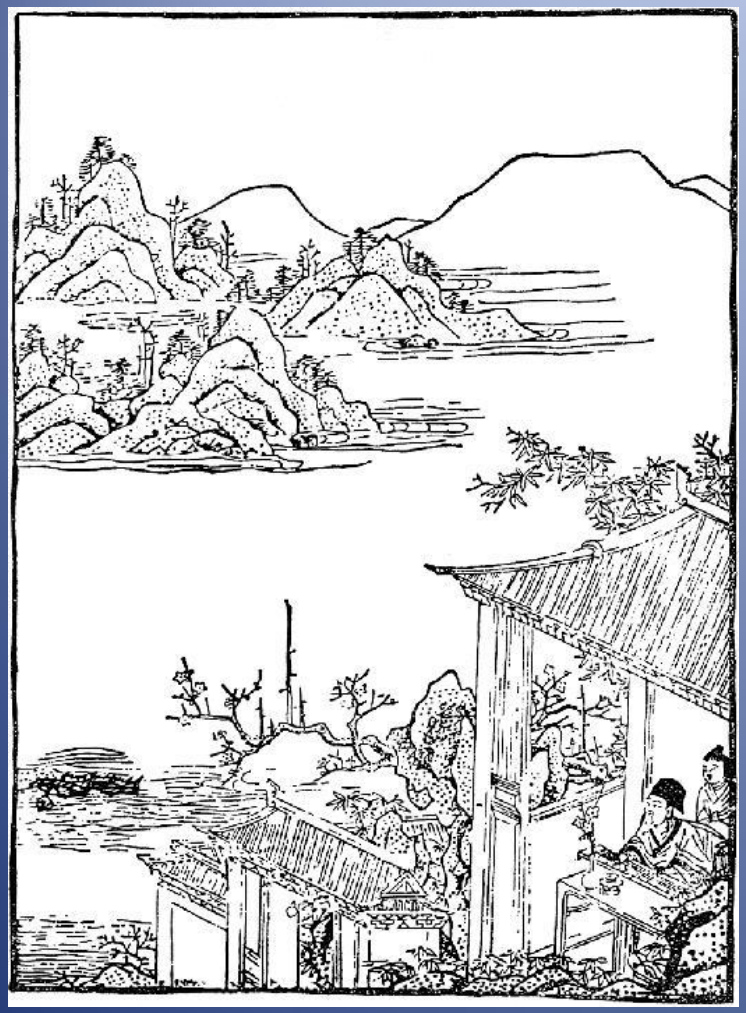
Nekaj misli o oblikovanju temeljev evropske harmonije v glasbi

DMFA, 4. feb. 2010



The Master instructing the grand music master of Lu said, "How to play music may be known. At the commencement of the piece, all the parts should sound together. As it proceeds, they should be in harmony while severally distinct and flowing without break, and thus on to the conclusion." (Konfucij, *Confucian analects*, ca. 500 let pred K.)

Music and nature in harmony:

woodblock, Ming dynasty, 1368–1644; illustration to a book of poems from the Tang period, 618–907 CE

Contemporaneously with these philosophers and before them, the so-called Pythagoreans, who were the first to take up mathematics, not only advanced this study, but also having been brought up in it they thought its principles were the principles of all things. Since of these principles numbers are by nature the first, and in numbers they seemed to see many resemblances to the things that exist and come into being-more than in fire and earth and water (such and such a modification of numbers being justice, another being soul and reason, another being opportunity-and similarly almost all other things being numerically expressible); **since, again, they saw that the modifications and the ratios of the musical scales were expressible in numbers; since, then, all other things seemed in their whole nature to be modelled on numbers, and numbers seemed to be the first things in the whole of nature, they supposed the elements of numbers to be the elements of all things, and the whole heaven to be a musical scale and a number.** And all the properties of numbers and scales which they could show to agree with the attributes and parts and the whole arrangement of the heavens, they collected and fitted into their scheme; and if there was a gap anywhere, they readily made additions so as to make their whole theory coherent. E.g. as the number 10 is thought to be perfect and to comprise the whole nature of numbers, they say that the bodies which move through the heavens are ten, but as the visible bodies are only nine, to meet this they invent a tenth--the 'counter-earth'. We have discussed these matters more exactly elsewhere.
(Aristotel, *Metafizika*, 5 pog., ca. 350 pred. K.)

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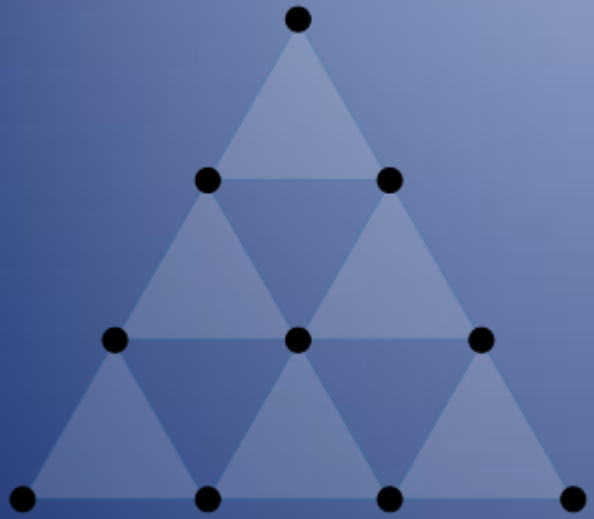
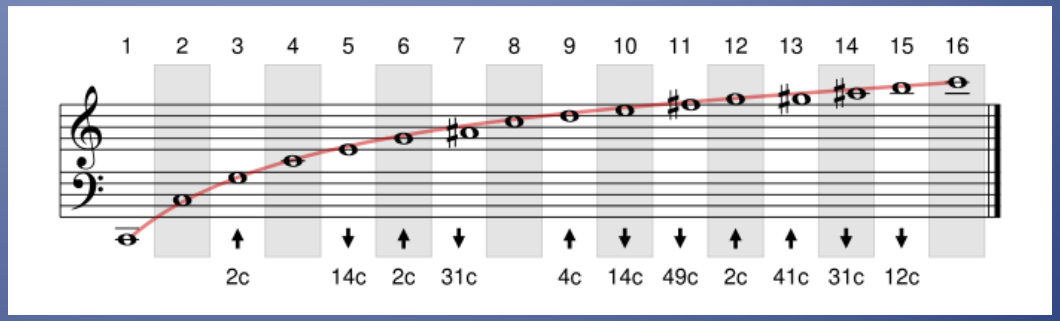
PITAGOROV TETRACTYS

“harmonia perfecta maxima”



6 : 8 = 9 : 12



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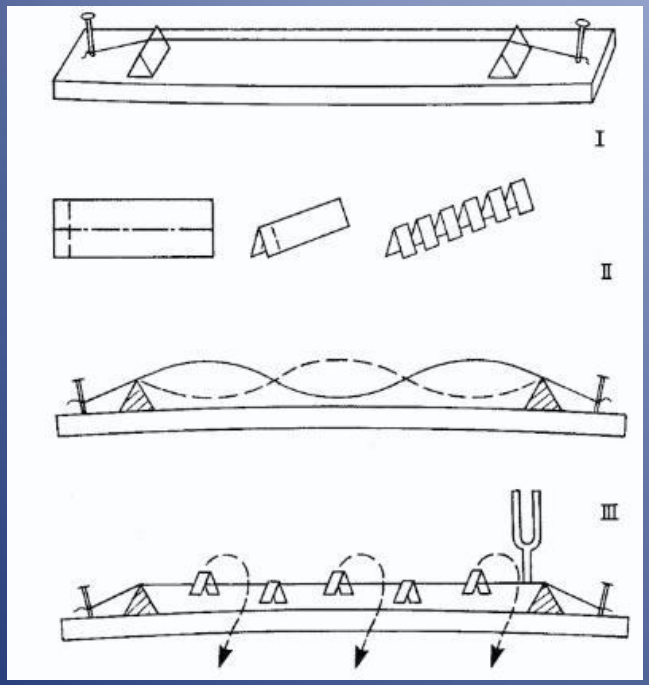
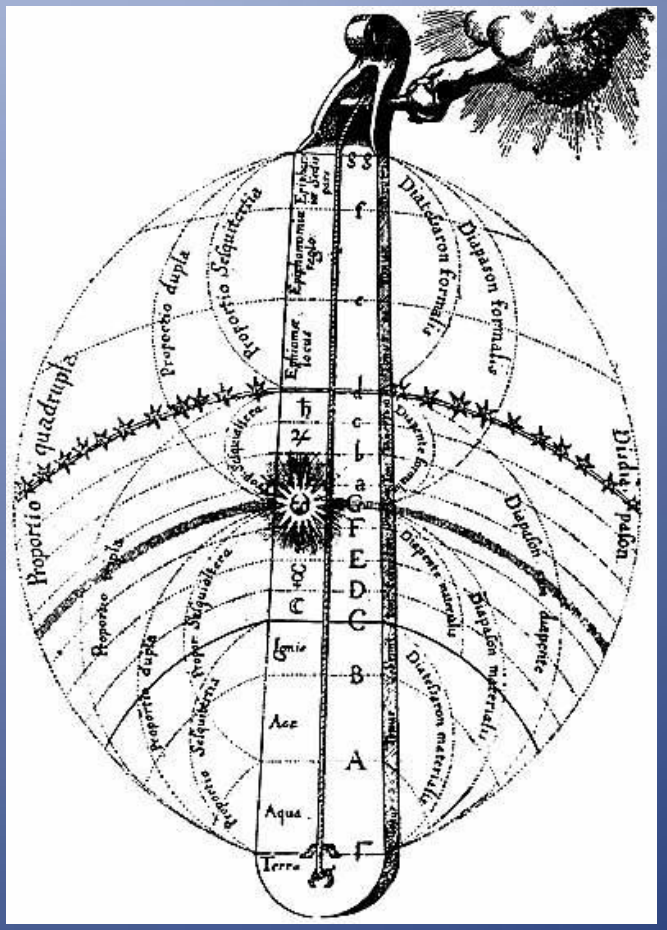
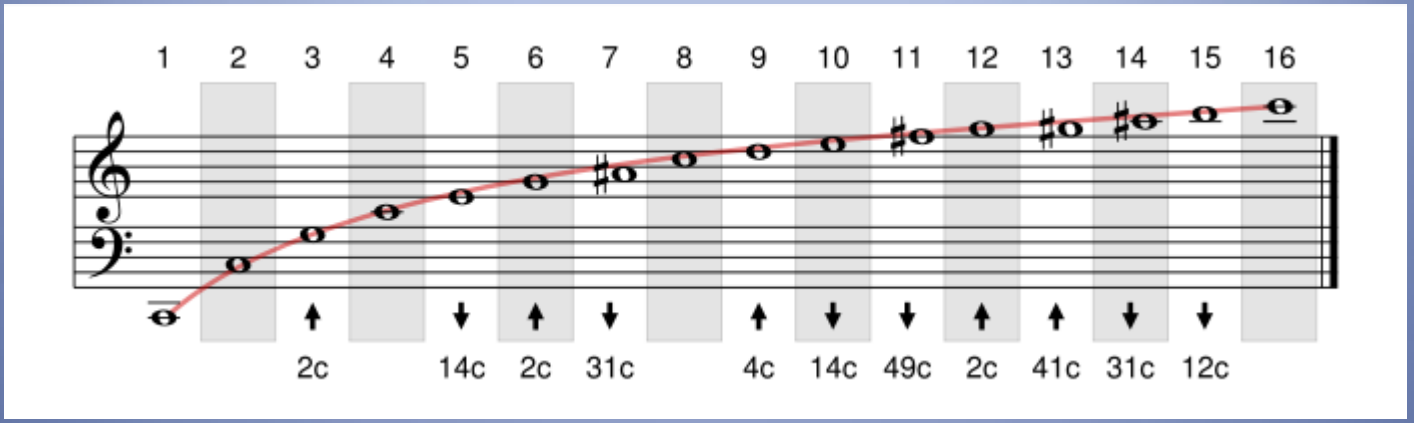
PITAGORA IN MONOKORD





(Robert Fludd's Celestial Monochord, 1618)



Številčna razmerja (proporci) in glasba (alikvoti)

1. Aritmetično razmerje [a-b = c-d]

aritmetična sredina: $n = \frac{a+b}{2}$; npr.: $3 = \frac{2+4}{2}$

2. Geometrično razmerje [a:b = c:d]

a:x = x:b, $x^2 = ab, x = \sqrt[2]{ab}$ npr.: $a = \frac{3}{2}$ $b = \frac{2}{3}$ $\sqrt[2]{1} = 1$

$\frac{3}{2}(g) : \frac{1}{1}(c) = \frac{1}{1}(c) : \frac{2}{3}(f)$

3. Harmonično razmerje [a : c = (a - b) : (b - c)]

a : b = (a - x) : (x - b), $x = \frac{2ab}{a+b}$

$\left(\frac{6}{12}(c,) - \frac{4}{12}(f,,)\right) : \left(\frac{4}{12}(f,,) - \frac{3}{12}(c,,)\right) = \frac{6}{12}(c,) : \frac{3}{12}(c,,)$

tp://hanskayser.com/EZ/kayser2/kayser2/index.php

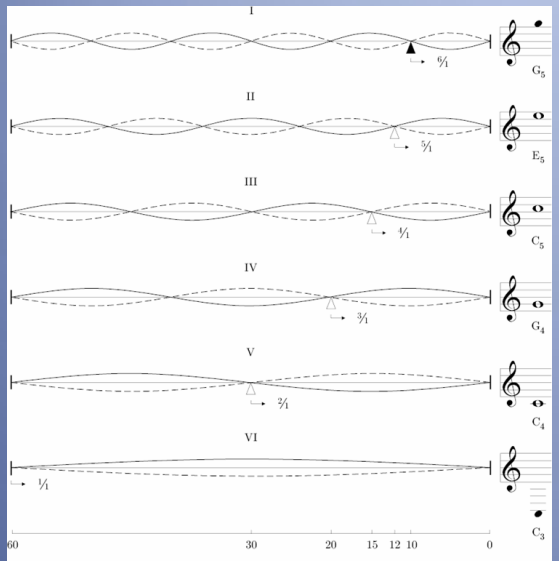
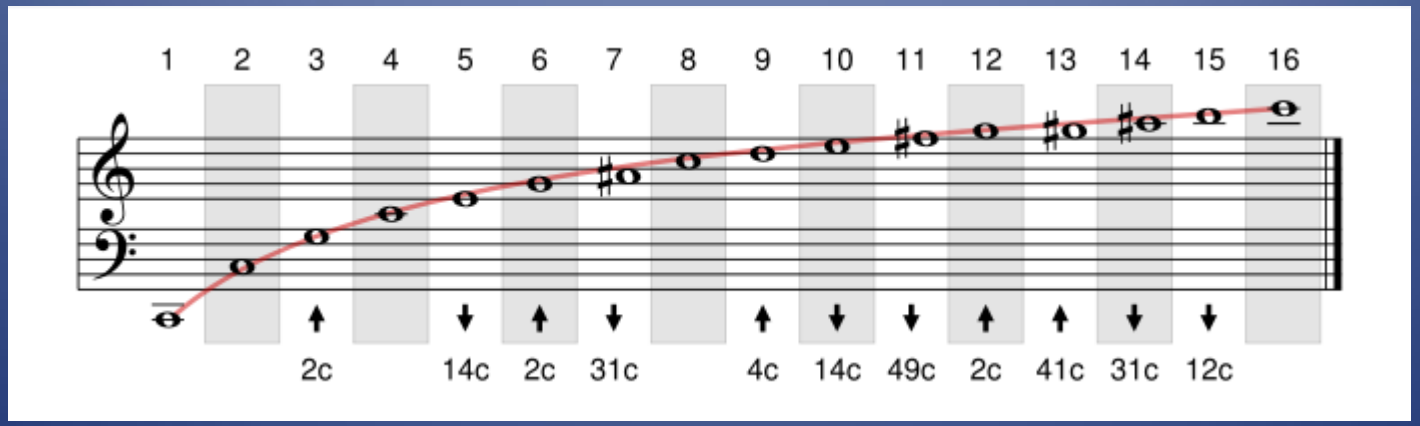


Figure 10.40 The division of the "double-octave and a fifth" into *four harmonic means* according to Stifel (1544). When we play this harmonic division of length ratio $^6/_1$ in ascending order, Strings III–I sound the C-major triad: C–E–G. In the *Istitutioni harmoniche* (1573), Prima Parte, Cap. 40, Zarlino fails to acknowledge the mathematical and musical significance of Stifel's harmonic division of length ratio $^6/_1$ in the context of demonstrating the *Scenario* on canon strings.



ZGODOVINA HARMONIJE

KATEGORIJE PERCEPCIJE TONSKIH VIŠIN

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VEČGLASJE IN VRSTE VEČGLASIJ

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INTERVALNA HARMONIJA												

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03 HAEC DIES

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AKORDIČNA / MODALNA / KOORDINATIVNA HARMONIJA				AKORDIČNA / TONALNA / SUBORDINATIVNA HARMONIJA							HARMONIJA VSEH VRST PROSTE VERTIKALNE KONSTRUKCIJE NETONSKA GLASBA		

05 DUFAY CHRISTE, REDEMPTOR

06 GALLUS ECCE QUOMODO MORITUR IUSTUS

NASTANEK EVROPSKE AKORDIČNE HARMONIJE

PROBLEM UGLASITVE VERTIKALE – GALLUS V RAZLIČNIH INTONACIJAH

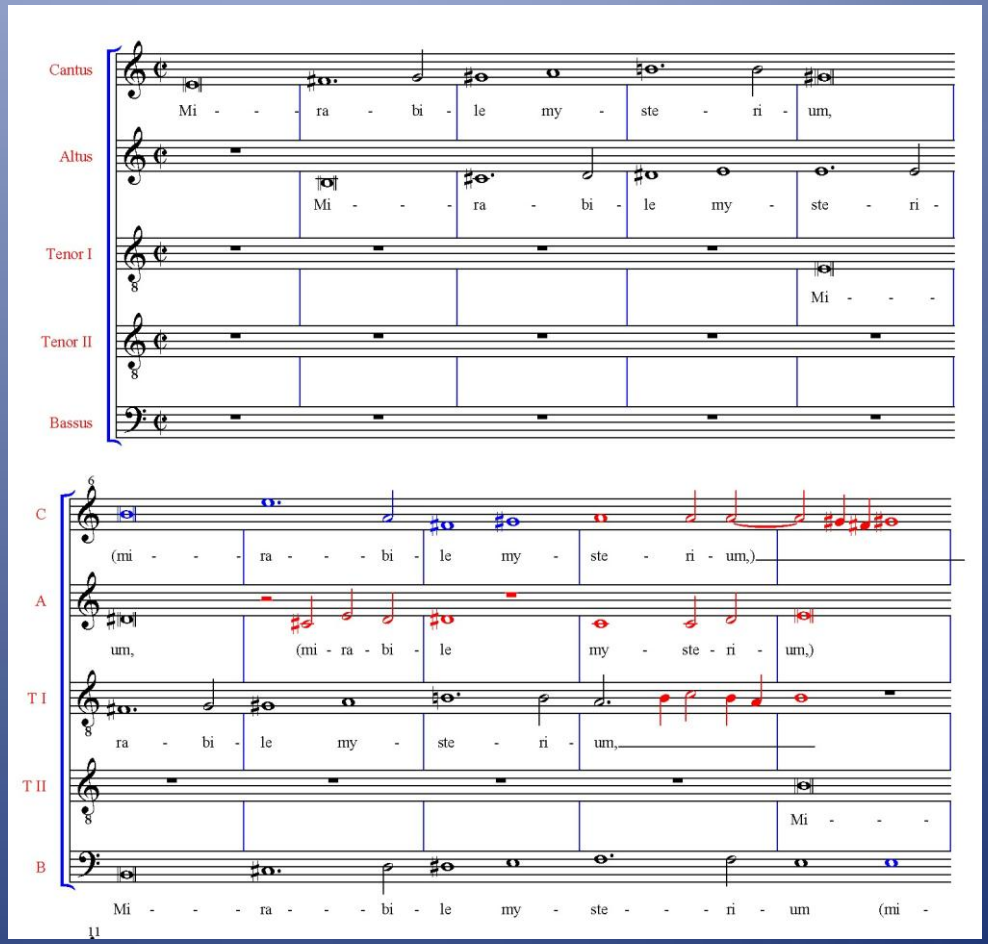
07 MIRABILE MYSTERIUM NARAVNA

08 MIRABILE MYSTERIUM PITAGOREJSKA (NARAVNA)

09 MIRABILE MYSTERIUM PITAGOREJSKA

10 MIRABILE MYSTERIUM WERCKMEISTER III

11 MIRABILE MYSTERIUM ENOLIČNA TEMPERATURA

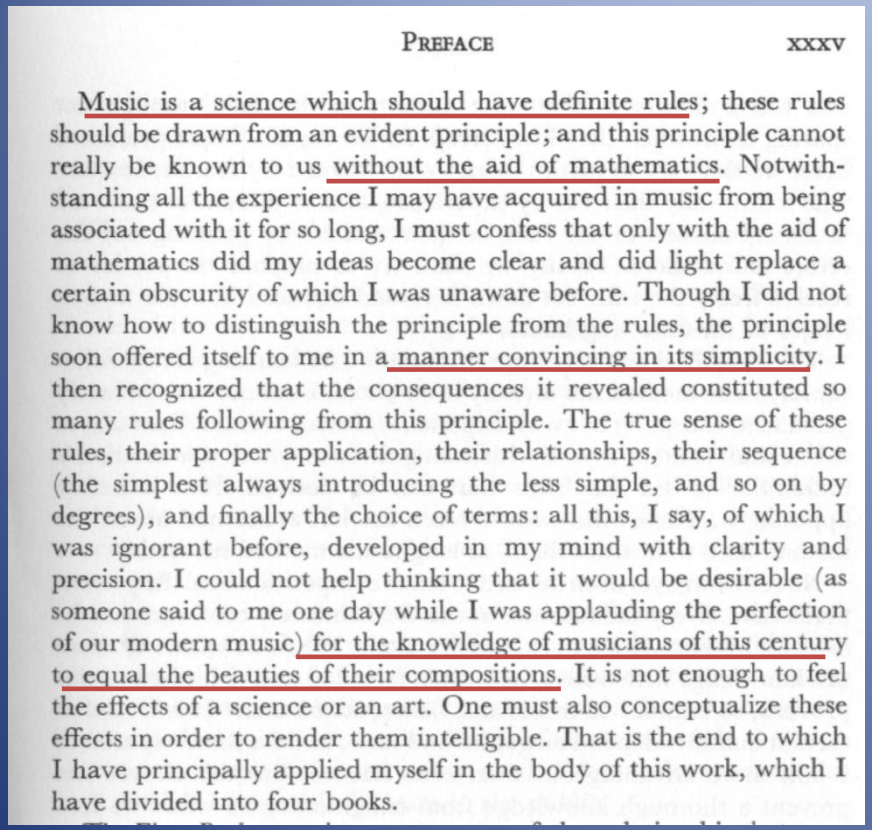


TEORIJA HARMONIJE DO BAROKA

Gioseffo Zarlino (1517-1590) - *Le istitutioni harmoniche* (1558)

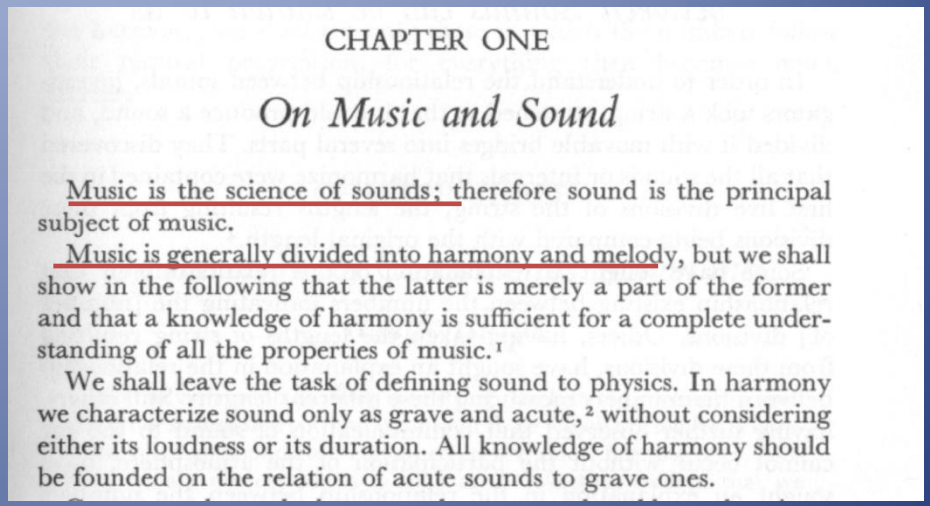
Vincenzo Galilei (ca. 1520- 1591) - *Dialogo di Vincentio Galilei ... della musica antica, et della moderna* (1581)

Pietro Aron tudi **Pietro Aaron** (1489 – po l. 1545) - *De institutione harmonica* (1516)
- *Thoscanello de la musica* (1523)
(Toscanello in musica)



PREFACE xxxv

Music is a science which should have definite rules; these rules should be drawn from an evident principle; and this principle cannot really be known to us without the aid of mathematics. Notwithstanding all the experience I may have acquired in music from being associated with it for so long, I must confess that only with the aid of mathematics did my ideas become clear and did light replace a certain obscurity of which I was unaware before. Though I did not know how to distinguish the principle from the rules, the principle soon offered itself to me in a manner convincing in its simplicity. I then recognized that the consequences it revealed constituted so many rules following from this principle. The true sense of these rules, their proper application, their relationships, their sequence (the simplest always introducing the less simple, and so on by degrees), and finally the choice of terms: all this, I say, of which I was ignorant before, developed in my mind with clarity and precision. I could not help thinking that it would be desirable (as someone said to me one day while I was applauding the perfection of our modern music) for the knowledge of musicians of this century to equal the beauties of their compositions. It is not enough to feel the effects of a science or an art. One must also conceptualize these effects in order to render them intelligible. That is the end to which I have principally applied myself in the body of this work, which I have divided into four books.



CHAPTER ONE

On Music and Sound

Music is the science of sounds; therefore sound is the principal subject of music.

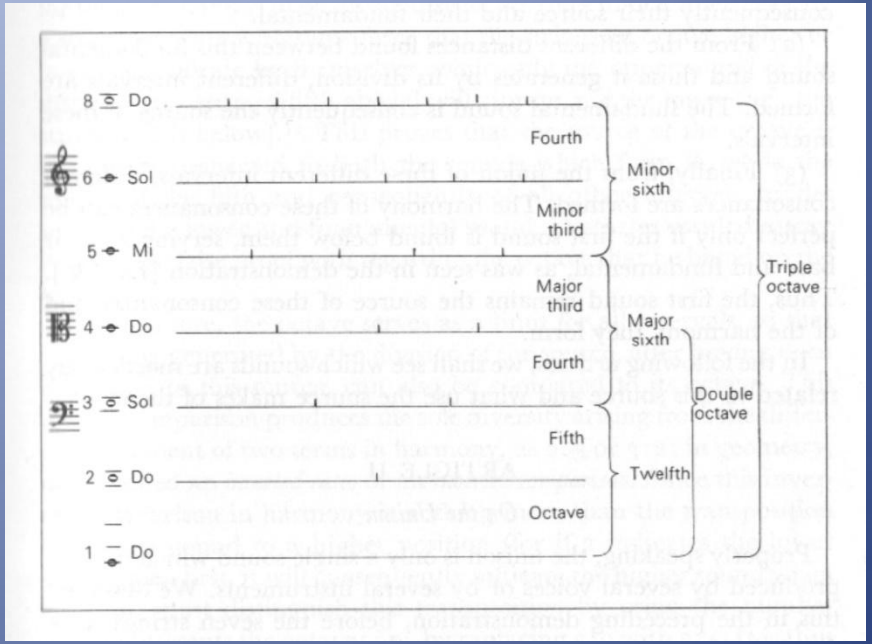
Music is generally divided into harmony and melody, but we shall show in the following that the latter is merely a part of the former and that a knowledge of harmony is sufficient for a complete understanding of all the properties of music.[1]

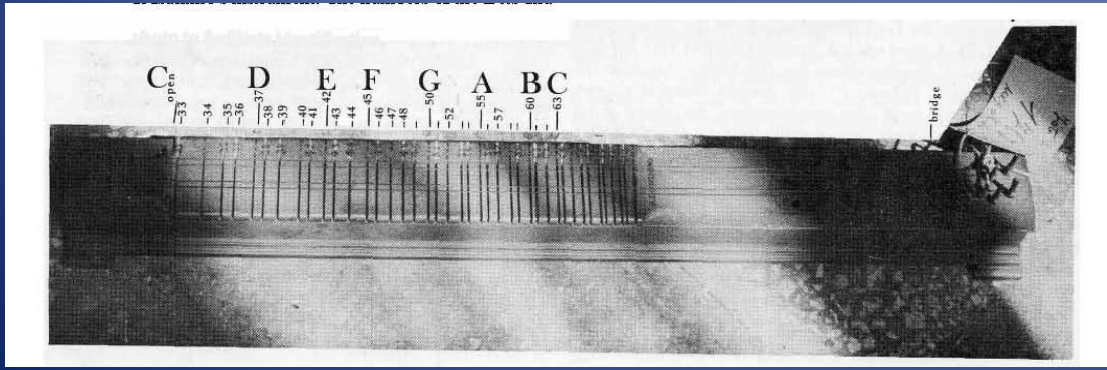
We shall leave the task of defining sound to physics. In harmony we characterize sound only as grave and acute,[2] without considering either its loudness or its duration. All knowledge of harmony should be founded on the relation of acute sounds to grave ones.

Jean-Philippe Rameau (1683-1764)

- *Traité de l'harmonie réduite à ses principes naturels* (1722)

OBLIKOVANJE AKUSTIČNIH TEMELJEV INSTRUMENTALNE BAROČNE GLASBE





STOPNJEVANJE PITAGOREJSKE PARADIGME – RAZNA RAZMERJA (ZARLINO)

- Izhodišče: več kot 12 kategorijski sistem brez enharmonije
- Osnovni problem enharmonije: pitagorejska in sintonična koma
- Intonacija akordov (kvinta, velika in mala terca)
- Alikvotni niz – osnova naravne intonacije
- Kvintni krog – osnova pitagorejske intonacije
- Enolična temperirana intonacija – posledica izenačitve kvint in terc v 12 tonskem sistemu

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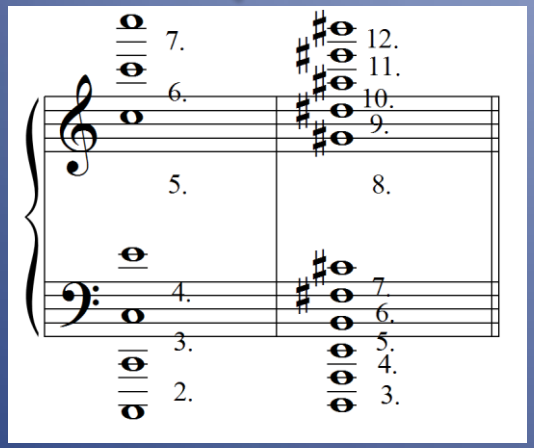

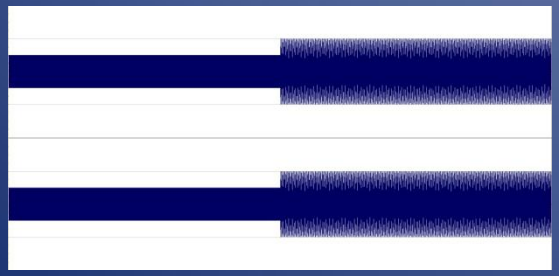

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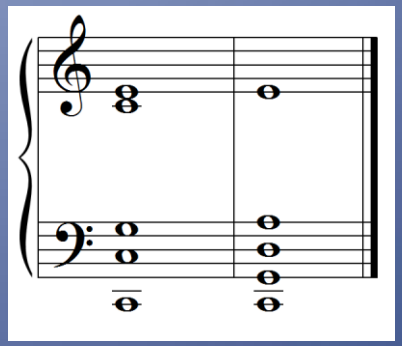

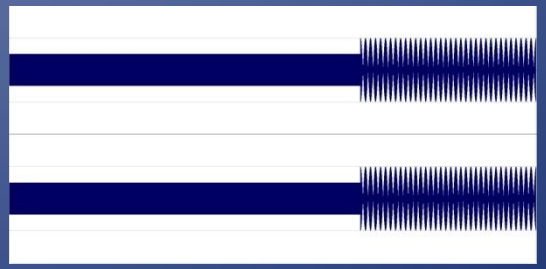

http://www.youtube.com/watch?v=BhZpvGSPx6w

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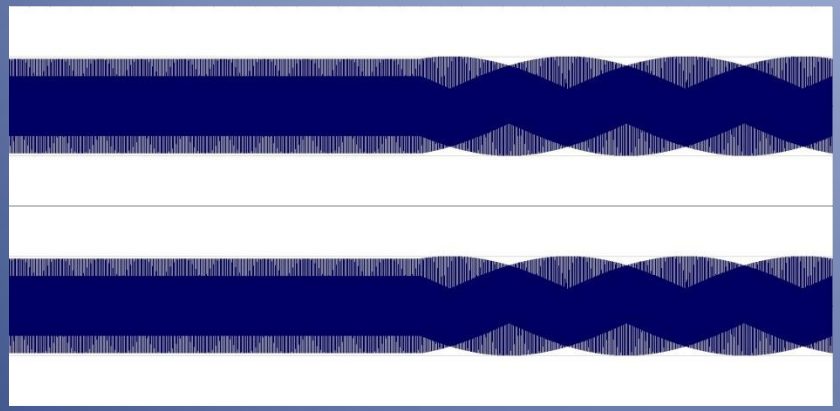
Čista kvinta 2/3 – 700 centa



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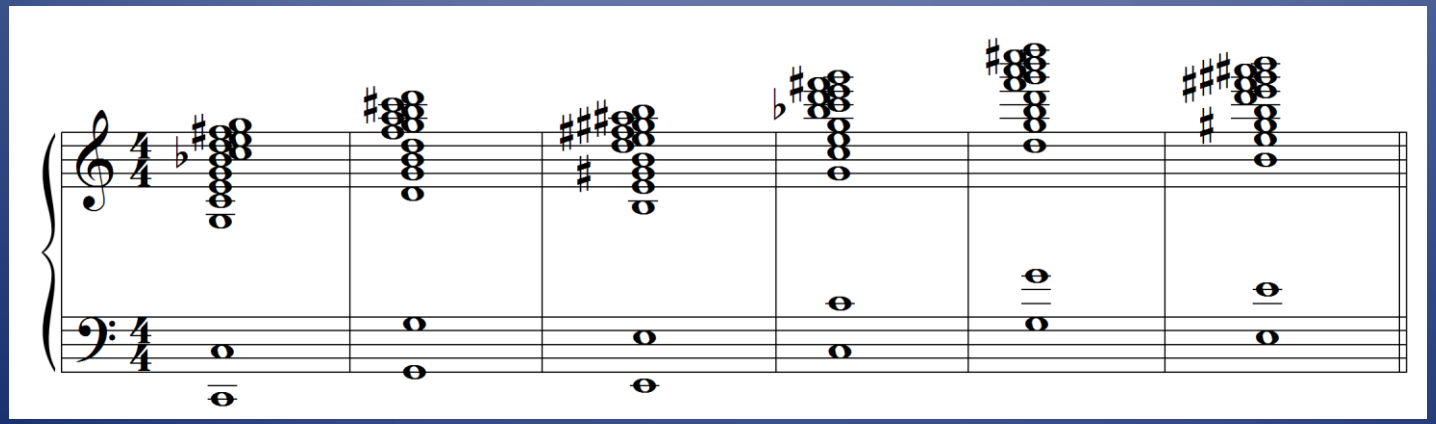

Durov 1/3/5 – naravna intonacija

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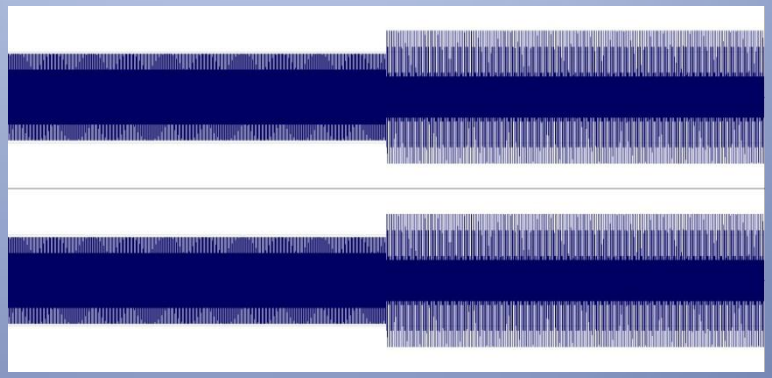

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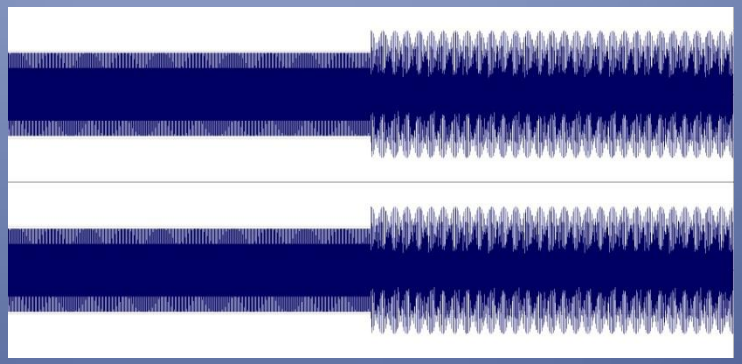
Durov 1/3/5 – pitagorejska intonacija



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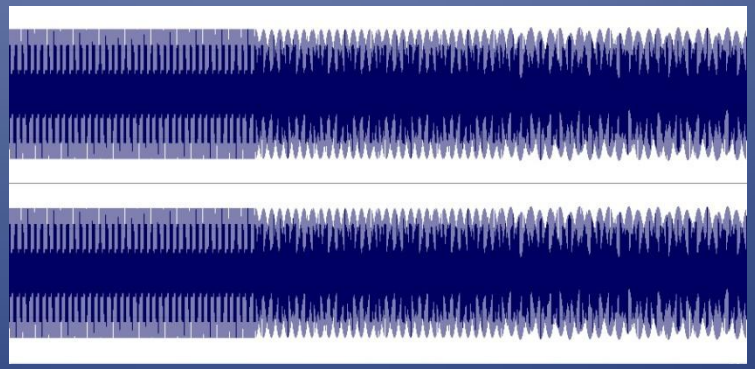
Durov 1/3/5 – naravna, pitagorejska, enolično temperirana intonacija



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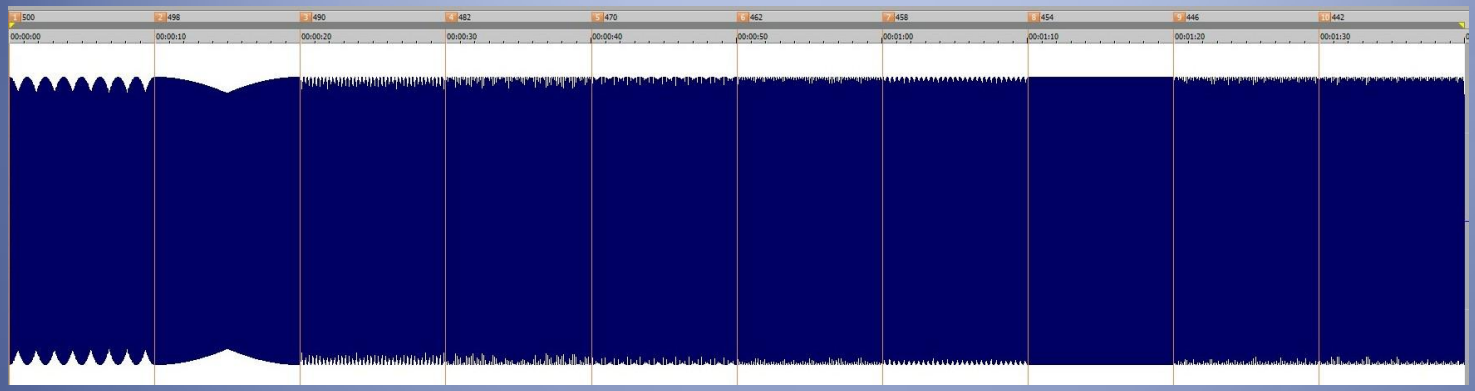
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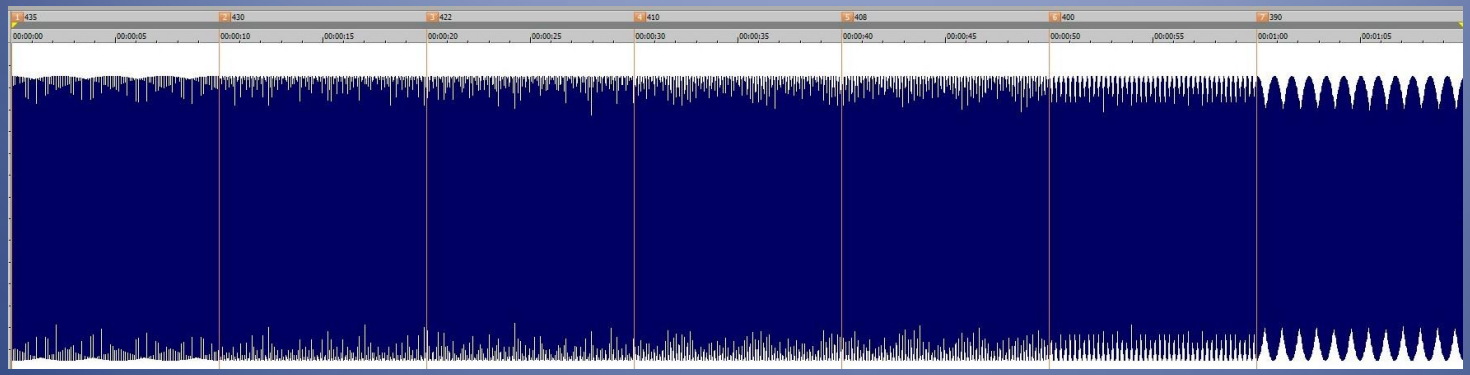
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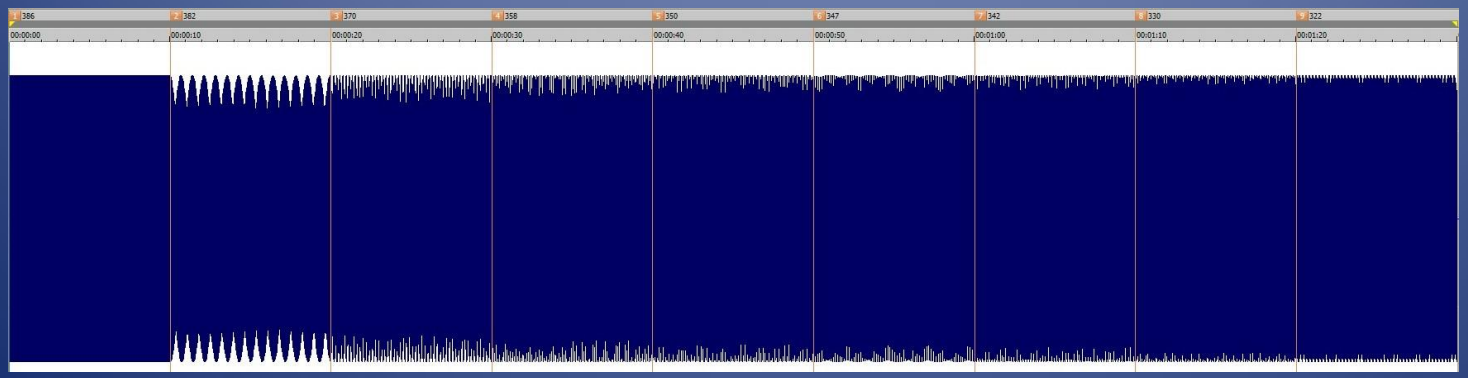
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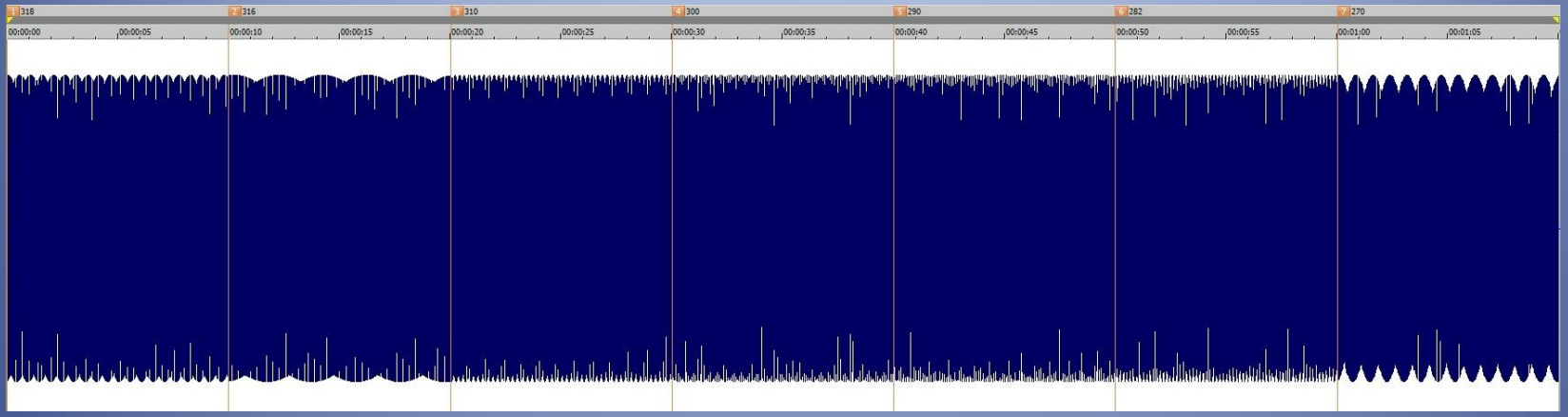
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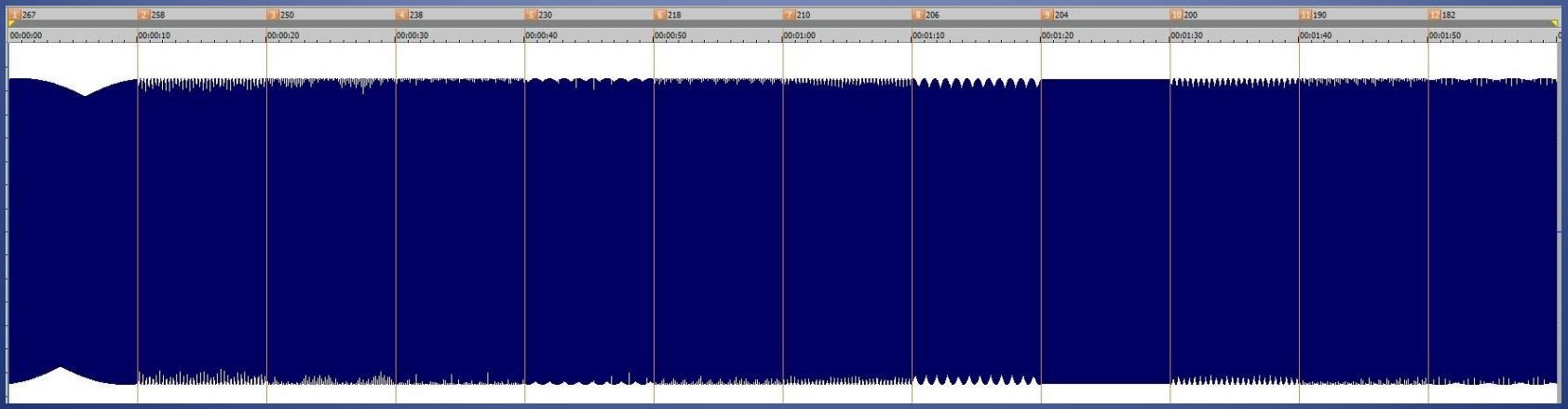
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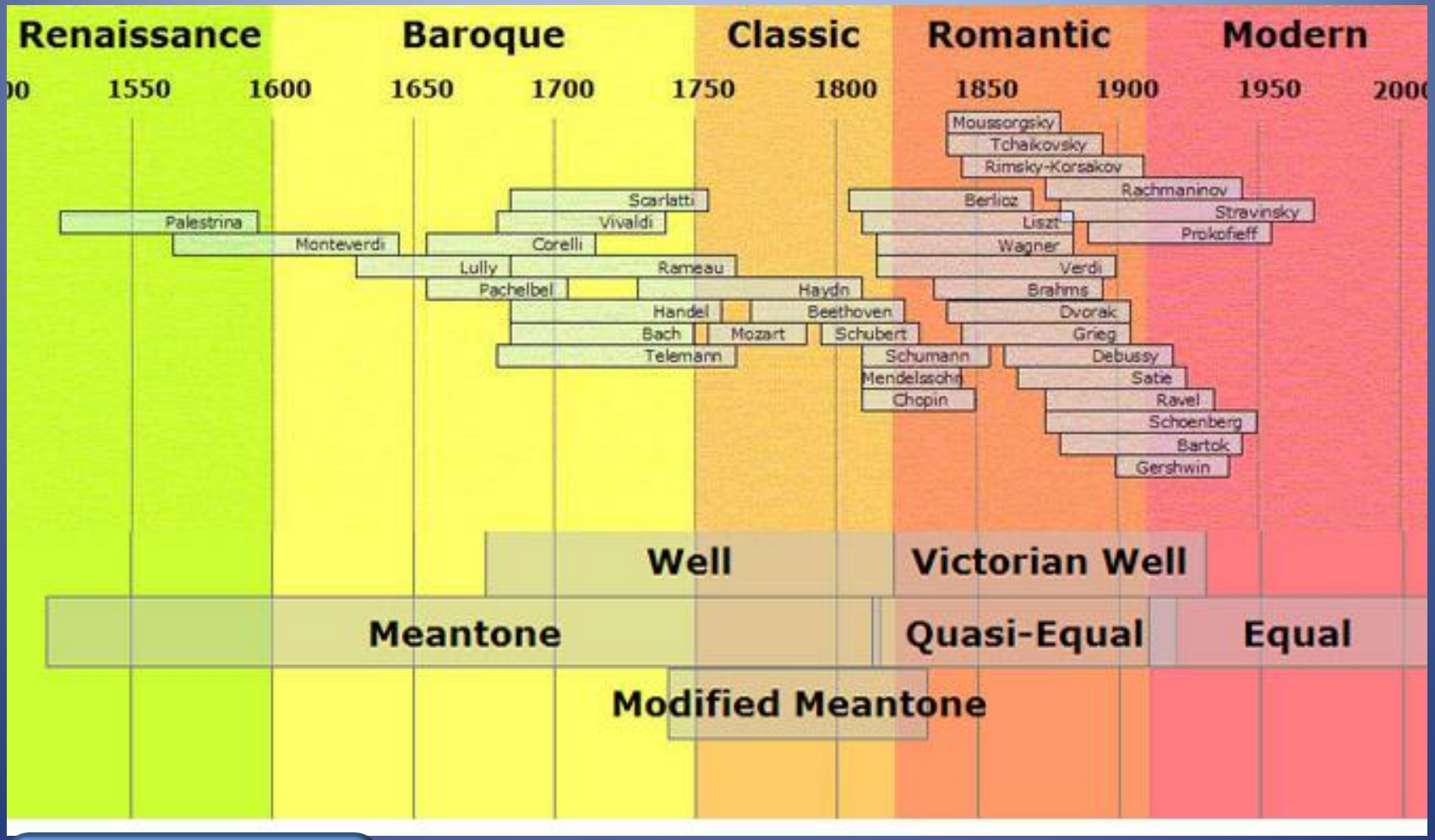

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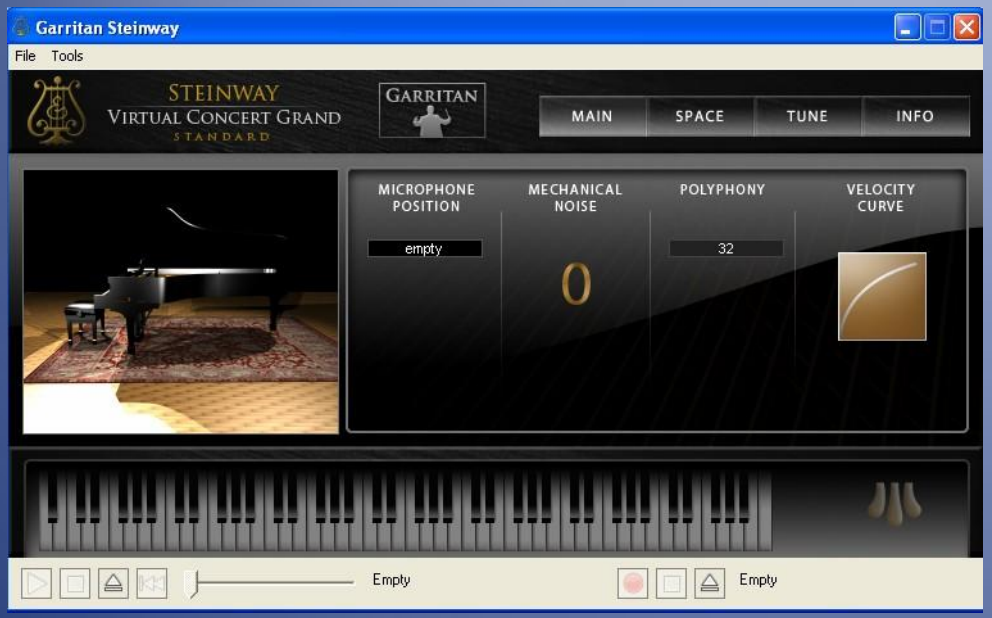
http://en.wikipedia.org/wiki/Music_and_mathematics#Mathematics_of_musical_scales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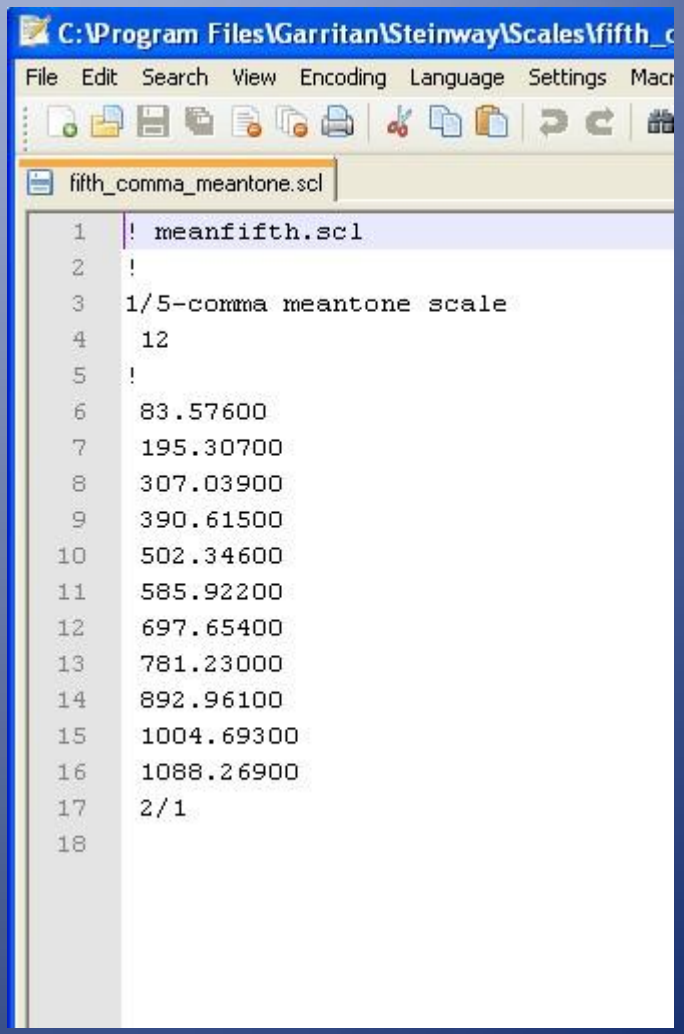
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3 1/5-comma meantone scale
4 12
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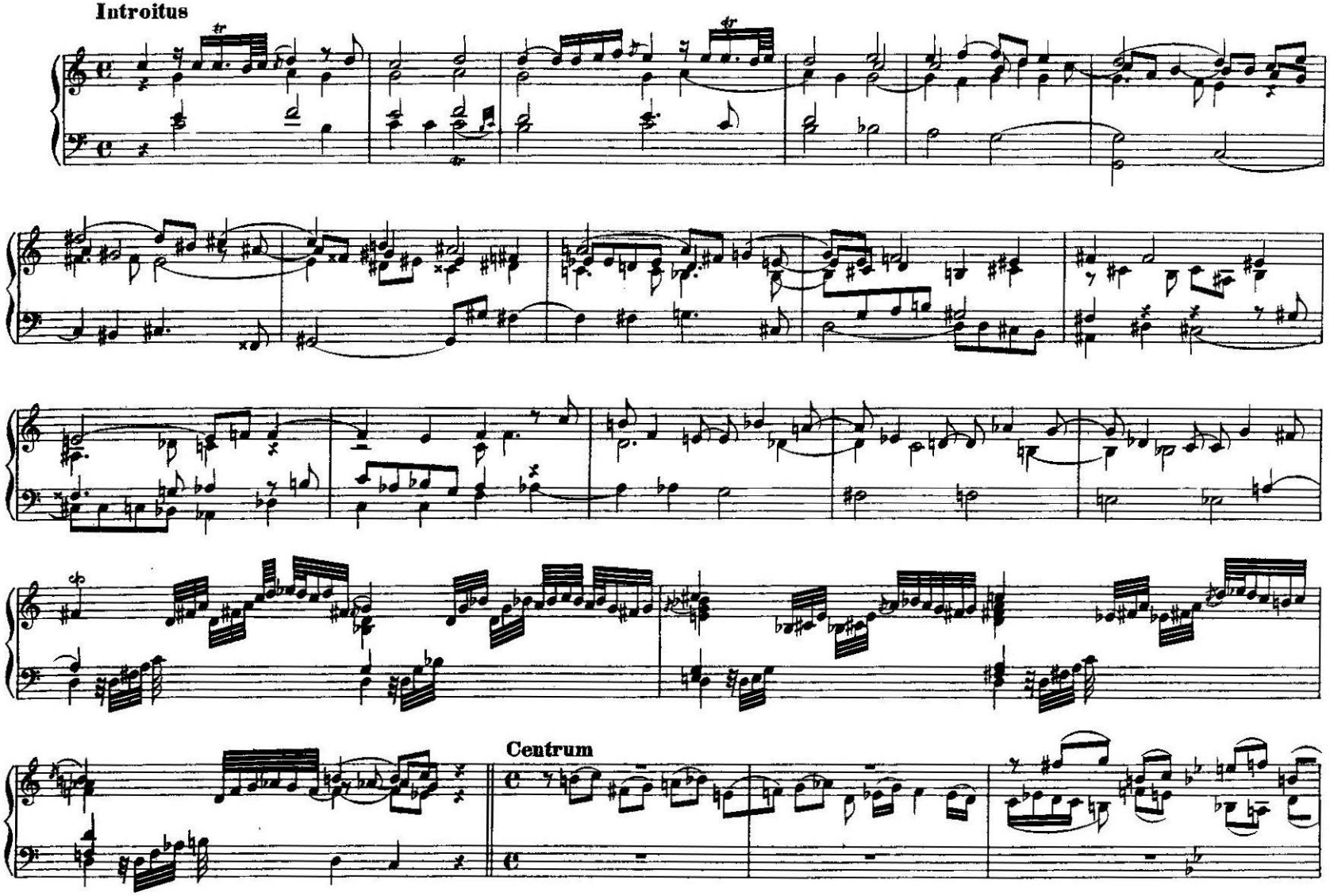
8 307.03900
9 390.61500
10 502.34600
11 585.92200
12 697.65400
13 781.23000
14 892.96100
15 1004.69300
16 1088.26900
17 2/1
18

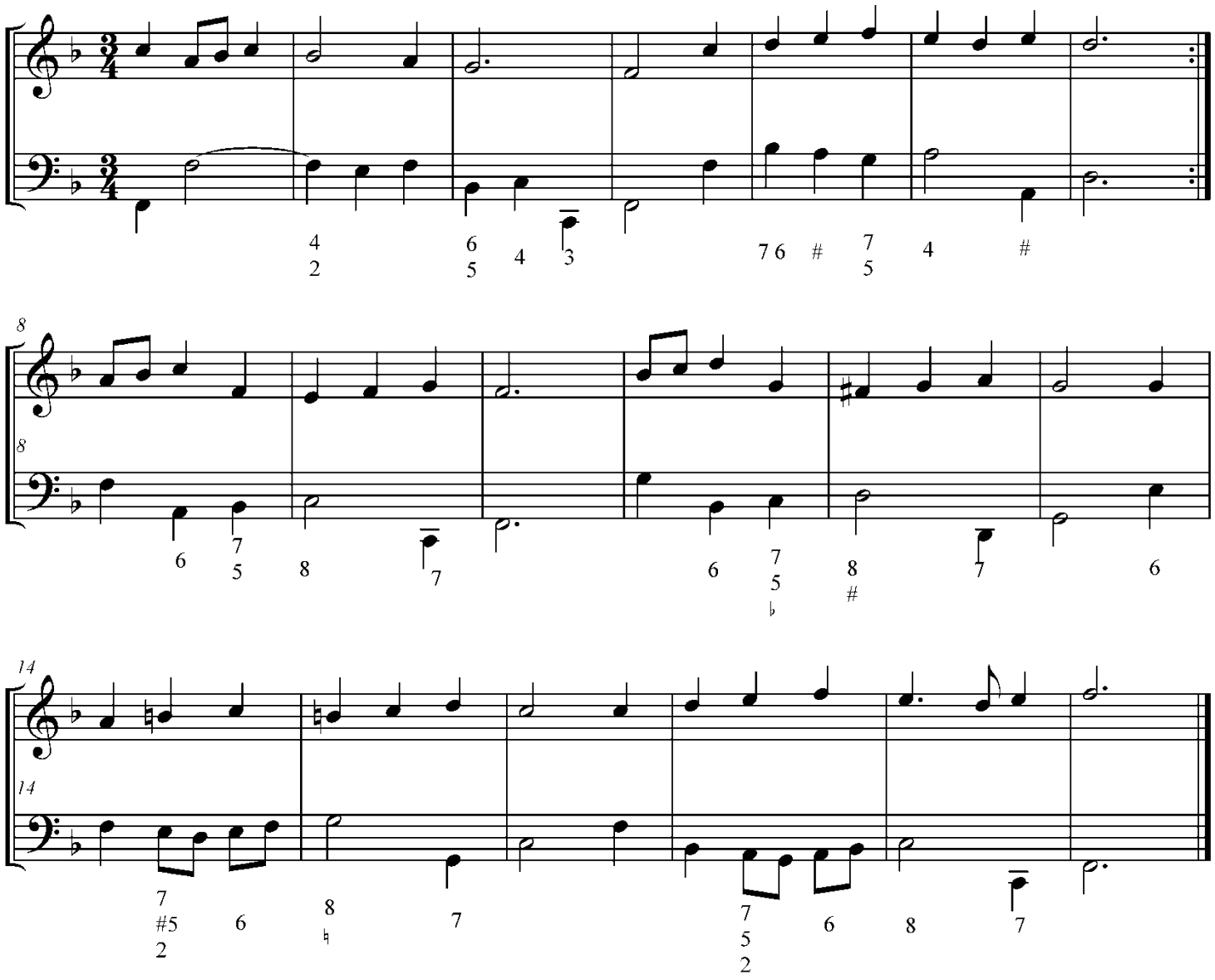
Column1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Equal Temperament	Bach Temperament - Early Journal - Str. 16	Wendy Carlos' Alpha scale with perfect fifth divided in nine, in two octaves	Wendy Carlos's optimized Werkmeister-style "Circular" temperament.	1/5-comma meantone scale	Basic JI with 7-limit tritone	Kirnberger III	Brad Lehman's Bach keyboard temperament	12-tone Pythagorean scale	12-tone Pythagorean scale - 5	Standard French temperament, Rameau version (1726), C. di Veroli, 2002	1/6-comma meantone scale (tritonic temperament of Salinas)	Andreas Werckmeister's temperament III, 1681	Zlati rez - 1,61803399 potenciran z 0,125	
	12	12	24	12	12	12	12	12	12	12	12	12	12	12	
1	100	96	78	92	83,576	16/15	90	98,045	2187/2048	2187/2048	88,334350	88,594	90,225	104	cis
2	200	202	156	197	195,307	9/8	193	196,090	9/8	9/8	193,156860	196,741	192,180	208	d
3	300	300	234	297	307,039	6/5	294	298,045	32/27	7625/6347	297,979360	304,888	294,135	312	es
4	400	398	312	392	390,615	5/4	386	392,180	81/64	81/64	5/4	393,482	390,225	417	e
5	500	500	390	500	502,346	4/3	498	501,955	4/3	12457/9217	503,42157	501,629	498,045	521	f
6	600	594	468	591	585,922	7/5	588	596,090	729/512	729/512	584,84714	590,224	588,270	625	fis
7	700	704	546	699	697,654	3/2	697	698,045	3/2	3/2	696,57843	698,371	696,090	729	g
8	800	798	624	794	781,230	8/5	792	798,045	6561/4096	6561/4096	793,15686	786,965	792,180	833	as
9	900	900	702	894	892,961	5/3	890	894,135	27/16	27/16	889,73529	895,112	888,270	937	a
10	1000	1000	780	999	1.004,693	9/5	996	998,045	16/9	13654/7577	1.001,46657	1.003,259	996,090	1041	b
11	1100	1096	858	1091	1.088,269	15/8	1088	1.094,135	243/128	243/128	1.082,89214	1.091,853	1.092,180	1145	h
12	2/1	1200.0	936	2/1	2/1	2/1	2/1	2/1	2/1	4012/1979	2/1	2/1	2/1	2/1	c
13			1014												
14			1092												
15			1170												
16			1248												
17			1326												
18			1404												
19			1482												
20			1560												
21			1638												
22			1716												
23			1794												
24			1200												

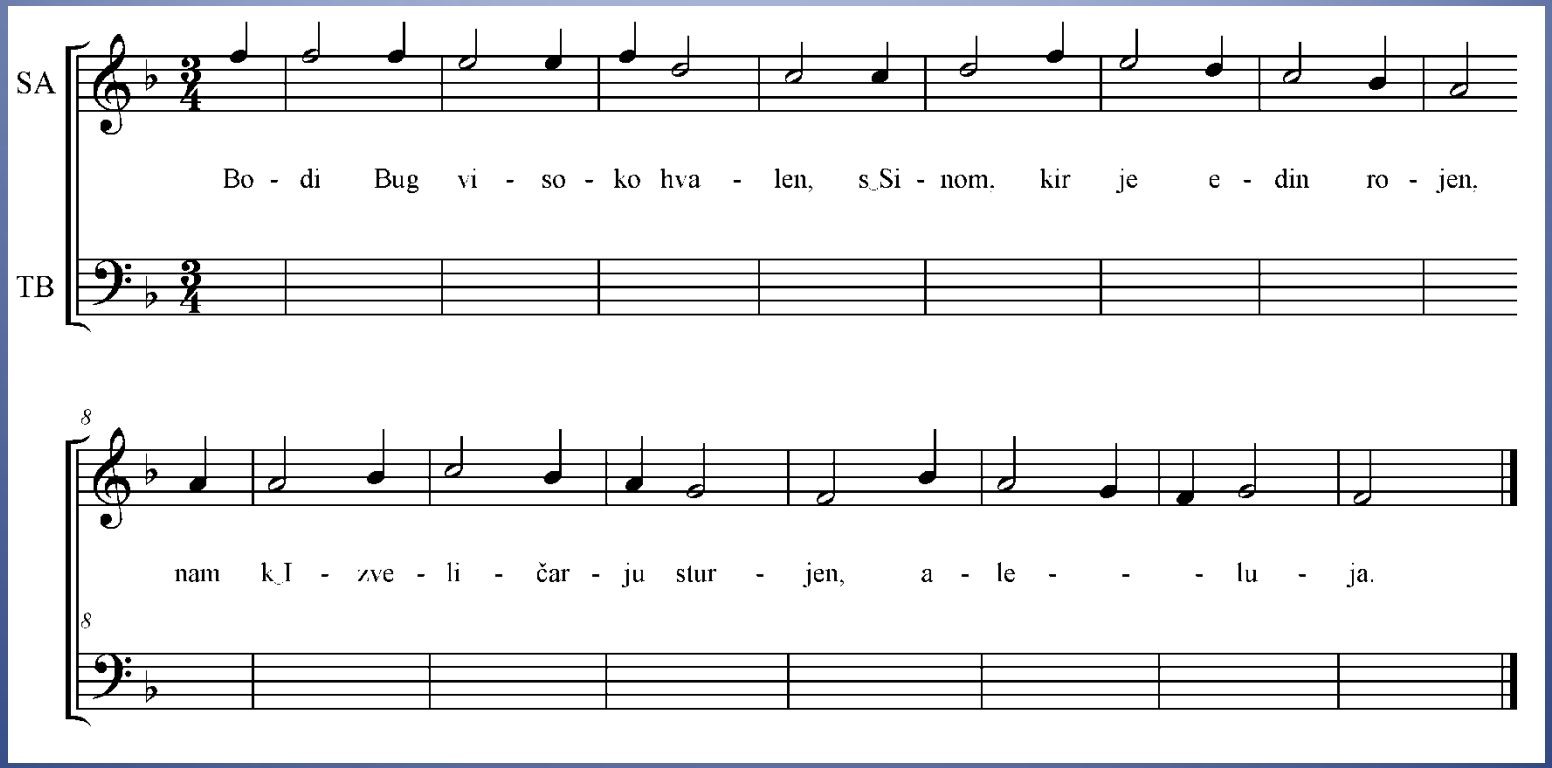
EXCEL

Nº 9. KLEINES HARMONISCHES LABYRINTH



J. S. Bach, Auf, auf, mein Herz, mit Freuden





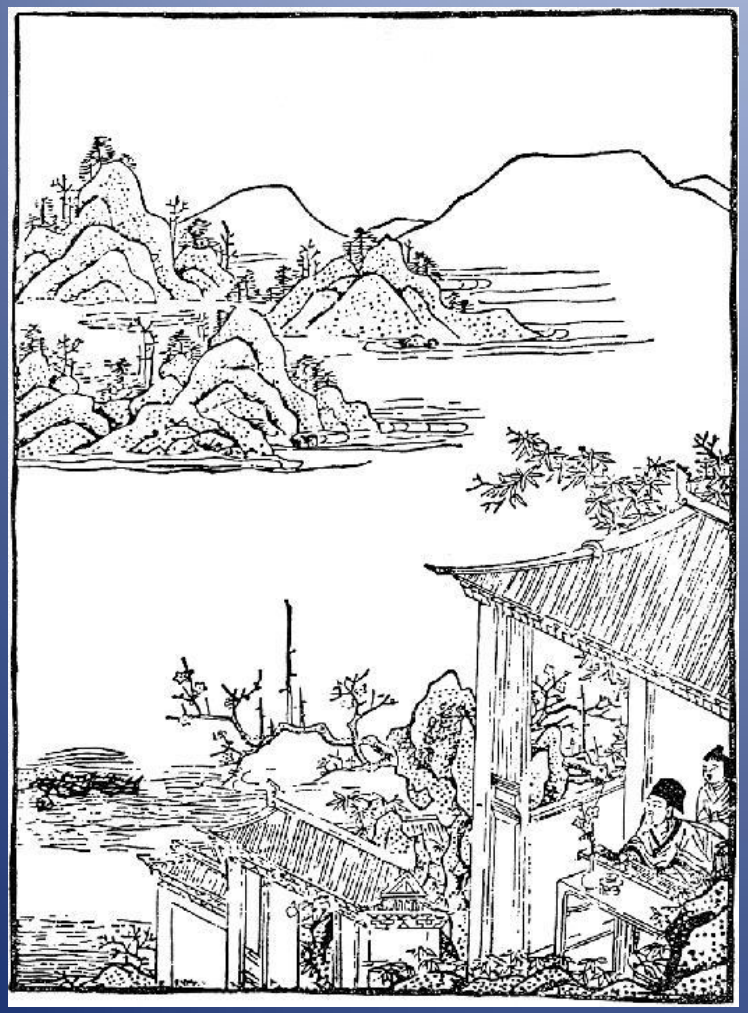
18 JEZUS JE V SMRTNI JEČI BIL – TRADICIONALNO / BACHOVO

19 JEZUS JE V SMRTNI JEČI BIL – TRADICIONALNO / PROSTO

HARMONIJA PO BAROKU

- KOORDINATIVNA HARMONIJA (po Carlu Dalhausu)
- SUBORDINATIVNA HARMONIJA (po Carlu Dalhausu)
- PRIMERI S HARMONIZACIJO LJUDSKE PESMI „NA PLANINCAH SONČECE SIJE“
- ŠIRJENJE 12 KATEGORIČNEGA SISTEMA – PRIMER HABA
- HARMONIZACIJA TRUBARJEVEGA KORALA
- SALVE REGINA IN RAZŠIRJANJE PROSTORA NARAVNE HARMONIJE

JE HARMONIJA ŠE HARMONIJA?



21 ANDREJ MISSON
SALVE REGINA