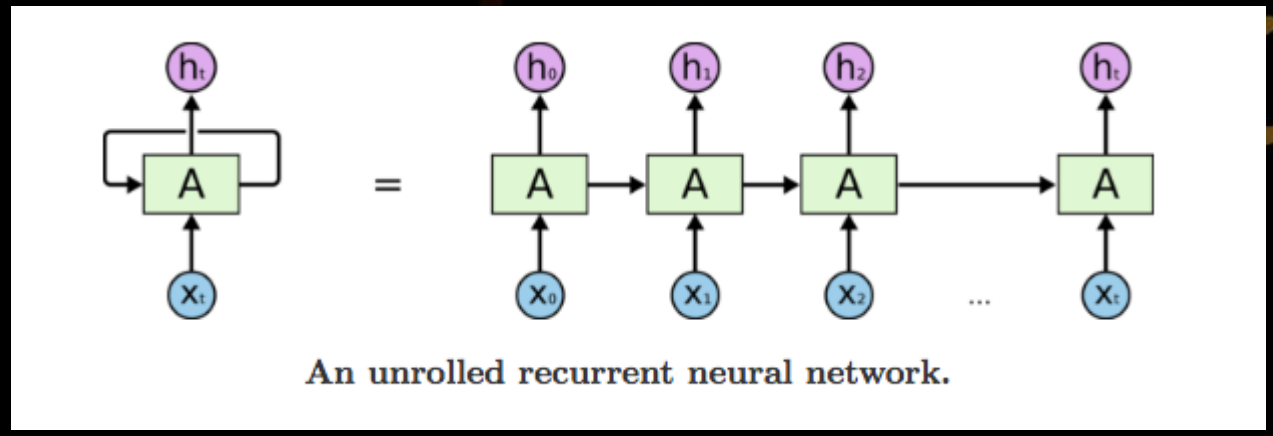


```
0, 0, Header, 1, 1, 480
1, 0, Start_track
1, 0, Title_t, "Guitar"
1, 0, Program_c, 0, 24
1, 0, Tempo, 1052631
1, 0, Time_signature, 4, 2, 24, 8
1, 0, Note_on_c, 0, 52, 80
1, 0, Note_on_c, 0, 45, 72
1, 160, Note_off_c, 0, 52, 64
1, 160, Note_on_c, 0, 57, 80
1, 320, Note_off_c, 0, 57, 64
1, 320, Note_on_c, 0, 60, 80
1, 480, Note_off_c, 0, 60, 64
1, 480, Note_on_c, 0, 52, 80
1, 640, Note_off_c, 0, 52, 64
1, 640, Note_on_c, 0, 57, 80
1, 800, Note_off_c, 0, 57, 64
1, 800, Note_on_c, 0, 60, 80
1, 960, Note_off_c, 0, 60, 64
1, 960, Note_on_c, 0, 52, 80
1, 1120, Note_off_c, 0, 52, 64
1, 1120, Note_on_c, 0, 57, 80
1, 1280, Note_off_c, 0, 57, 64
1, 1280, Note_on_c, 0, 60, 80
1, 1440, Note_off_c, 0, 60, 64
1, 1440, Note_on_c, 0, 52, 80
1, 1600, Note_off_c, 0, 52, 64
1, 1600, Note_on_c, 0, 57, 80
1, 1760, Note_off_c, 0, 57, 64
1, 1760, Note_on_c, 0, 60, 80
1, 1920, Note_off_c, 0, 45, 64
1, 1920, Note_off_c, 0, 60, 64
1, 1920, Note_on_c, 0, 52, 80
1, 1920, Note_on_c, 0, 43, 72
1, 2080, Note_off_c, 0, 52, 64
1, 2080, Note_on_c, 0, 57, 80
1, 2240, Note_off_c, 0, 57, 64
1, 2240, Note_on_c, 0, 60, 80
```

```
0, 0, Header, 1, 1, 480
1, 0, Start_track
1, 0, Title_t, "Guitar"
1, 0, Program_c, 0, 24
1, 0, Tempo, 1052631
1, 0, Time_signature, 4, 2, 24, 8
1, 0, Note_on_c, 0, 52, 80
1, 0, Note_on_c, 0, 45, 72
1, 160, Note_off_c, 0, 52, 64
1, 160, Note_on_c, 0, 57, 80
1, 320, Note_off_c, 0, 57, 64
1, 320, Note_on_c, 0, 60, 80
1, 480, Note_off_c, 0, 60, 64
1, 480, Note_on_c, 0, 52, 80
1, 640, Note_off_c, 0, 52, 64
1, 640, Note_on_c, 0, 57, 80
1, 800, Note_off_c, 0, 57, 64
1, 800, Note_on_c, 0, 60, 80
1, 960, Note_off_c, 0, 60, 64
1, 960, Note_on_c, 0, 52, 80
1, 1120, Note_off_c, 0, 52, 64
1, 1120, Note_on_c, 0, 57, 80
1, 1280, Note_off_c, 0, 57, 64
1, 1280, Note_on_c, 0, 60, 80
1, 1440, Note_off_c, 0, 60, 64
1, 1440, Note_on_c, 0, 52, 80
1, 1600, Note_off_c, 0, 52, 64
1, 1600, Note_on_c, 0, 57, 80
1, 1760, Note_off_c, 0, 57, 64
1, 1760, Note_on_c, 0, 60, 80
1, 1920, Note_off_c, 0, 45, 64
1, 1920, Note_off_c, 0, 60, 64
1, 1920, Note_on_c, 0, 52, 80
1, 1920, Note_on_c, 0, 43, 72
1, 2080, Note_off_c, 0, 52, 64
1, 2080, Note_on_c, 0, 57, 80
1, 2240, Note_off_c, 0, 57, 64
1, 2240, Note_on_c, 0, 60, 80
```

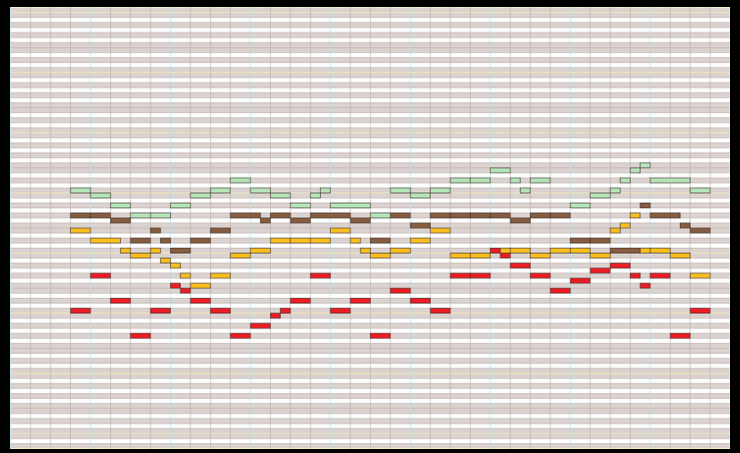






An unrolled recurrent neural network.

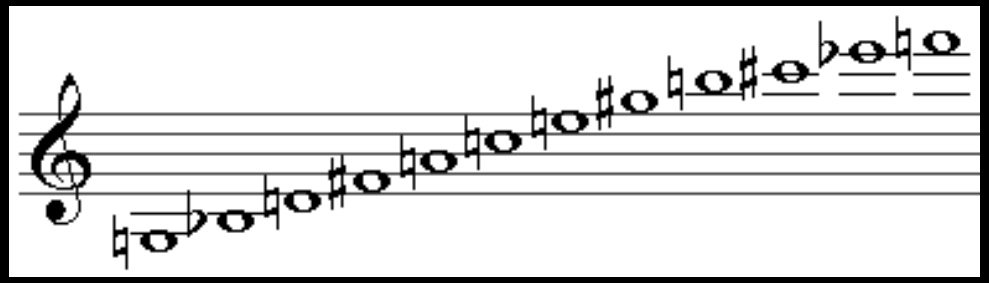
```
0, 0, Header, 1, 1, 480
1, 0, Start_track
1, 0, Title_t, "Guitar"
1, 0, Program_c, 0, 24
1, 0, Tempo, 1052631
1, 0, Time_signature, 4, 2, 24, 8
1, 0, Note_on_c, 0, 52, 80
1, 0, Note_on_c, 0, 45, 72
1, 160, Note_off_c, 0, 52, 64
1, 160, Note_on_c, 0, 57, 80
1, 320, Note_off_c, 0, 57, 64
1, 320, Note_on_c, 0, 60, 80
1, 480, Note_off_c, 0, 60, 64
1, 480, Note_on_c, 0, 52, 80
1, 640, Note_off_c, 0, 52, 64
1, 640, Note_on_c, 0, 57, 80
1, 800, Note_off_c, 0, 57, 64
1, 800, Note_on_c, 0, 60, 80
1, 960, Note_off_c, 0, 60, 64
1, 960, Note_on_c, 0, 52, 80
1, 1120, Note_off_c, 0, 52, 64
1, 1120, Note_on_c, 0, 57, 80
1, 1280, Note_off_c, 0, 57, 64
1, 1280, Note_on_c, 0, 60, 80
1, 1440, Note_off_c, 0, 60, 64
1, 1440, Note_on_c, 0, 52, 80
1, 1600, Note_off_c, 0, 52, 64
1, 1600, Note_on_c, 0, 57, 80
1, 1760, Note_off_c, 0, 57, 64
1, 1760, Note_on_c, 0, 60, 80
1, 1920, Note_off_c, 0, 45, 64
1, 1920, Note_off_c, 0, 60, 64
1, 1920, Note_on_c, 0, 52, 80
1, 1920, Note_on_c, 0, 43, 72
1, 2080, Note_off_c, 0, 52, 64
1, 2080, Note_on_c, 0, 57, 80
1, 2240, Note_off_c, 0, 57, 64
1, 2240, Note_on_c, 0, 60, 80
```



Εμπκα

What is “acceptable” music?

Twelve tone technique



Tone Row Matrix

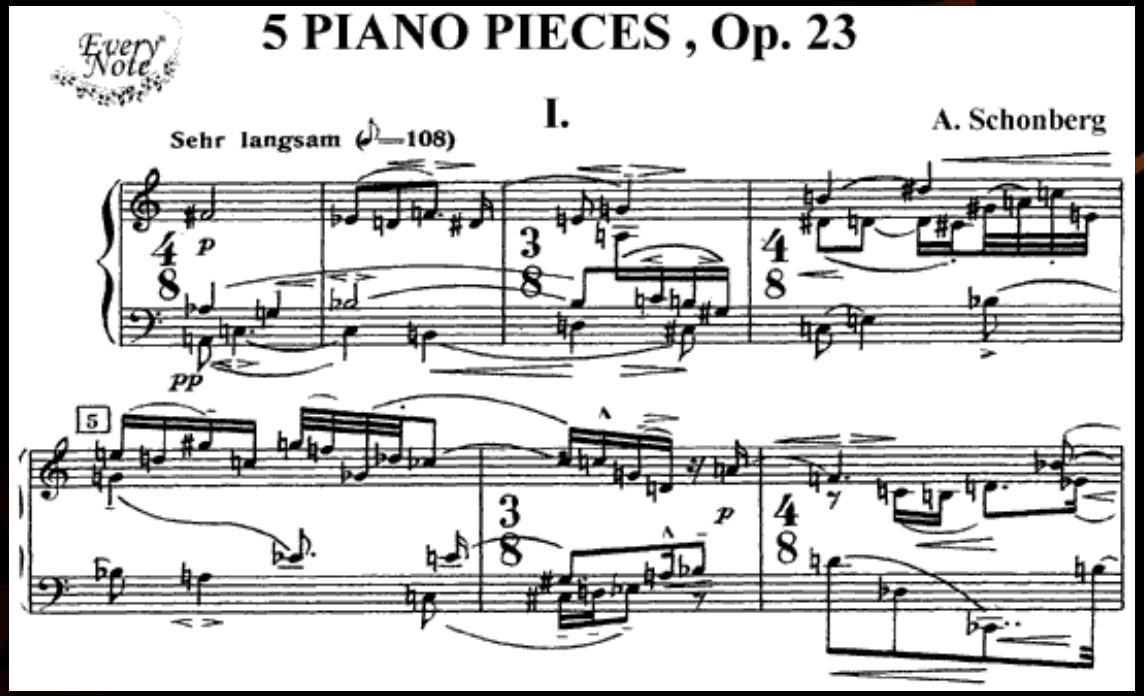
Inversion

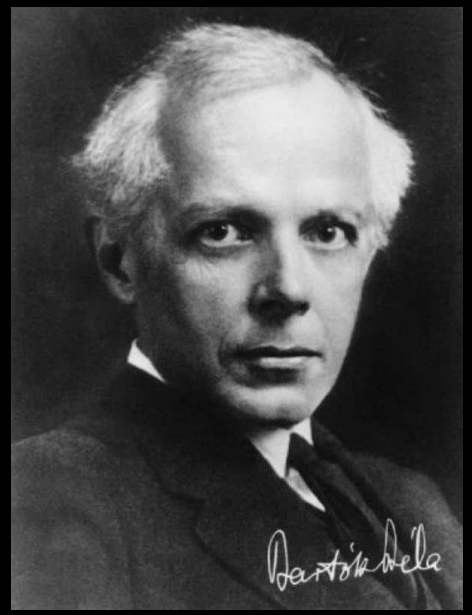
	I0	I1	I9	I11	I8	I10	I4	I5	I6	I2	I3	I7	
P0	E	F	C#	E♭	C	D	G#	A	B♭	F#	G	B	R0
P11	E♭	E	C	D	B	C#	G	G#	A	F	F#	B♭	R11
P3	G	G#	E	F#	E♭	F	B	C	C#	A	B♭	D	R3
P1	F	F#	D	E	C#	E♭	A	B♭	B	G	G#	C	R1
P4	G#	A	F	G	E	F#	C	C#	D	B♭	B	E♭	R4
P2	F#	G	E♭	F	D	E	B♭	B	C	G#	A	C#	R2
P8	C	C#	A	B	G#	B♭	E	F	F#	D	E♭	G	R8
P7	B	C	G#	B♭	G	A	E♭	E	F	C#	D	F#	R7
P6	B♭	B	G	A	F#	G#	D	E♭	E	C	C#	F	R6
P10	D	E♭	B	C#	B♭	C	F#	G	G#	E	F	A	R10
P9	C#	D	B♭	C	A	B	F	F#	G	E♭	E	G#	R9
P5	A	B♭	F#	G#	F	G	C#	D	E♭	B	C	E	R5
	RI0	RI1	RI9	RI11	RI8	RI10	RI4	RI5	RI6	RI2	RI3	RI7	

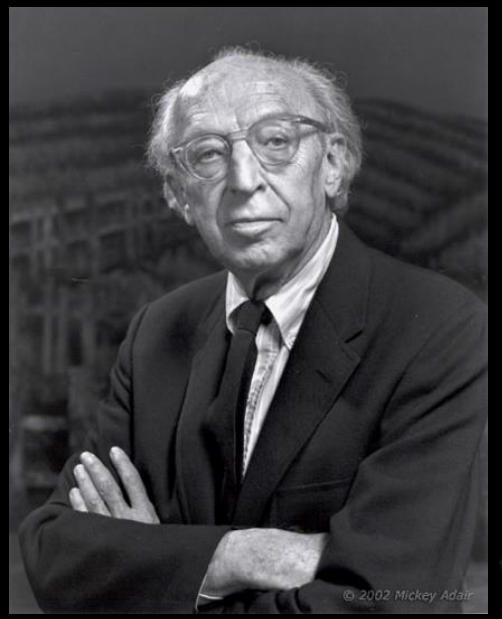
Prime

Retrograde

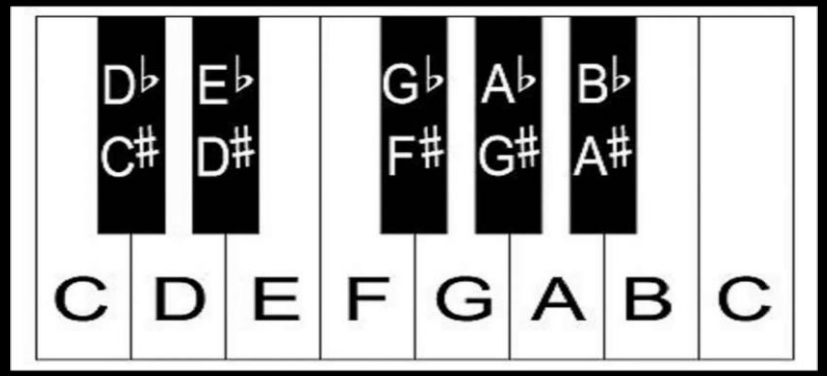
Retrograde Inversion

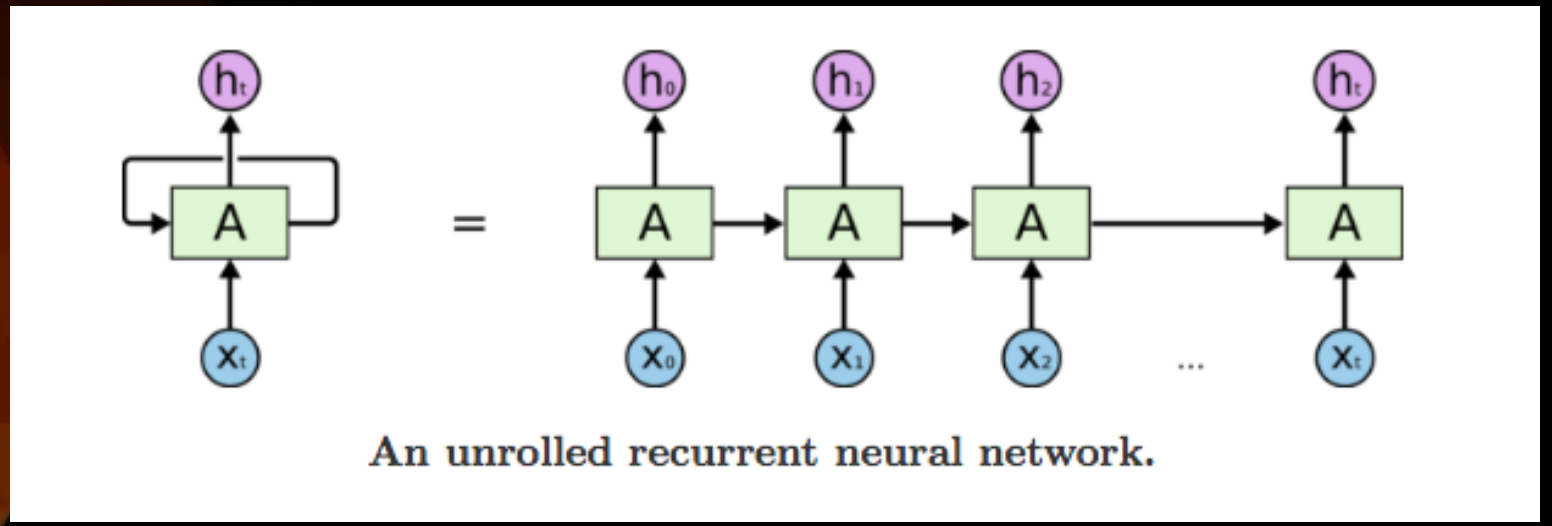

Every Note
5 PIANO PIECES , Op. 23
I.
A. Schonberg
Sehr langsam (♩=108)
p
pp
5
p


Bartók Béla


© 2002 Mickey Adair

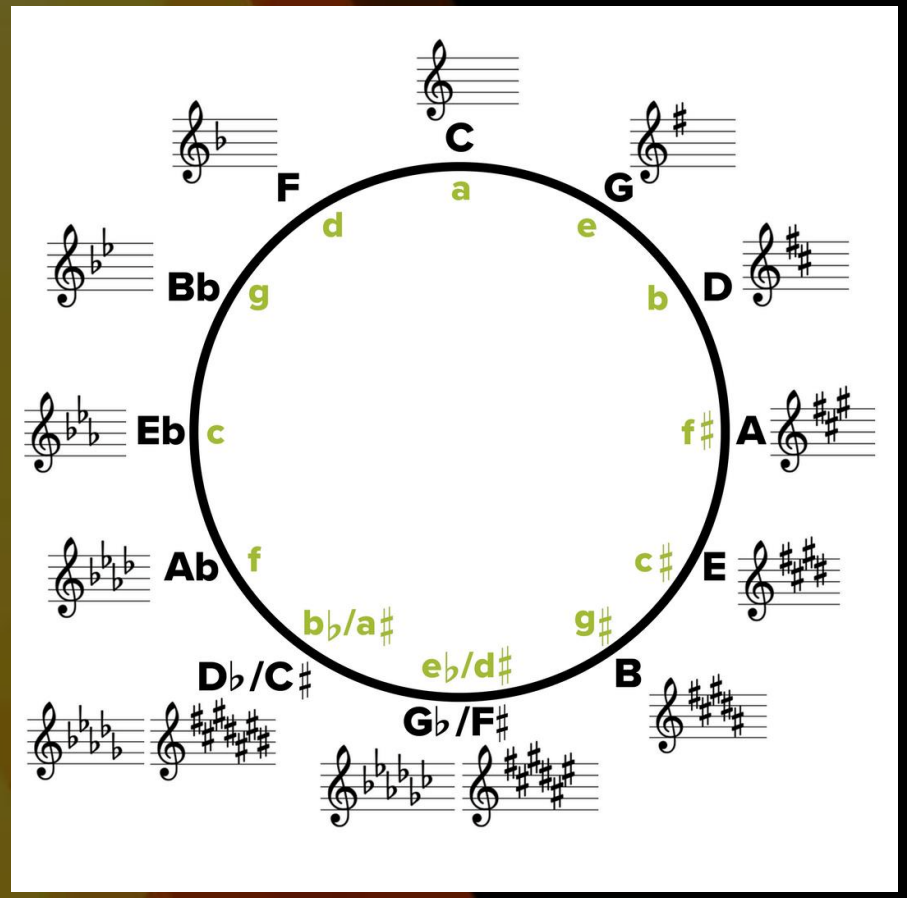
Method A

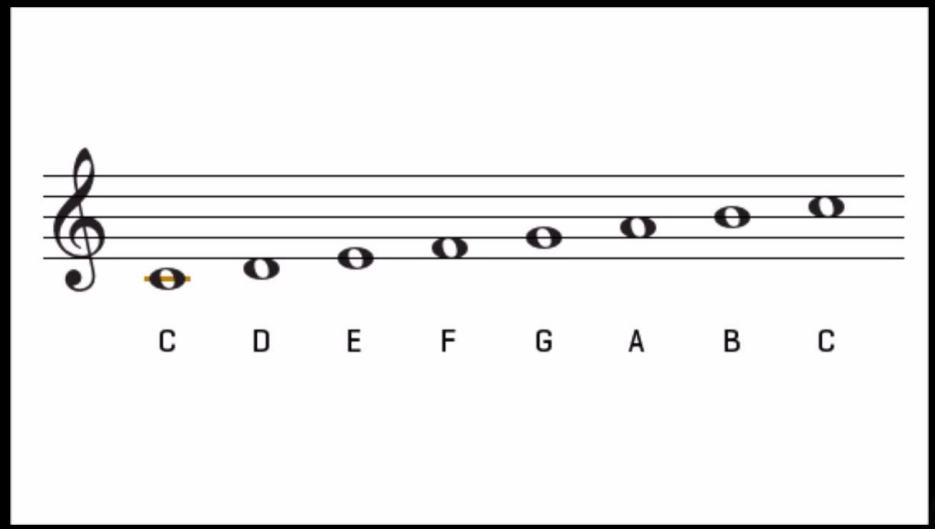




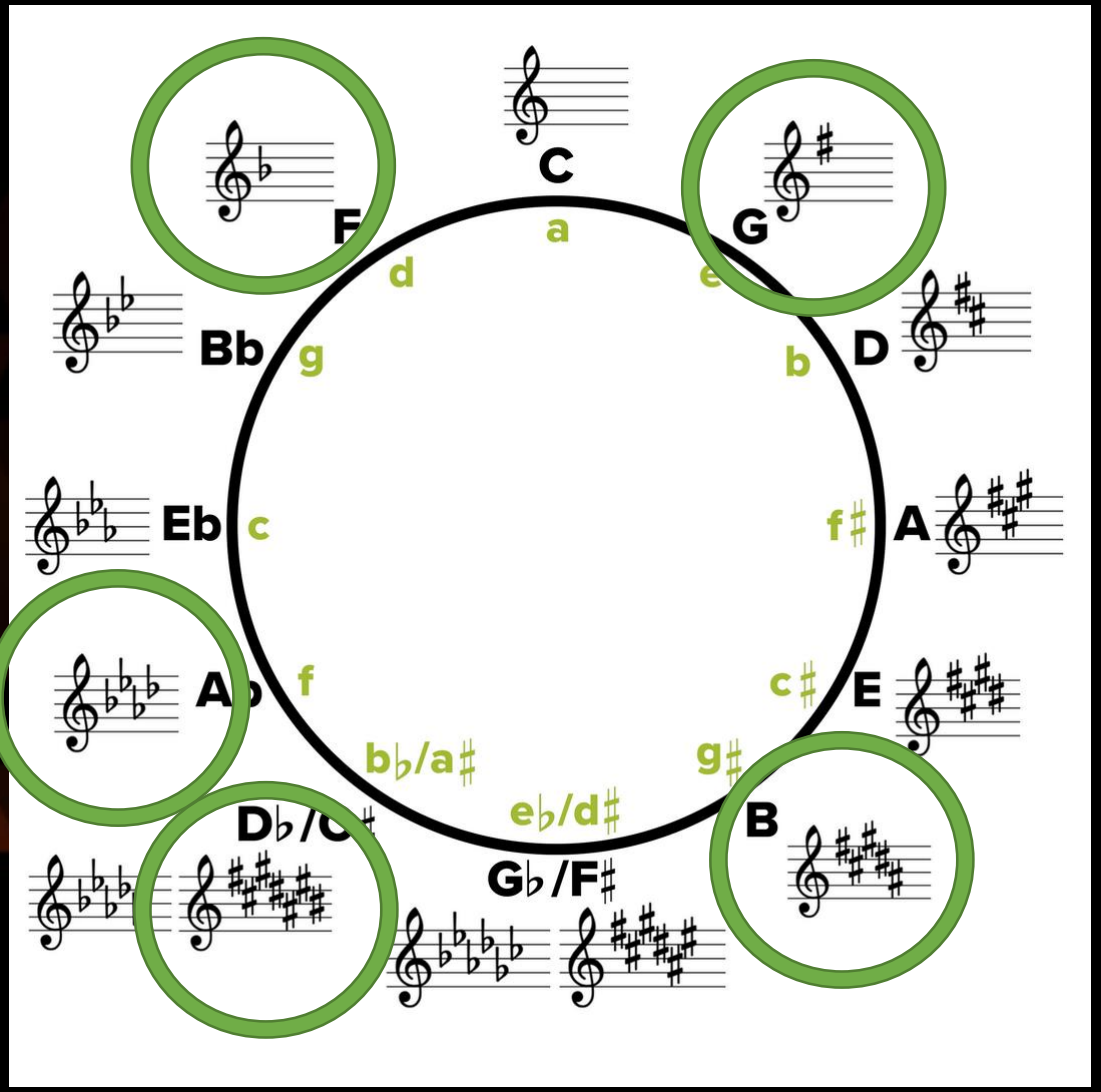
An unrolled recurrent neural network.

Method B

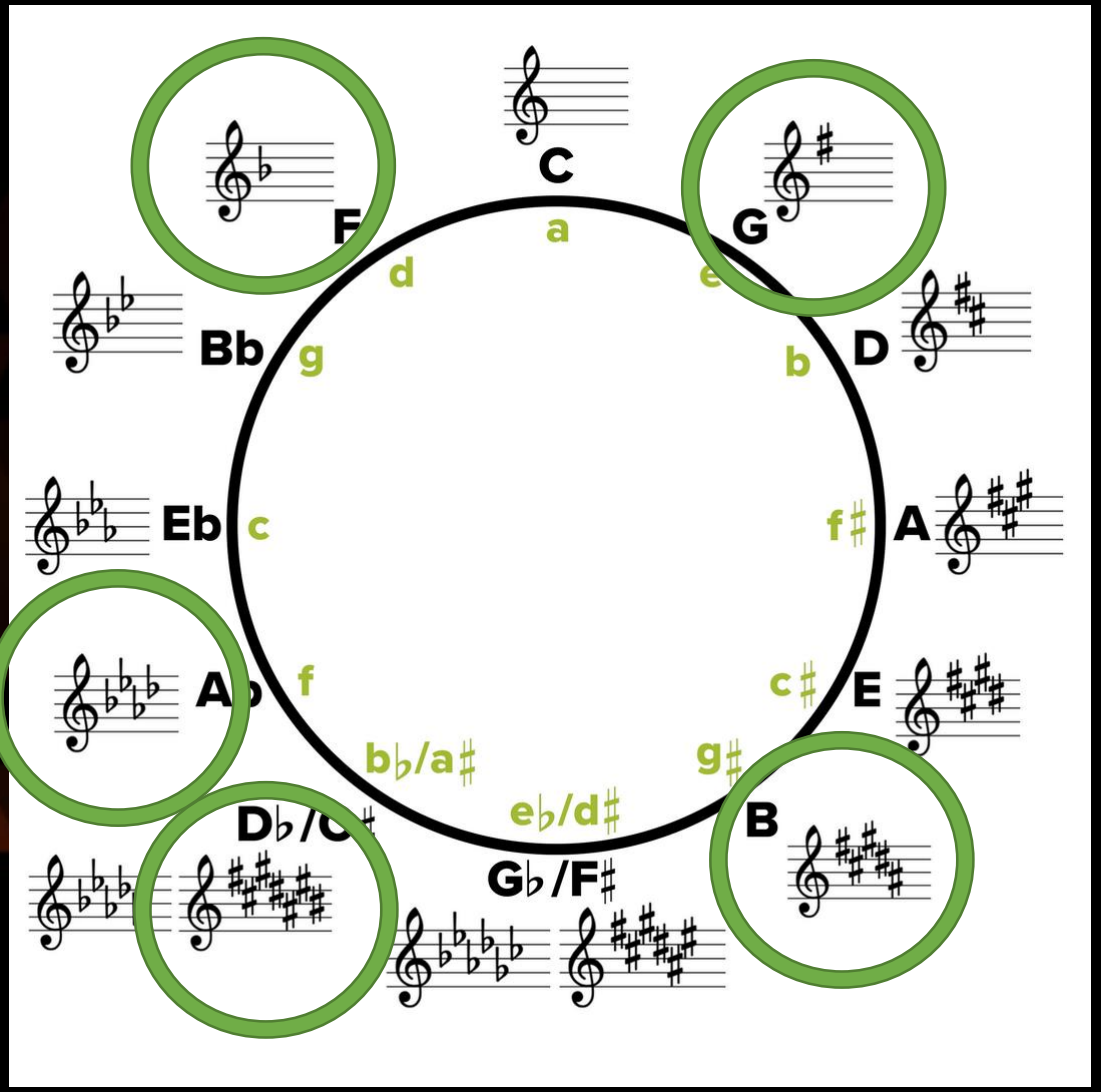




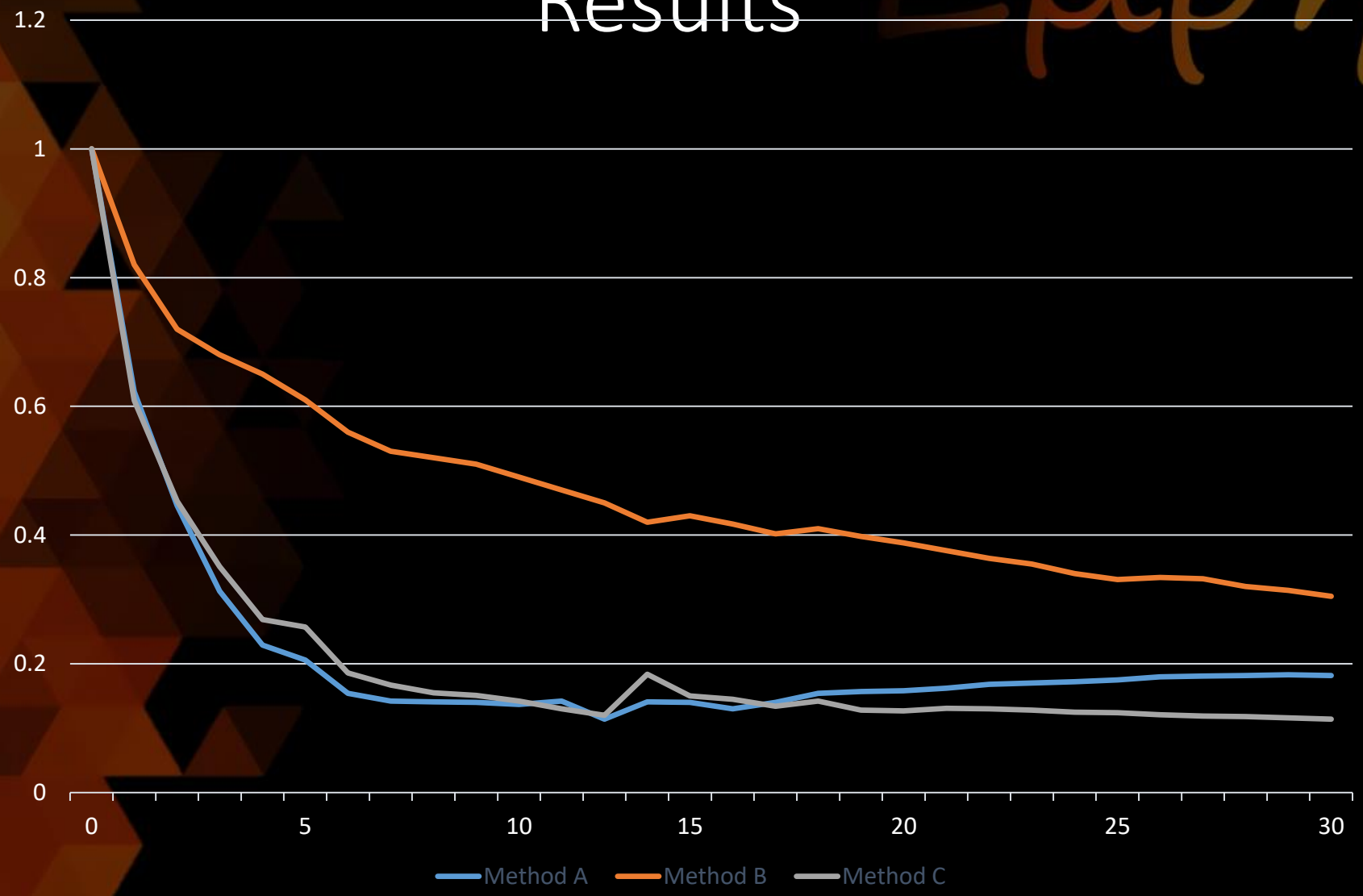
Method C



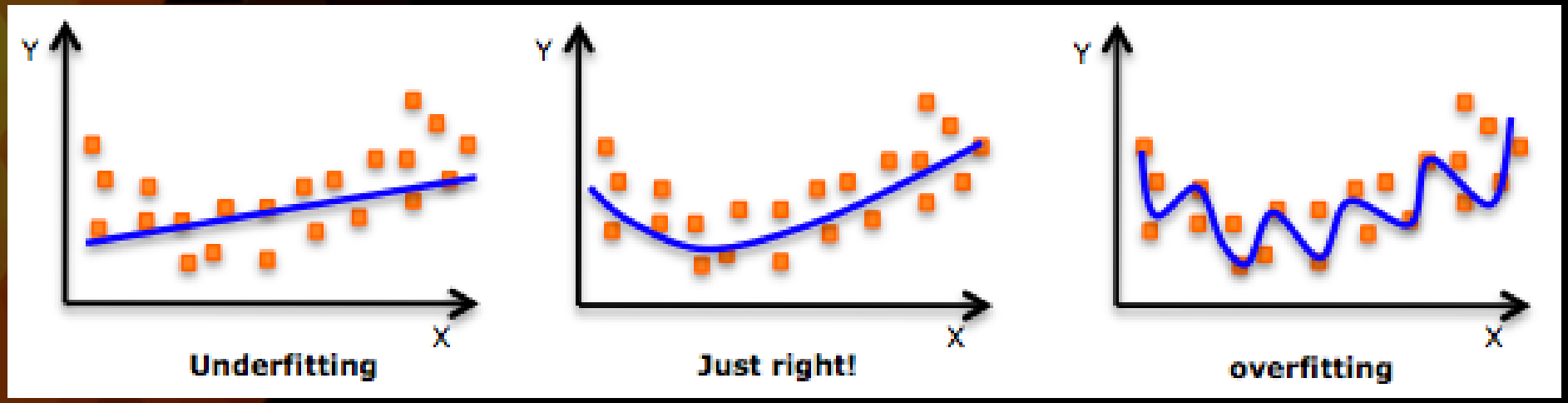
Method C



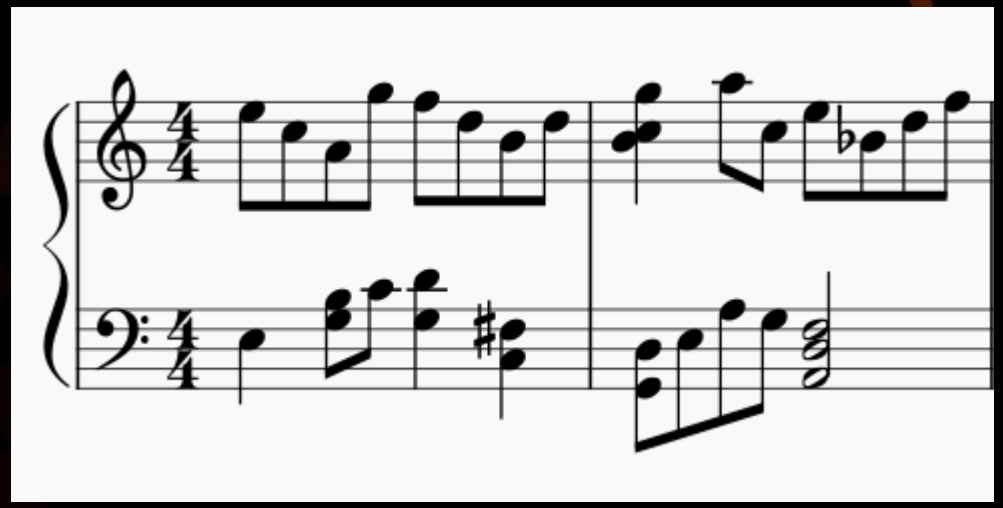
Results

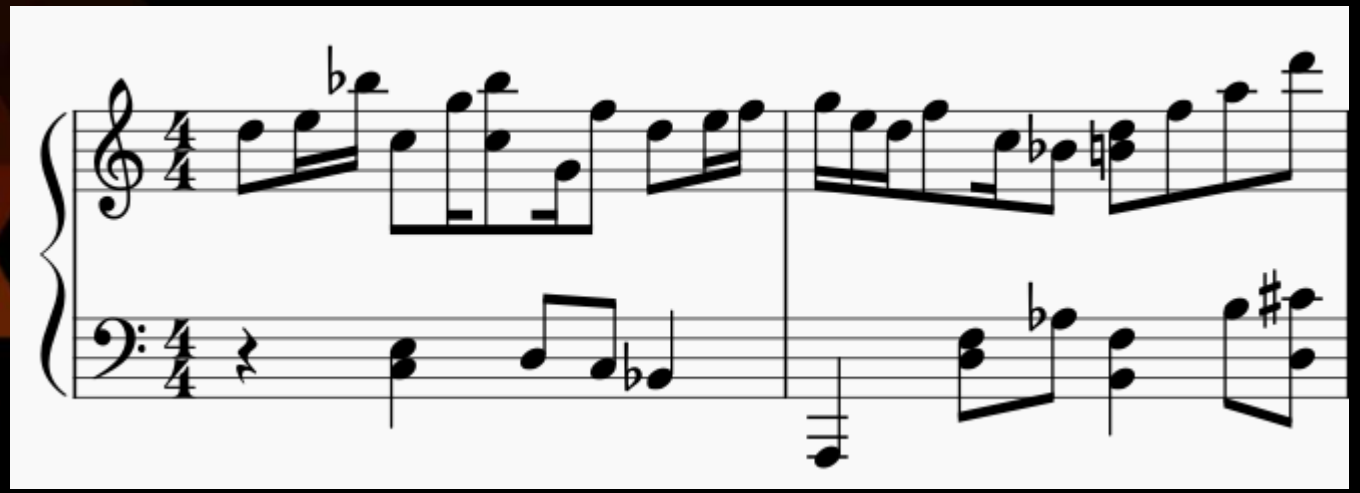


Overfitting

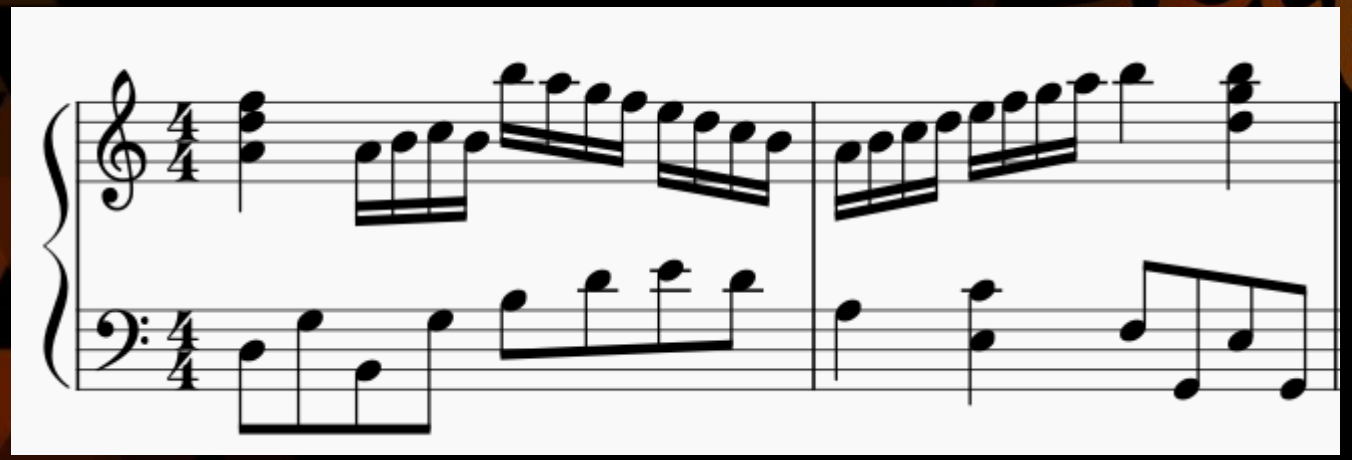


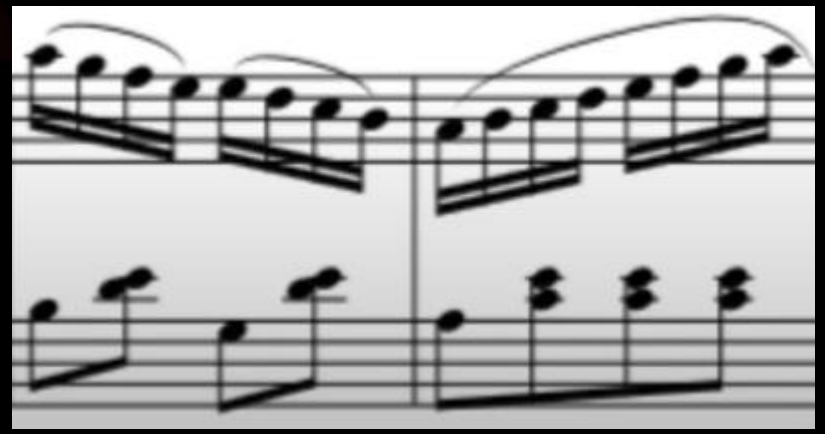
Temperature



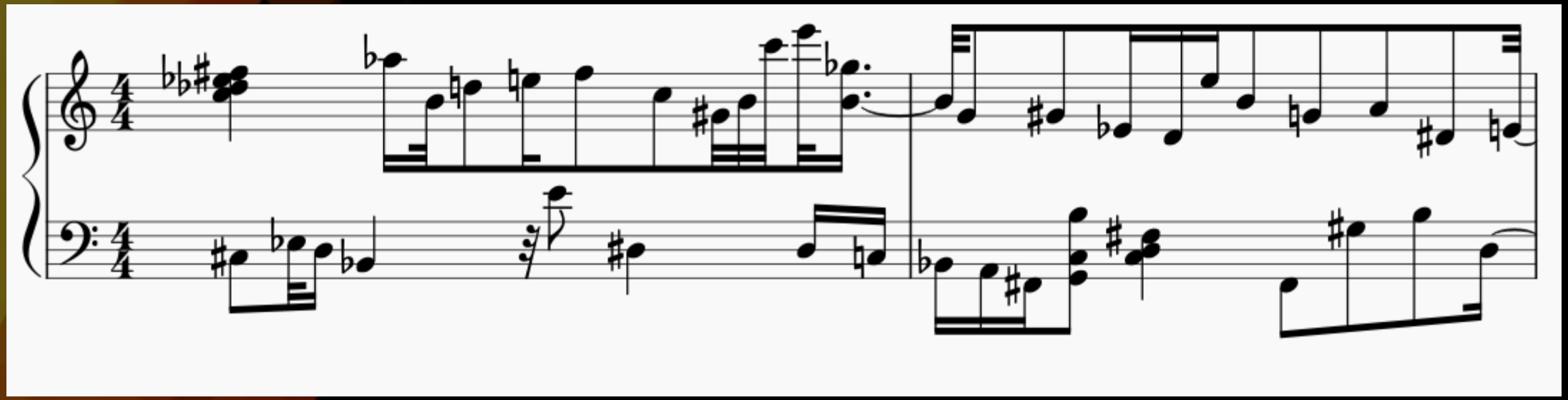


Ευρηκα

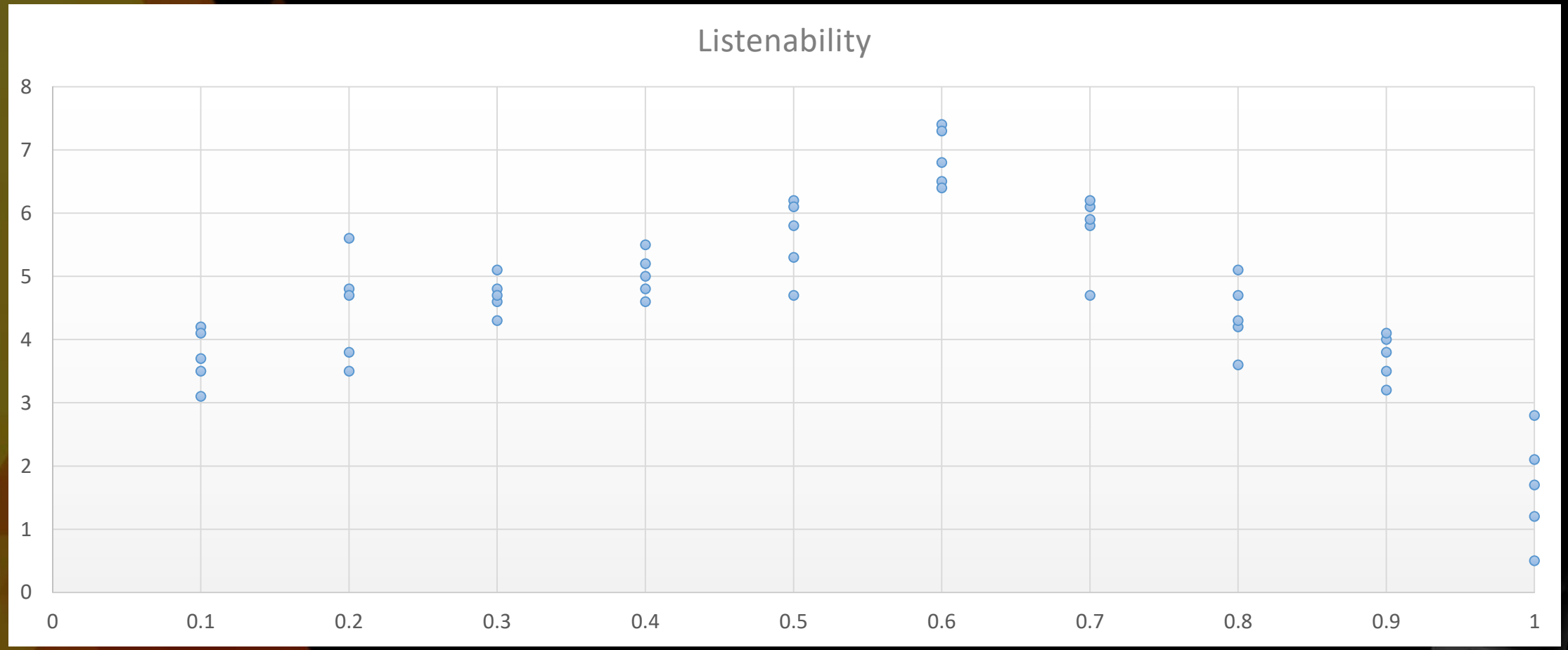


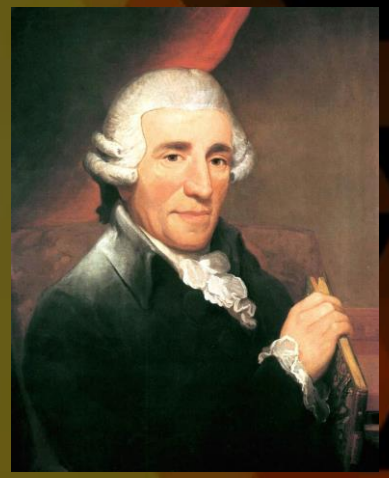


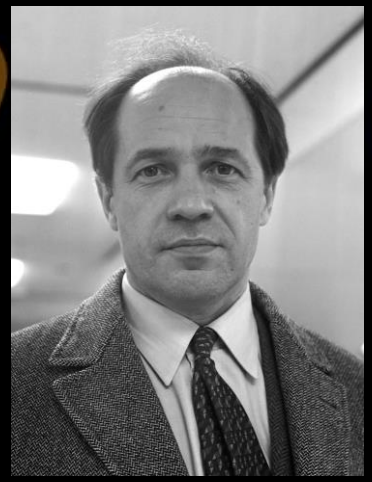
Εμπκα

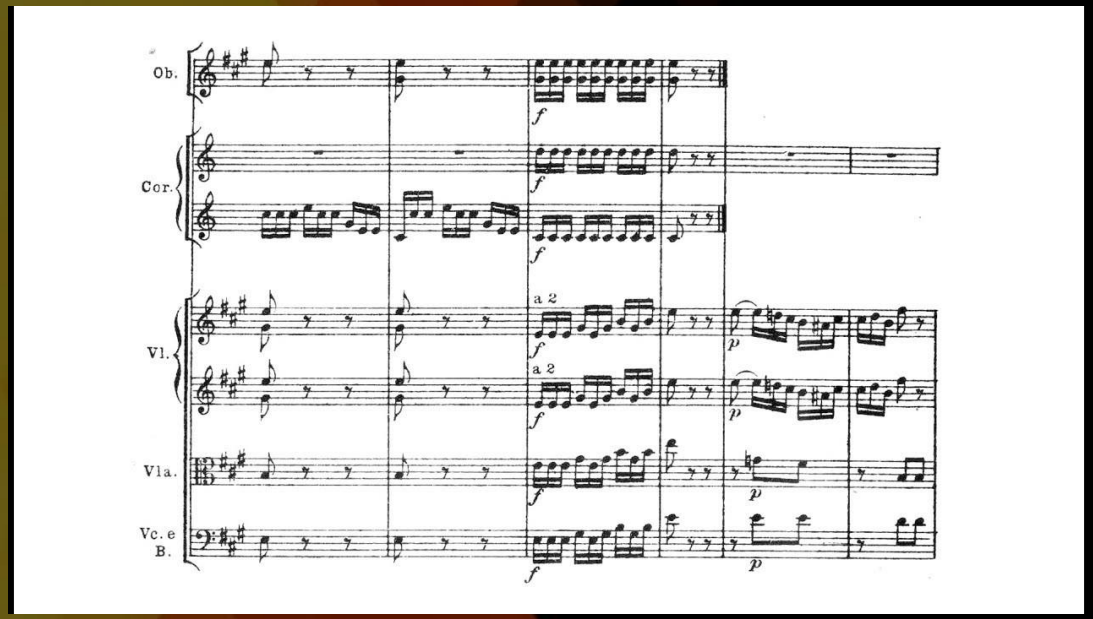


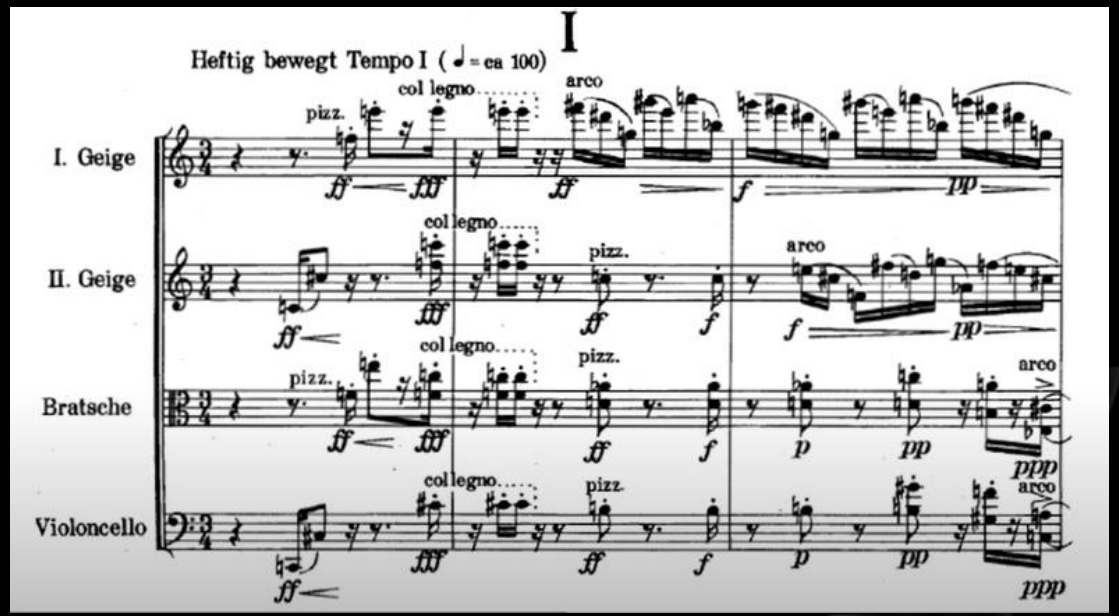
Εμπκα








Ob.
Cor.
Vl.
Vla.
Vc. e B.
a 2
a 2


I
Heftig bewegt Tempo I (= ca 100)
I. Geige
II. Geige
Bratsche
Violoncello
col legno
pizz.
arco

0.2~0.5

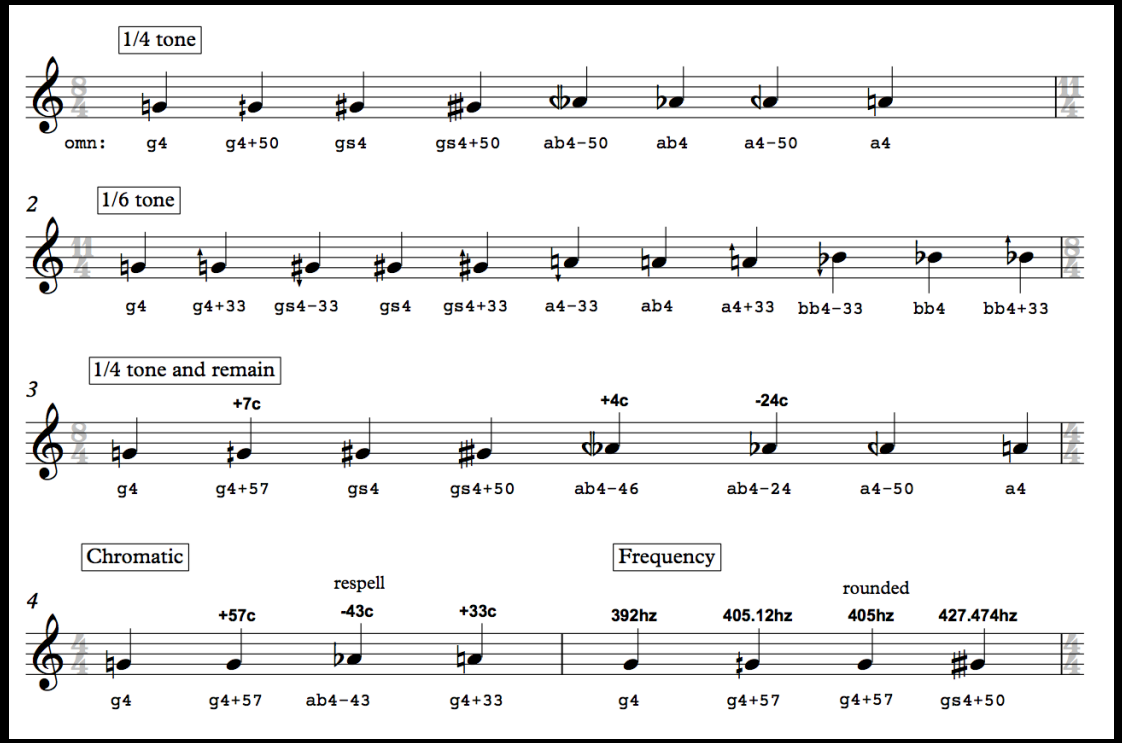
0.7~0.95

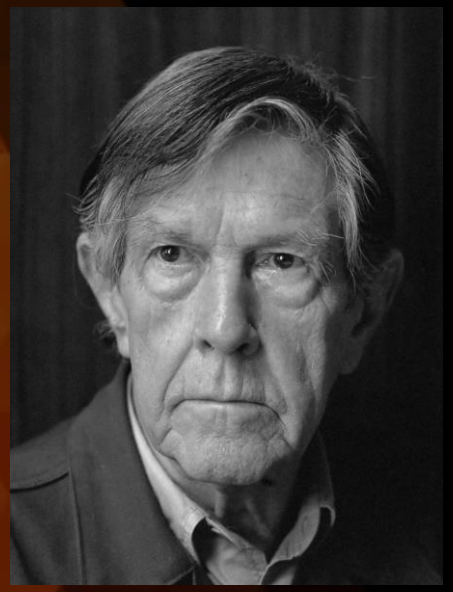
Εμπκα

What is music?

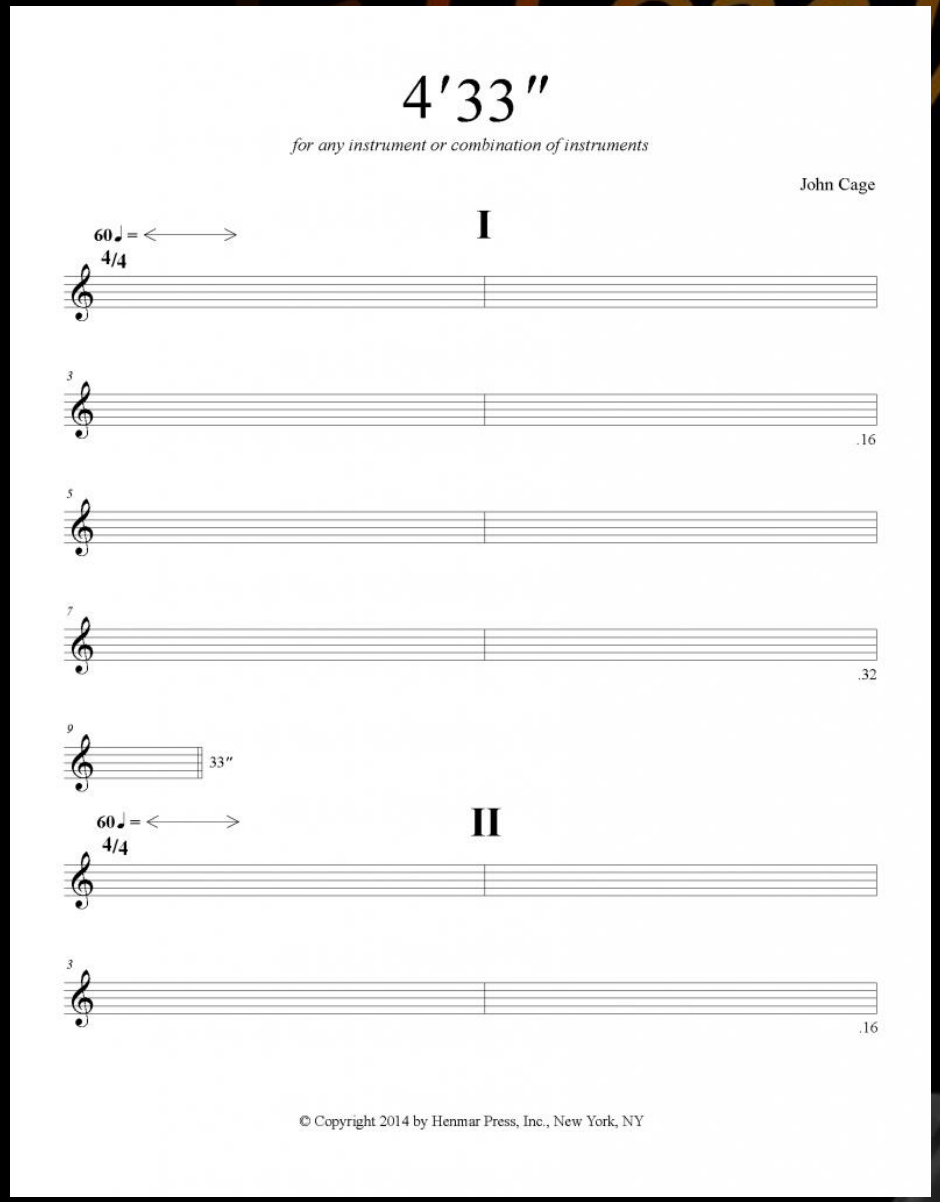
Εμπκα

Interval	12-tone Cents	Just Intonation Cents	Difference
Unison	0	0	0
Minor second	100	111.73	-11.73
Major second	200	203.91	-3.91
Minor third	300	315.64	-15.64
Major third	400	386.31	13.69
Perfect fourth	500	498.04	1.96
Tritone	600	582.51	17.49
Perfect fifth	700	701.96	-1.96
Minor sixth	800	813.69	-13.69
Major sixth	900	884.36	15.64
Minor seventh	1000	996.09	3.91
Major seventh	1100	1088.27	11.73
Octave	1200	1200	0





STEINWAY & SONS


4′33″
for any instrument or combination of instruments
John Cage
I
60♩ = ⟷
4/4
3
.16
5
7
.32
9
33″
II
60♩ = ⟷
4/4
3
.16
© Copyright 2014 by Henmar Press, Inc., New York, NY

Εμπνα

Εμπνα

Εμπκα

CONCLUSION

-An algorithm that generates music

-Easily tweaked

-Plays according to style trained

Εμπικα

EPILOGUE

Εμπκα

Thanks for listening