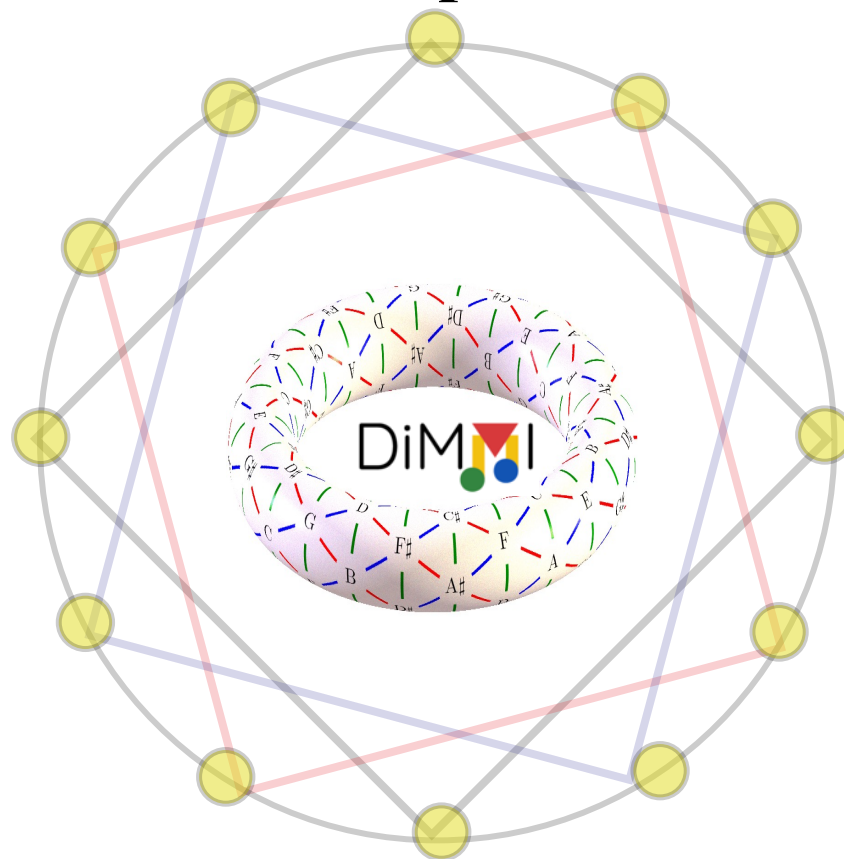


Some thoughts on new forms of contamination between contemporary and popular music: the role of mathematical formalization and computer-aided modelling



A conversation between

Moreno Andreatta & Fabio Cifariello Ciardi

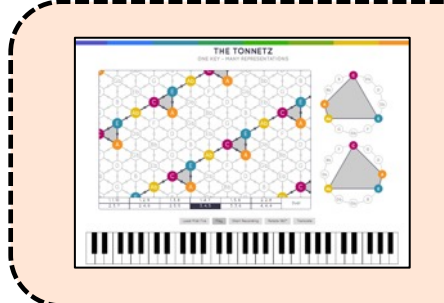
Contamination within the 'mathemusical' activity

MATHEMATICS

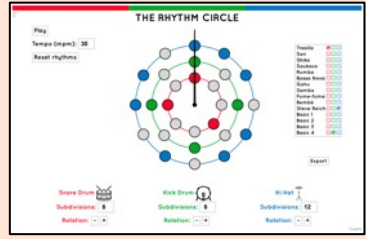
Mathematical statement

generalisation

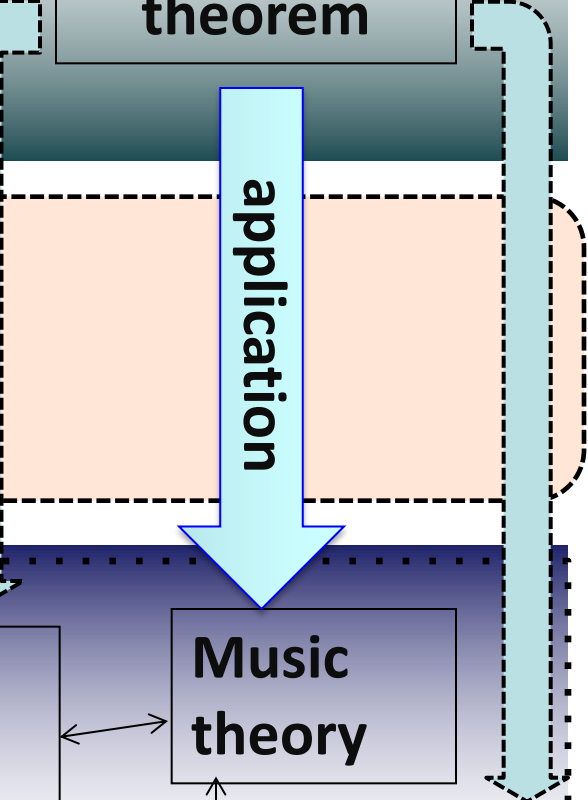
General theorem



formalisation



COMPUTER SCIENCE



MUSIC

Musical problem

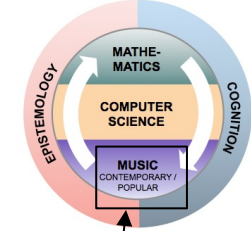
~~→~~
←

Music analysis

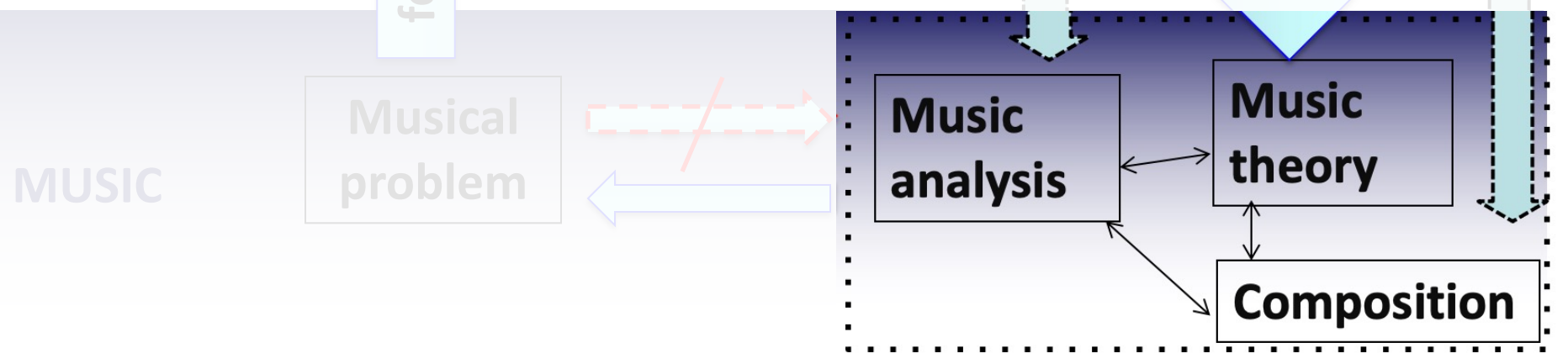
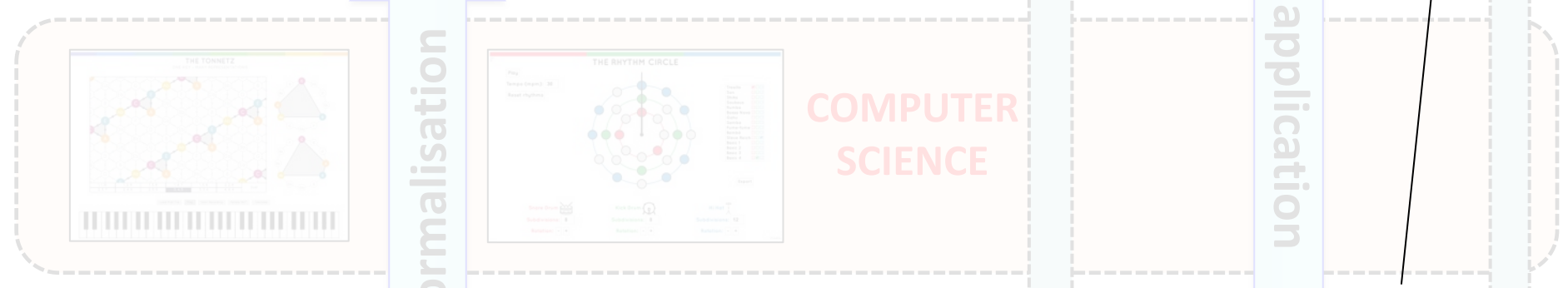
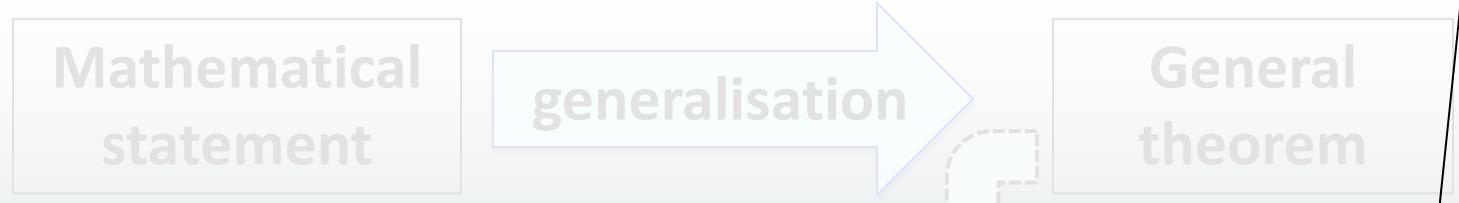
Music theory

Composition

Contamination within the 'mathemusical' activity

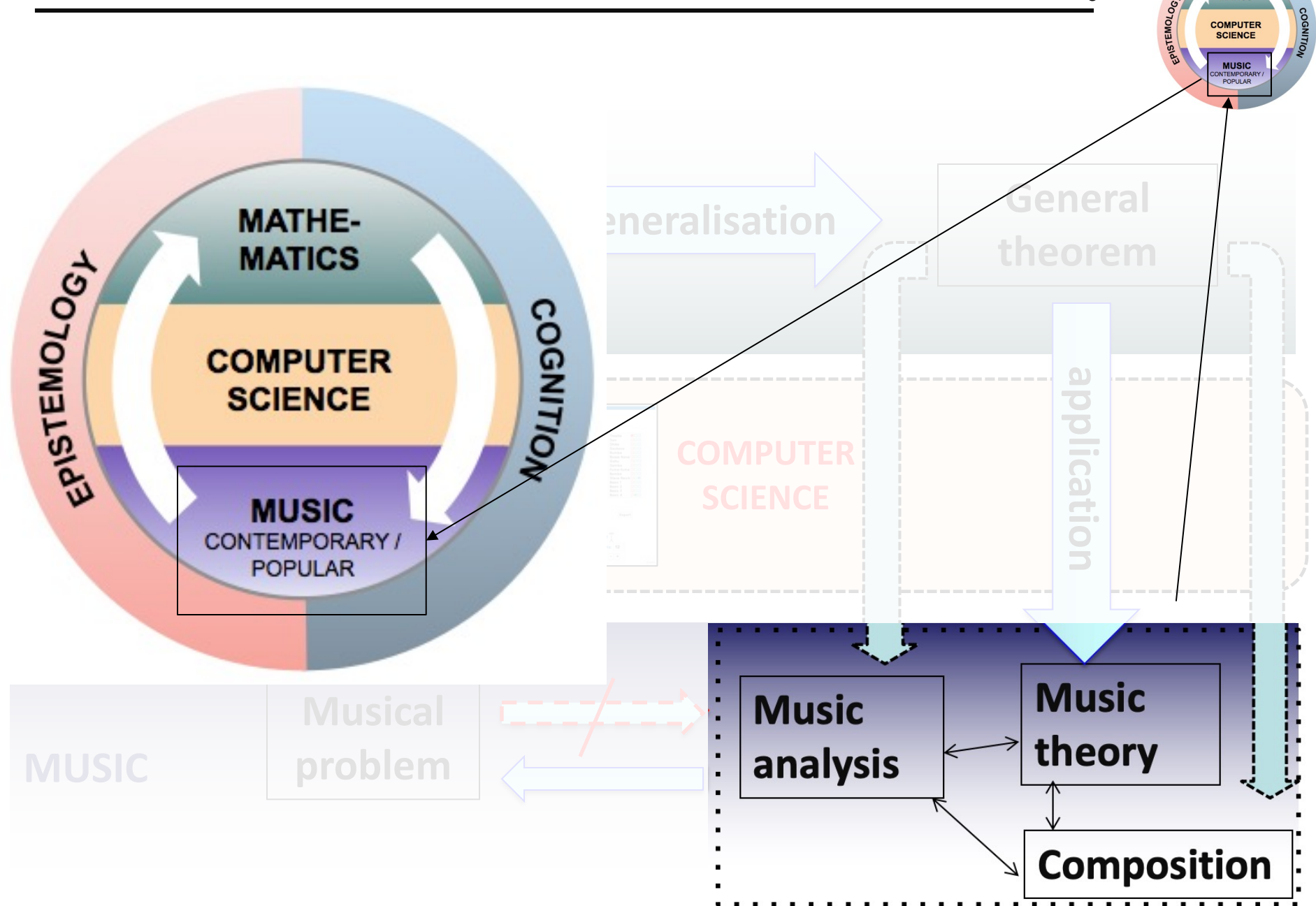


MATHEMATICS



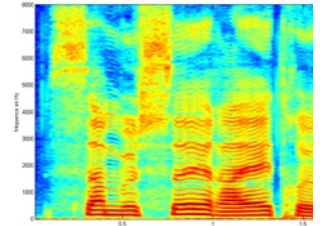
MUSIC

Contamination within the 'mathemusical' activity



The SMIR Project: Structural Music Information Research

Signal and audio-based Approaches

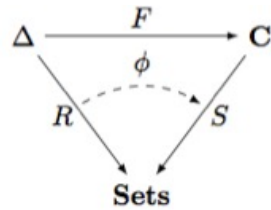
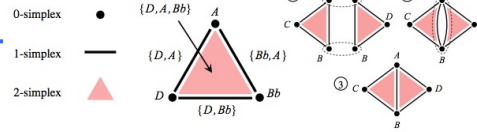
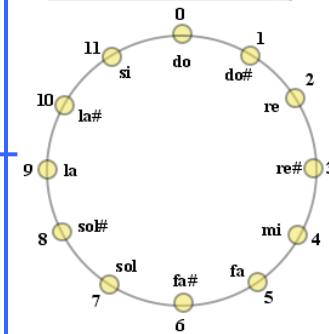
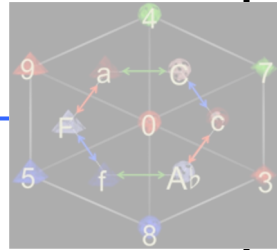
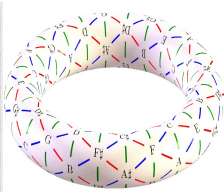
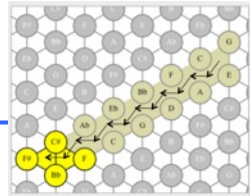


Algebraic models



Topological models

Categorical models

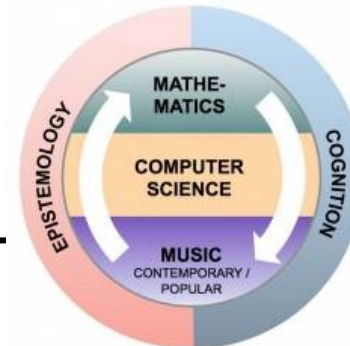


Computational models

Cognitive models

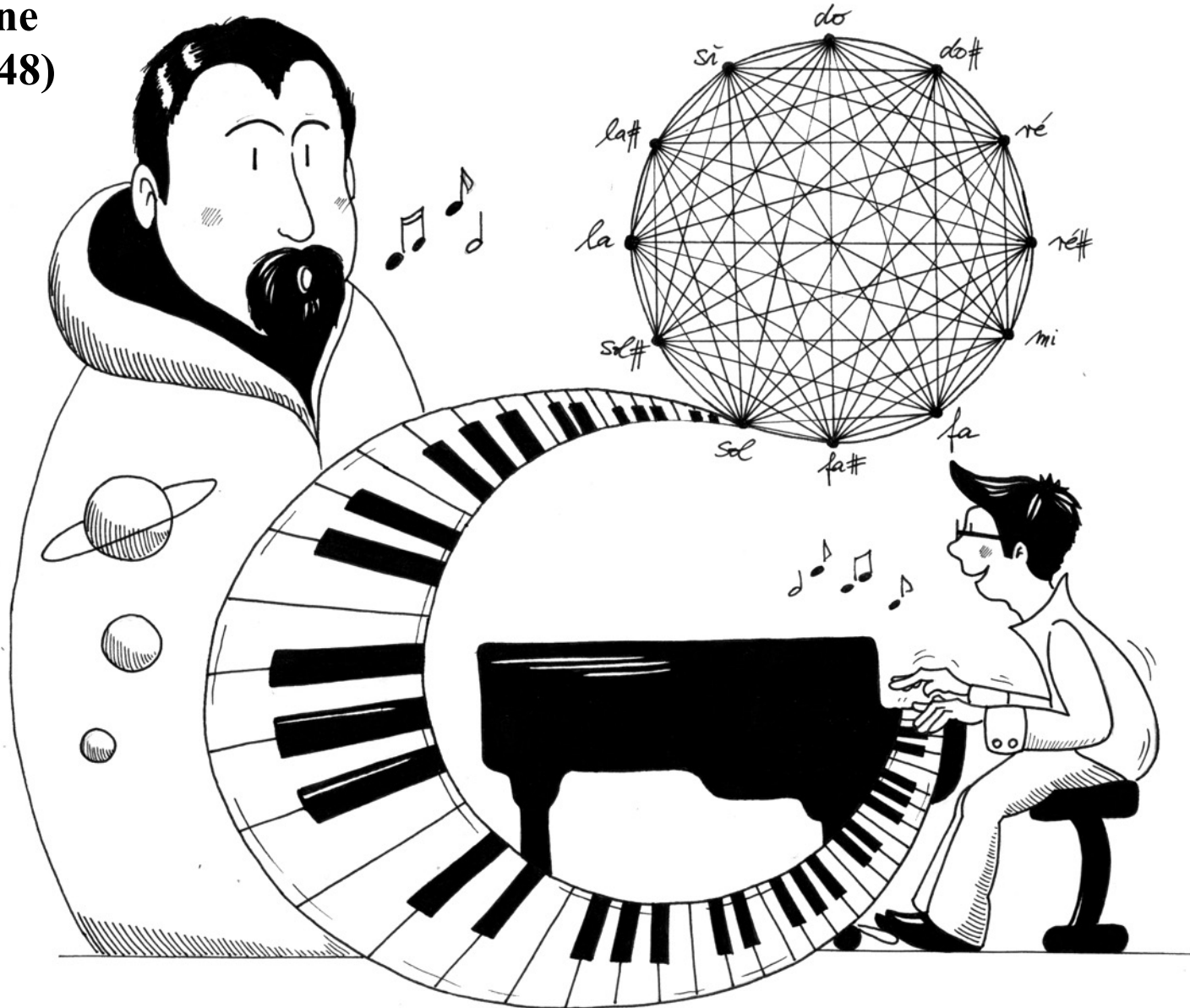
Structural Symbolic Music Information Research

<http://repmus.ircam.fr/moreno/smir>

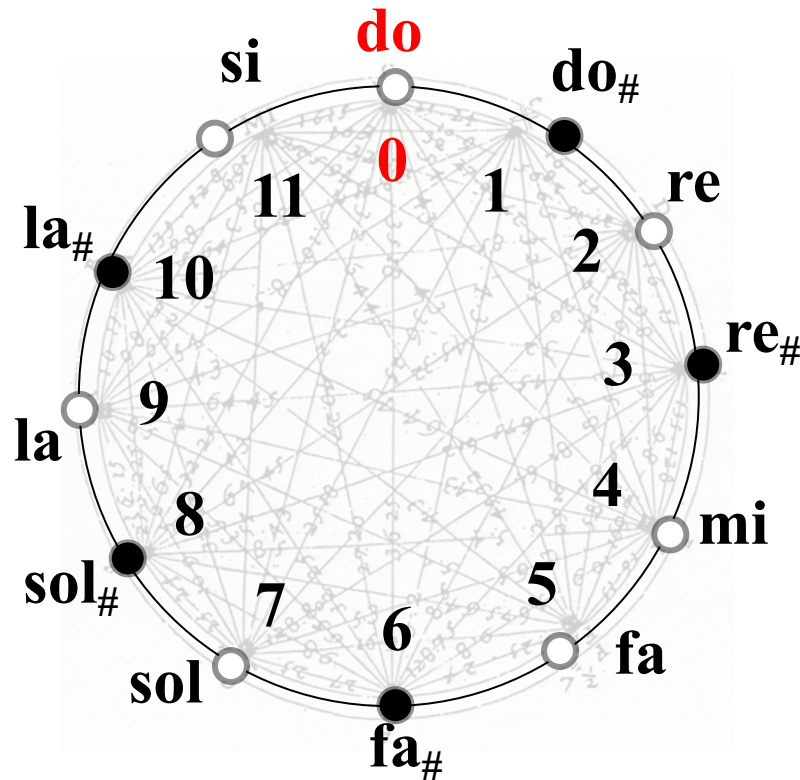


The circular representation of the pitch space

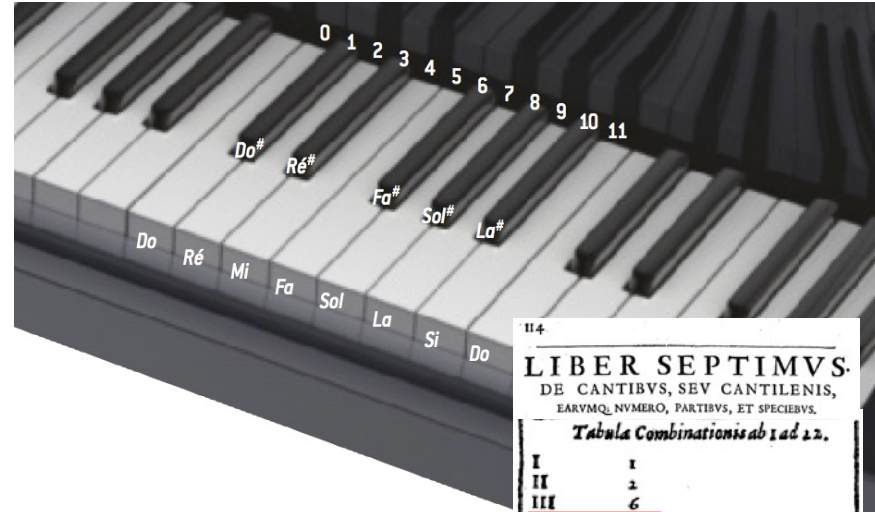
Mersenne
(1588-1648)



The circular representation of the pitch space



Harmonicorum Libri XII, 1648

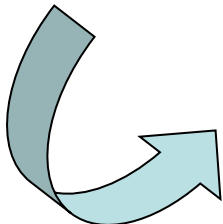


114

LIBER SEPTIMVS.
DE CANTIBVS, SEV CANTILENIS,
EARVMQ; NVMERO, PARTIBVS, ET SPECIEBV.

Tabula Combinationis ab 1 ad 12.

I	1
II	2
III	6
IV	24
V	120
VI	720
VII	5040
VIII	40320
IX	362880
X	3628800
XI	39916800
XII	479001600
XIII	6127020800
XIV	8718192000
XV	1307674368000
XVI	20922789888000
XVII	335687418096000
XVIII	6402373705728000
XIX	121645100408832000
XX	24329020081766400000
XXI	510909421717094400000
XXII	114000727776076800000



Musical notation for a chromatic scale. The notation shows two staves of music. Below the staves is a linear scale with 12 positions labeled with numbers 0 through 12. The notes are: 0 (do), 1 (do#), 2 (re), 3 (re#), 4 (mi), 5 (fa), 6 (fa#), 7 (sol), 8 (sol#), 9 (la), 10 (la#), 11 (si), 12 (do).

Varietas, seu Combinatio quatuor notarum.

A grid of musical notation showing combinations of four notes. The grid is organized into rows and columns, with numbers 1 through 24 indicating the combinations. The notes are: 1 (do), 2 (do#), 3 (re), 4 (re#), 5 (mi), 6 (fa), 7 (fa#), 8 (sol), 9 (sol#), 10 (la), 11 (la#), 12 (si), 13 (do), 14 (do#), 15 (re), 16 (re#), 17 (mi), 18 (fa), 19 (fa#), 20 (sol), 21 (sol#), 22 (la), 23 (la#), 24 (si).

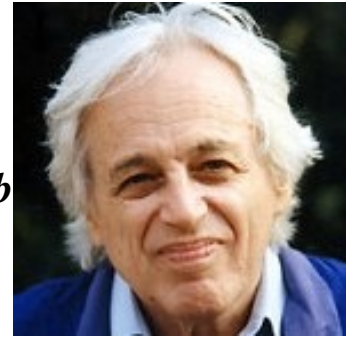
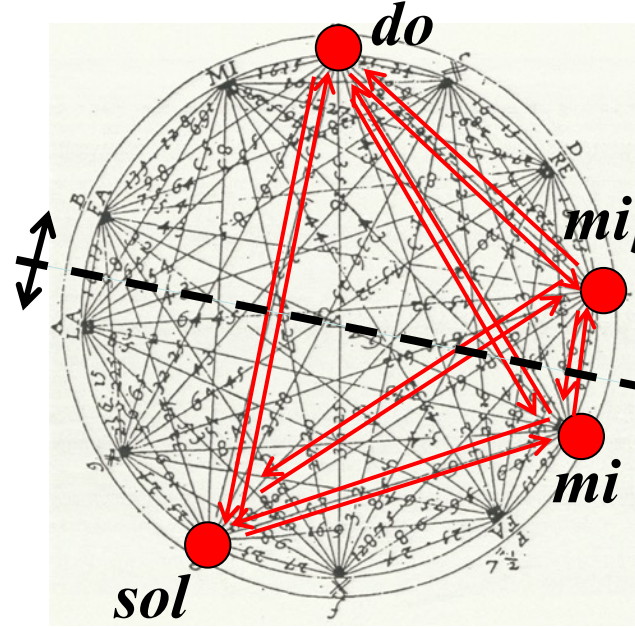
Permutational strategies in contemporary music

II 4. Marin Mersenne, *Harmonicorum Libri XII*, 1648

LIBER SEPTIMVS.
DE CANTIBVS, SEV CANTILENIS,
EARVMQ; NVMERO, PARTIBVS, ET SPECIEBVS.

Tabula Combinationis ab 1 ad 12.

I	1
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X	3628800
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XIII	6117020800
XIV	87178191200
XV	1307674368000
XVI	20922789888000
XVII	335687418096000
XVIII	6402373705728000
XIX	121645100408832000
XX	2432901008176640000
XXI	51090942171709440000
XXII.	112400072777607680000



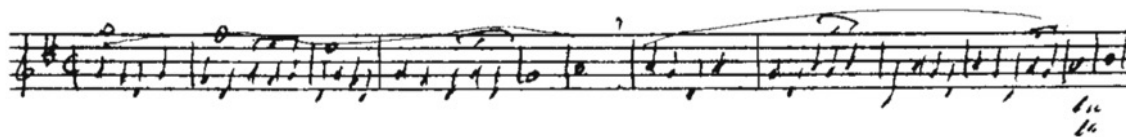
Six Bagatelles
(G. Ligeti, 1953)

Varietas, seu Combinatio quatuor notarum.

A musical score for 'Varietas, seu Combinatio quatuor notarum' showing 24 numbered staves. Each staff contains a sequence of notes, likely representing a permutation of four notes. The notes are arranged in a grid-like pattern across the staves.



Permutational melodies in song writing



Se telefonando, 1966

(Maurizio Costanzo/Ennio Morricone) / Mina

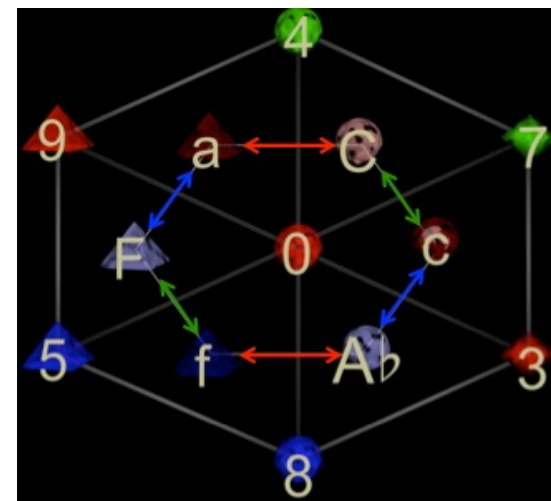


(min. 0'53'')



Ennio Morricone

The harmonic space

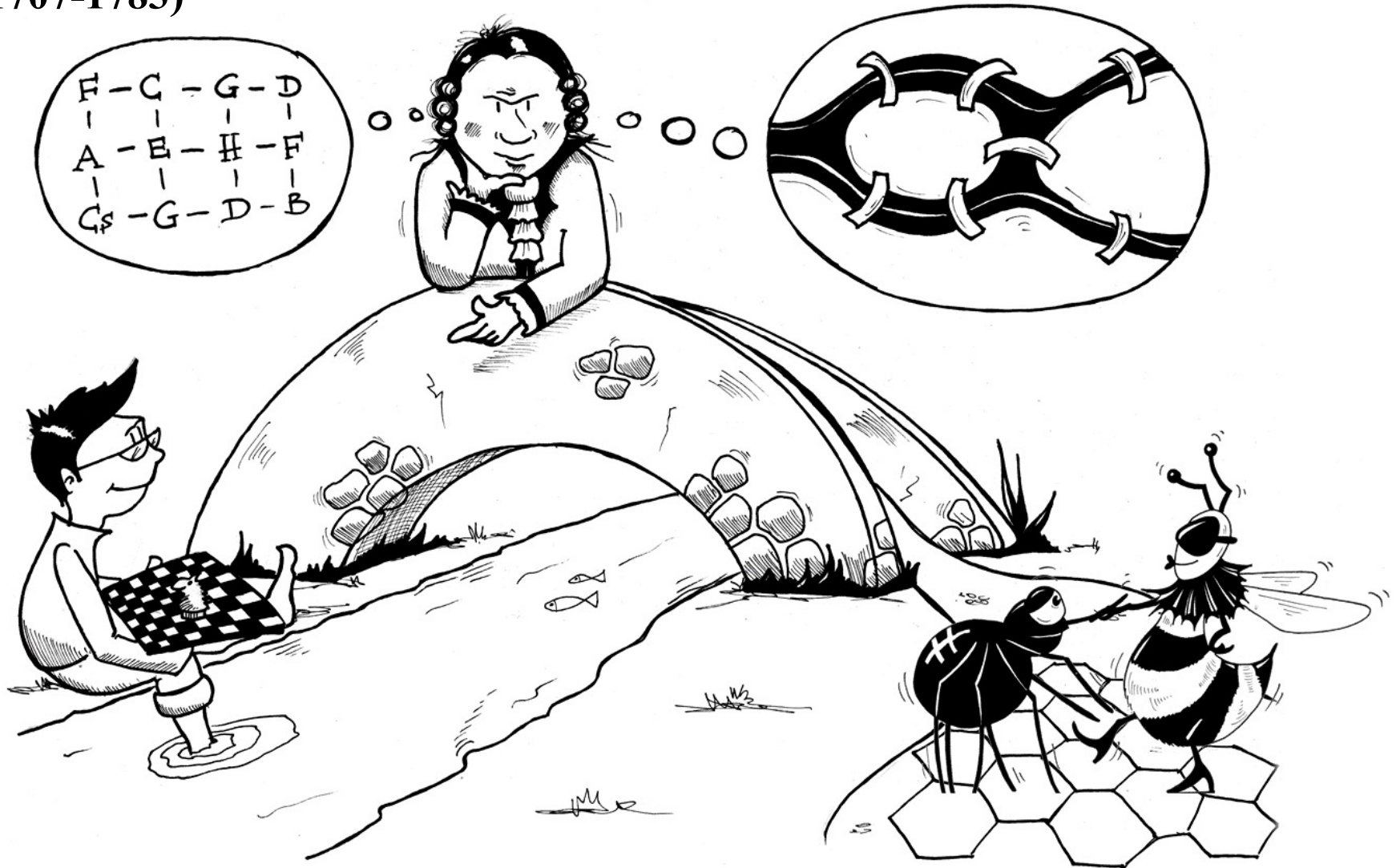


C	c	C#	c#	D	d
E_b	e_b	E	e	F	f
F#	f#	G	g	G#	g#
A	a	B_b	b_b	B	b

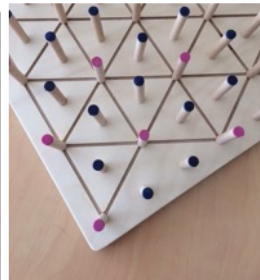
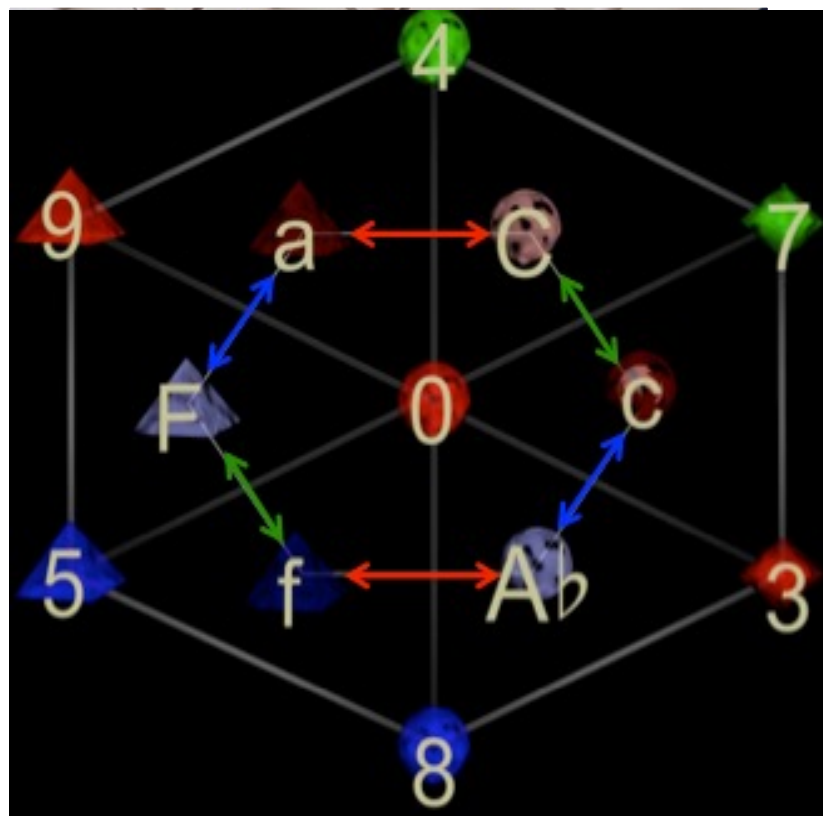
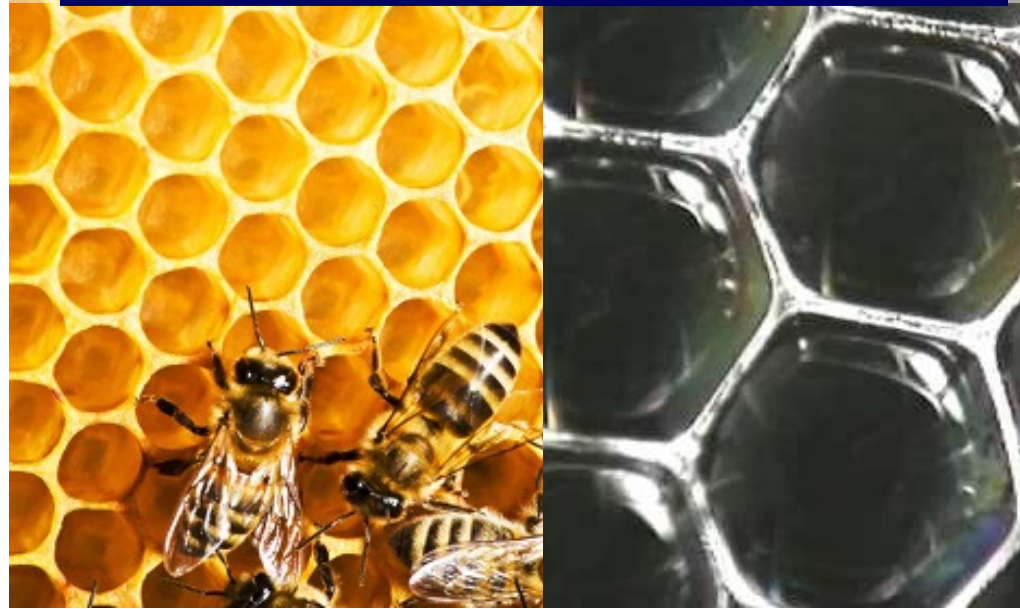
Chord enumeration

The spatial representation of the pitch space

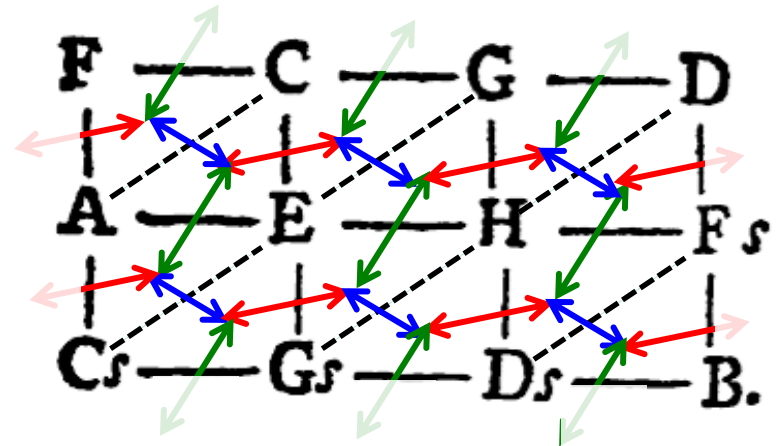
Euler
(1707-1783)



The Tonnetz (or 'honeycomb' hexagonal tiling)

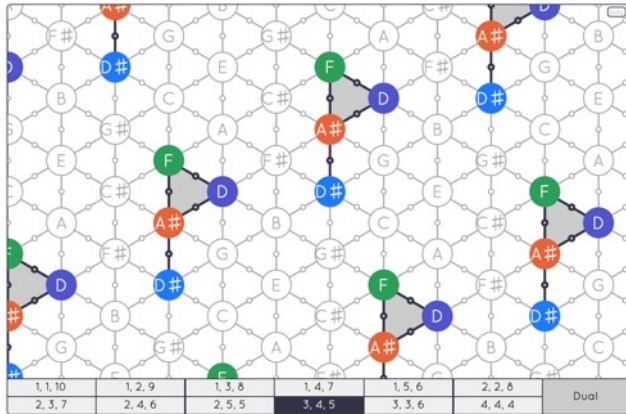


Leonhard Euler

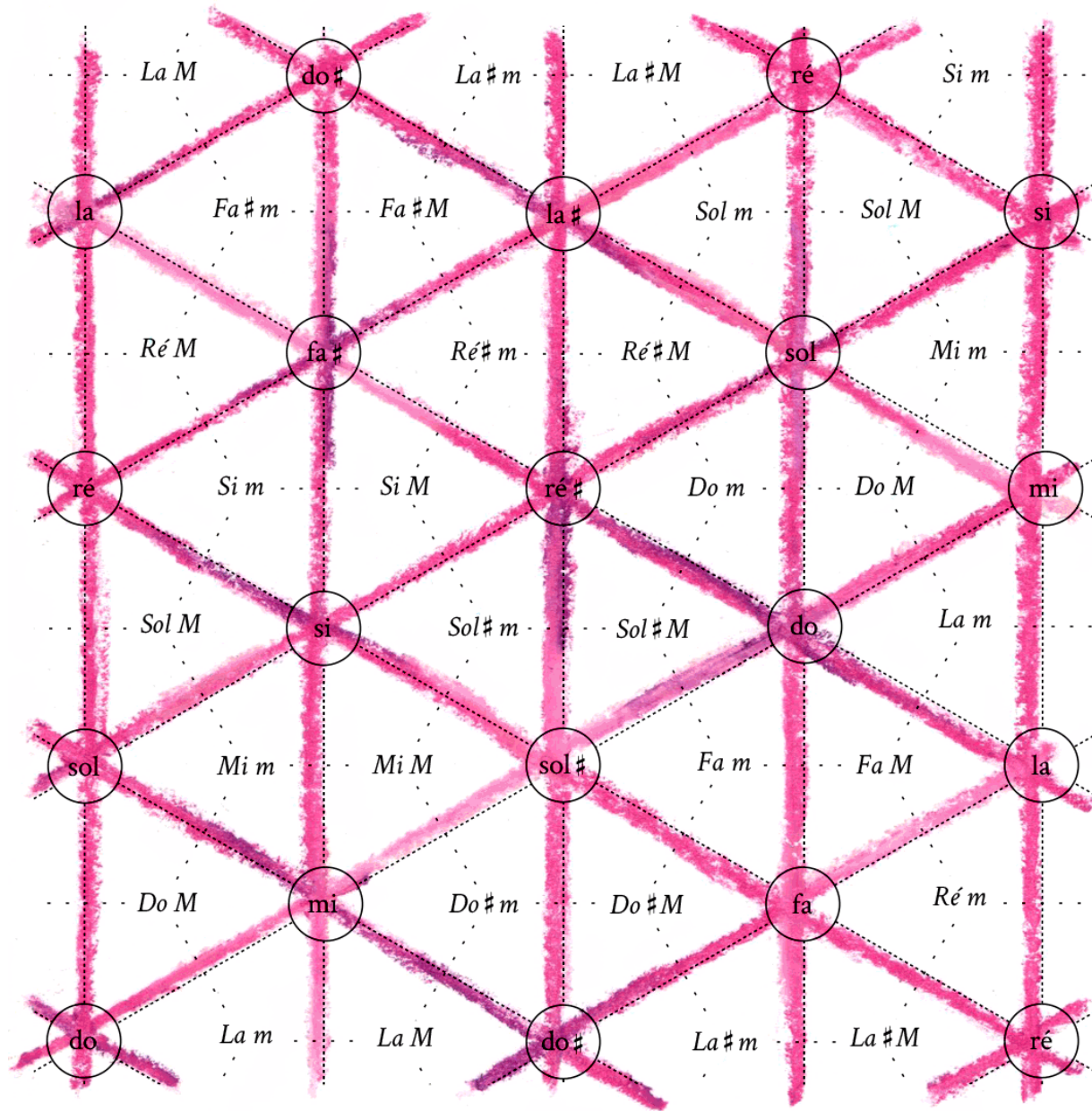
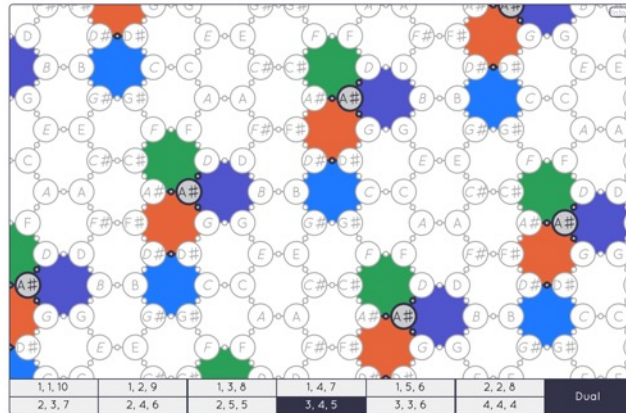
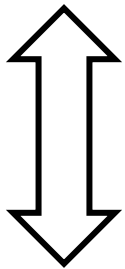


Speculum Musicum (1773)

Triangular *versus* Honeycomb representation



duality



Pousseur's Harmonic Network and Rameau's Theory

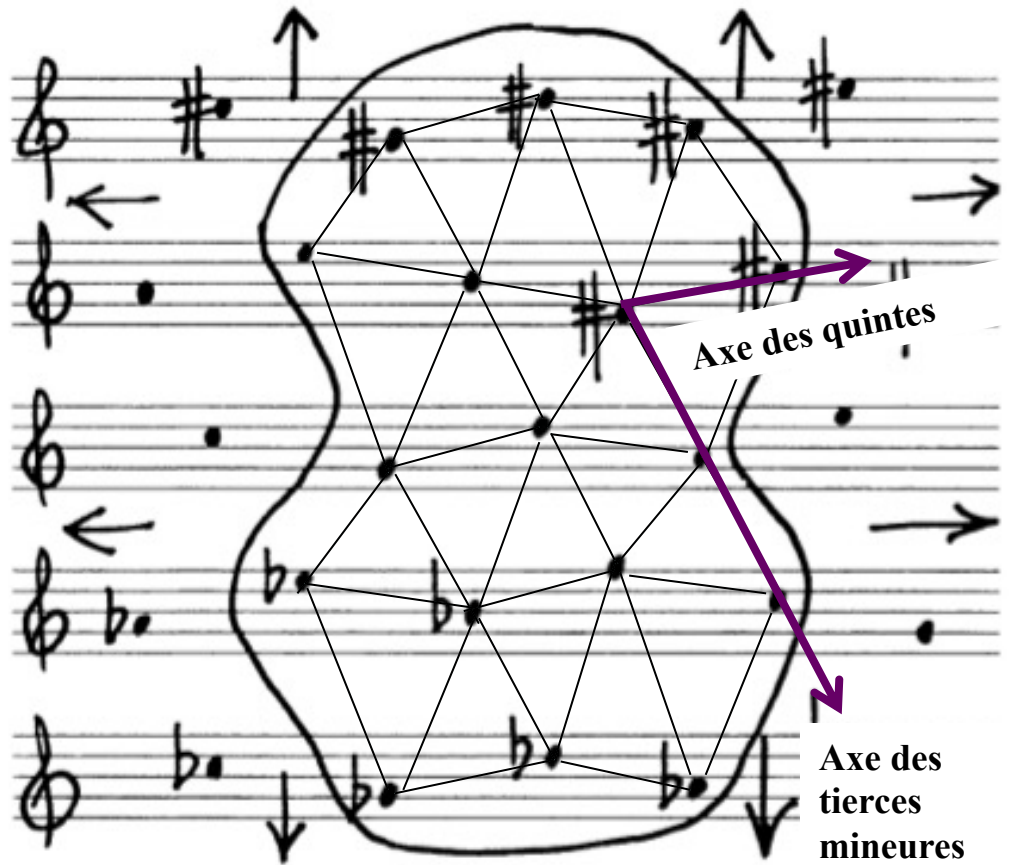
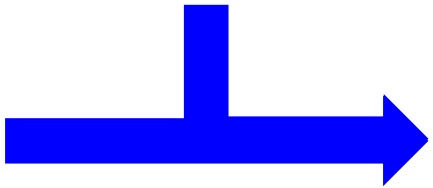
PROGRESSIONS TRIPLES ET QUINTUPLES

si b.....1	re.....5	fa#.....25	la#.....125
fa.....3	la.....15	ut#.....75	
ut.....9	mi.....45	sol#.....225	
Sol.....27	si.....135	ré#.....675	
ré.....81	fa#.....405	la#.....2025	
la.....243	ut#.....1215		
mi.....729	Sol#.....3645		
si.....2187	ré#.....10935		
fa#.....6561	la#.....32805		
ut#.....19683			
Sol#.....59049			
ré#.....177247			
la#.....531441			

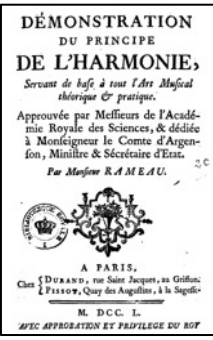
Axe des tierces majeures

La progression triple qui est perpendiculaire donne des Quintes, et la quintuple qui est orizontale donne des Tierces majeures.

Axe des quintes



Axe des tierces mineures



- « L'apothéose de Rameau. Essai sur la question harmonique, *Musiques Nouvelles. Revue d'esthétique*, 21, 105-172, 1968
- « Applications Analytiques de la 'technique des réseaux' », *Revue belge de Musicologie*, Vol. 52, pp. 247-298, 1998

• J.-Ph. Rameau, *Démonstration du principe de l'harmonie*, 1750

Pousseur's Harmonic Network and Rameau's Theory

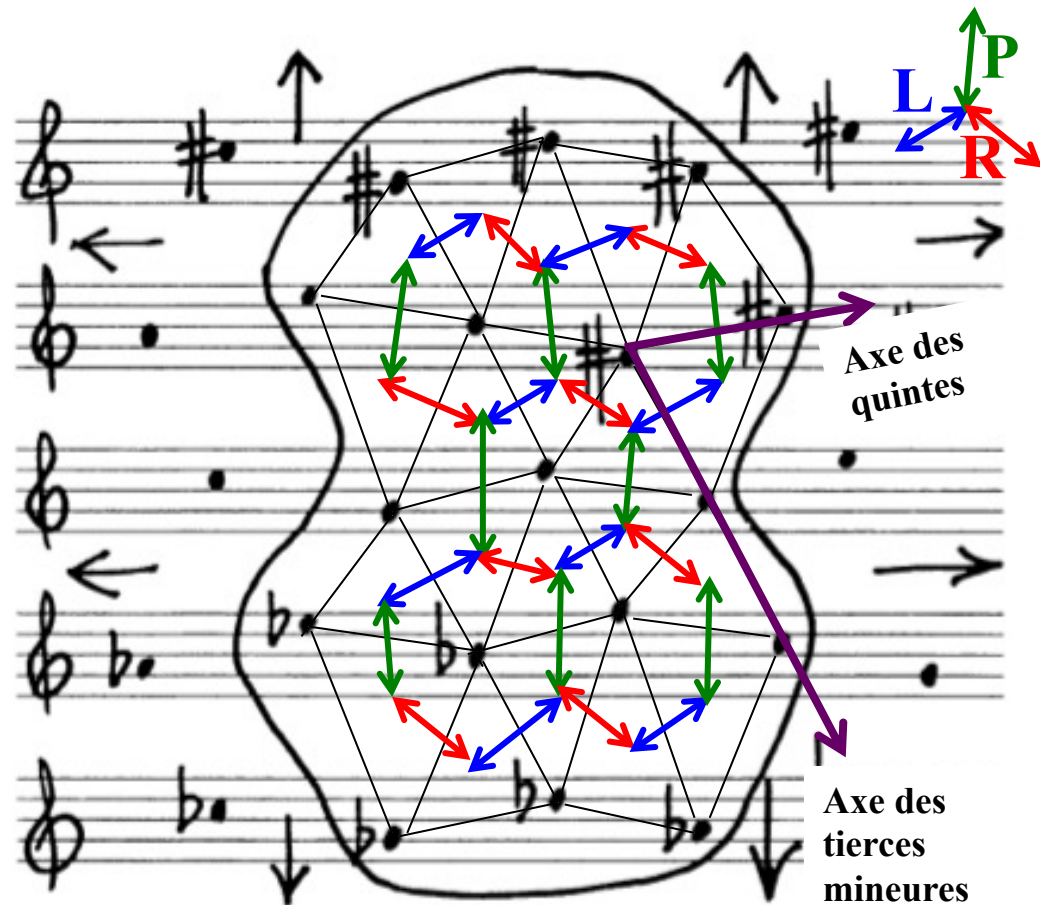
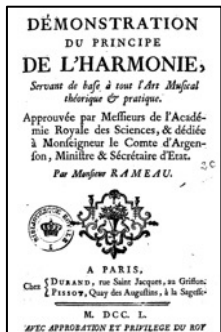
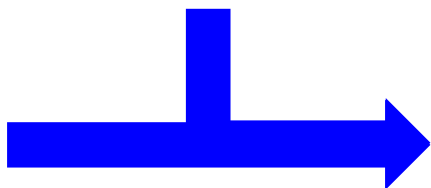
PROGRESSIONS TRIPLES ET QUINTUPLES

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ut#.....19683			
Sol#.....59049			
re#.....177247			
la#.....531441			

Axe des tierces majeures

La progression triple qui est perpendiculaire donne des Quintes, et la quintuple qui est Orizontale donne des Tierces majeures.

Axe des quintes

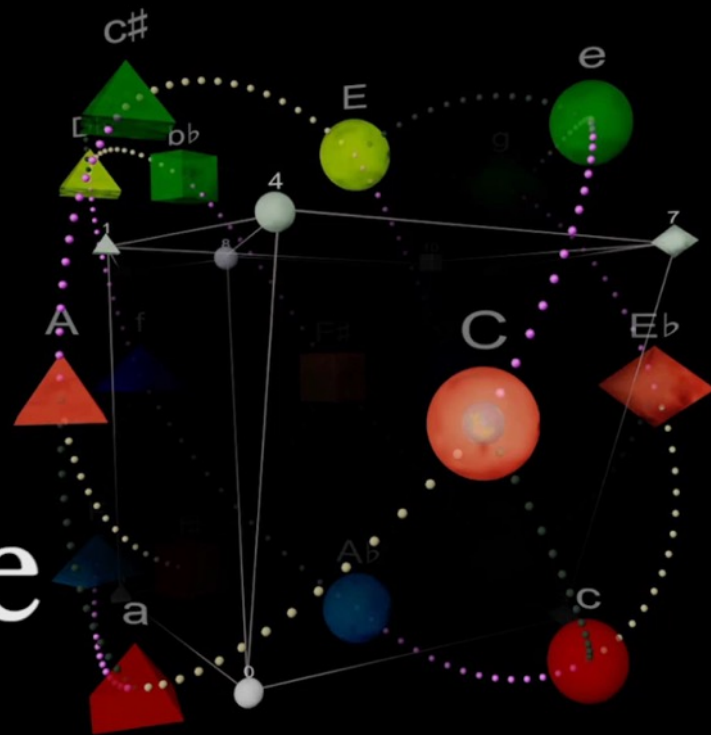


- « L'apothéose de Rameau. Essai sur la question harmonique, *Musiques Nouvelles. Revue d'esthétique*, 21, 105-172, 1968
- « Applications Analytiques de la 'technique des réseaux' », *Revue belge de Musicologie*, Vol. 52, pp. 247-298, 1998

• J.-Ph. Rameau, *Démonstration du principe de l'harmonie*, 1750

Beethoven and the Hypersphere

(and the Tonnetz)



Gilles Baroin 2016
www.MatheMusic.net

➔ www.mathemusic.net

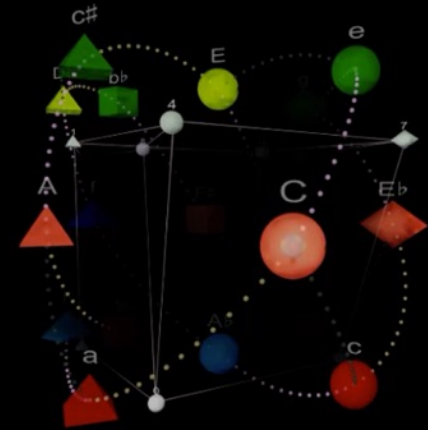


Gilles Baroin

Hamiltonian Song

www.MatheMusic.net

Le Blé en Herbe



Lyrics, music and performance by Polo
Mathemusical supervision by Moreno Andreatta
Hyperspheres and animation by Gilles Baroin, 2016

➔ www.mathemusic.net



Polo Lamy

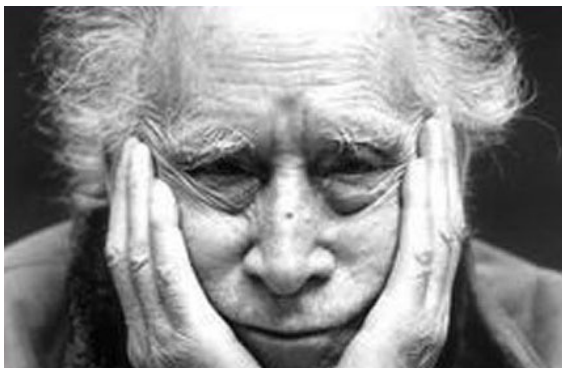


Gilles Baroin

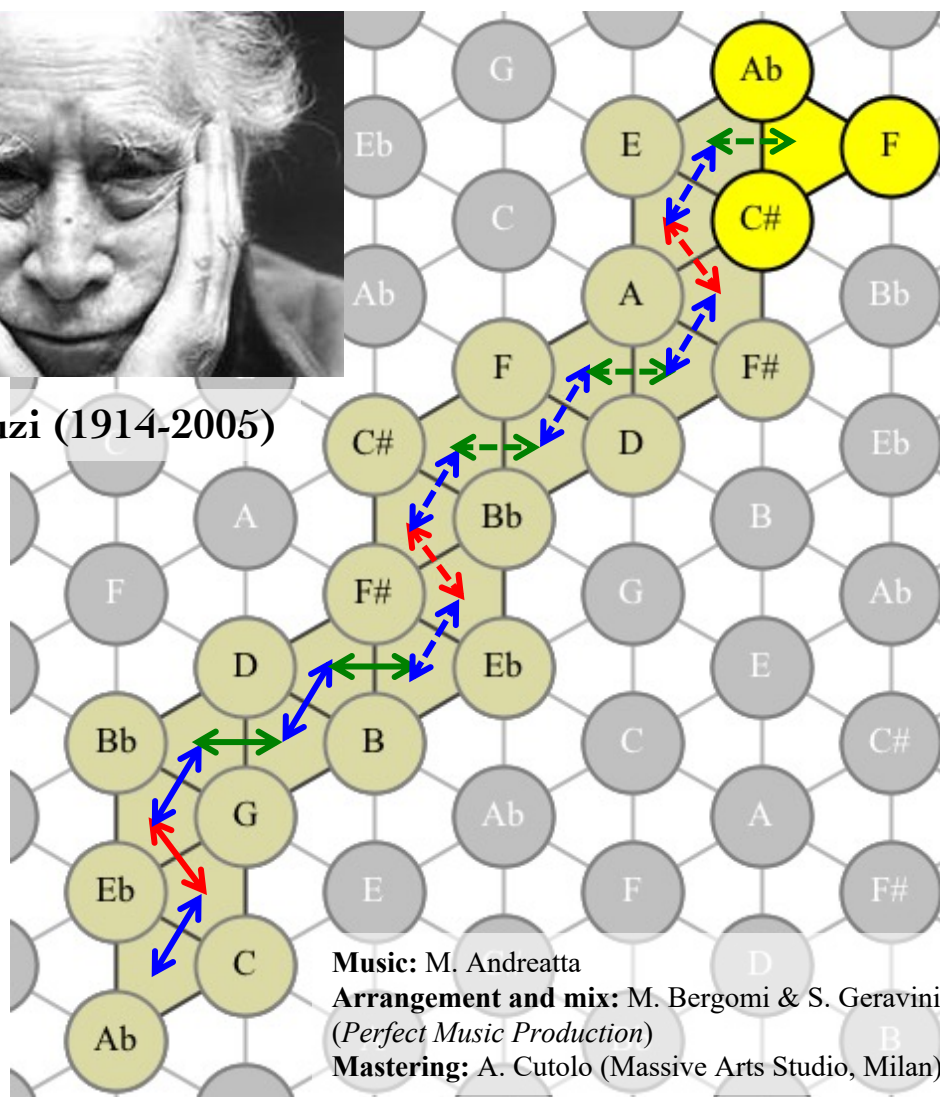
Exploring the catalogue of Hamiltonian harmonic cycles

8. C-Cm-Eb-Gm-Bb-Dm-F-Fm-Ab-Abm-B-Ebm-F#-Bbm-C#-C#m-E-Em-G-Bm-D-F#m-A-Am--PRLRLRPR
9. C-Em-E-Abm-Ab-Cm-Eb-Gm-G-Bm-B-Ebm-F#-Bbm-Bb-Dm-D-F#m-A-C#m-C#-Fm-F-Am--LPLPLR
10. C-Em-E-Abm-B-Ebm-Eb-Gm-G-Bm-D-F#m-F#-Bbm-Bb-Dm-F-Am-A-C#m-C#-Fm-Ab-Cm--LPLRLP
11. C-Em-G-Gm-Bb-Bbm-C#-C#m-E-Abm-B-Bm-D-Dm-F-Fm-Ab-Cm-Eb-Ebm-F#-F#m-A-Am--LRPRRPRR
12. C-Em-G-Gm-Bb-Bbm-C#-Fm-Ab-Cm-Eb-Ebm-F#-F#m-A-C#m-E-Abm-B-Bm-D-Dm-F-Am--LRPRRLR

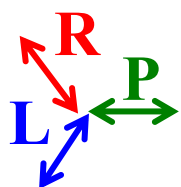
L P L P L R ...
 P L P L R L ...
 L P L R L P ...
 P L R L P L ...
L R L P L P ...
 R L P L P L ...



Mario Luzi (1914-2005)



Music: M. Andreatta
 Arrangement and mix: M. Bergomi & S. Geravini
 (Perfect Music Production)
 Mastering: A. Cutolo (Massive Arts Studio, Milan)



La sera non è più la tua canzone,
 è questa roccia d'ombra traforata
 dai lumi e dalle voci senza fine,
 la quiete d'una cosa già pensata.

Ah questa luce viva e chiara viene
 solo da te, sei tu così vicina
 al vero d'una cosa conosciuta,
 per nome hai una parola ch'è passata
 nell'intimo del cuore e s'è perduta.

Caduto è più che un segno della vita,
 riposi, dal viaggio sei tornata
 dentro di te, sei scesa in questa pura
 sostanza così tua, così romita
 nel silenzio dell'essere, (compiuta).

L'aria tace ed il tempo dietro a te
 si leva come un'arida montagna
 dove vaga il tuo spirito e si perde,
 un vento raro scivola e ristagna.

Relaxing the Hamiltonian constraints in song writing



01:29

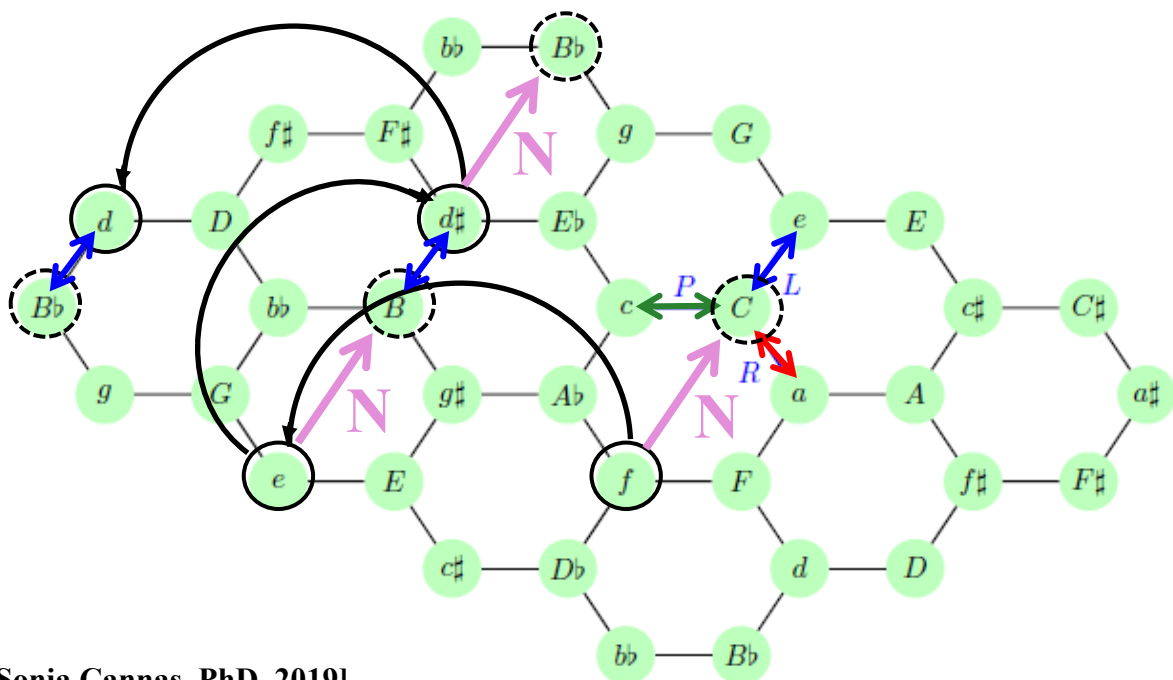
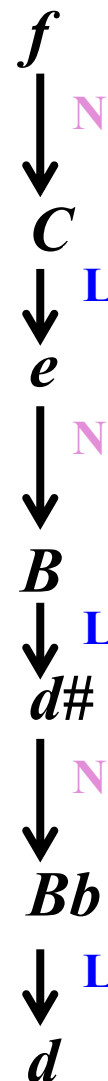
FRANGIFLUTTI (L. Mello / M. Andreatta)

Nel rifrangere i nostri cuori,
– gente nata che esige cura –
sono stato tra i meno bravi
nella tua favola incicura.

Ora è tardi lo so oramai
venti freddi come una fiaba
però tengo a cantare il canto
Eva sola che resta maga.

Eva cenno di ribellione
Eva fascio pronto all'addio
Eva donna che sa parlare
Al silenzio fatto d'oblio.

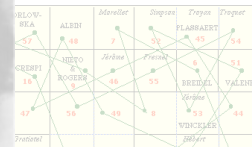
Sai parole da incatenare
sai sorridere per piacere
sai scappare senza tornare
sai ferire e sai far l'amore.



Rules and constraints in the artistic process



Cent mille milliards de poèmes



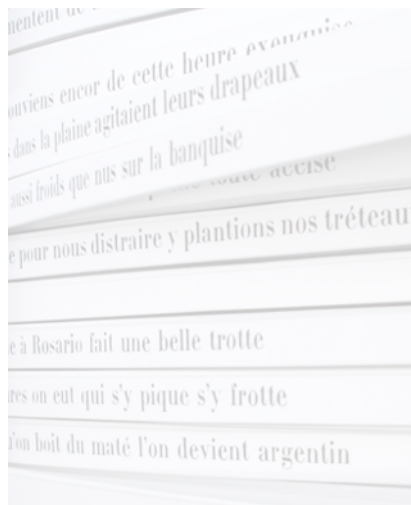
OuLiPo

OuLiPo (Ouvroir de
ure Potentielle)

DIZIONI Dizionario
Musicale
Multidisciplinare
Integrato

Trento, 26-27 novembre 2021

REGOLE



Raymond Queneau



Italo Calvino

*Il castello dei destini
incrociati, 1969*

Roman
ition
Densel

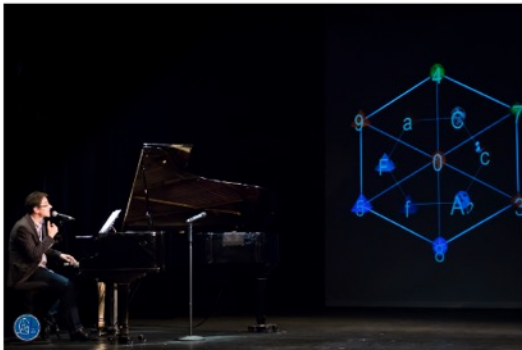


www.morenoandreatta.com

- Music and Poetry
- Music and Maths
- Improvisation
- Software

Music at the interface with mathematics and poetry

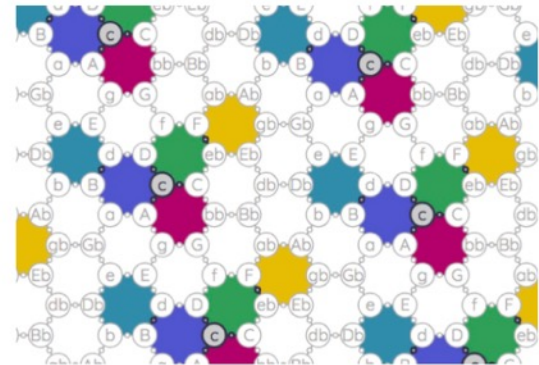
Music and maths



Improvisation

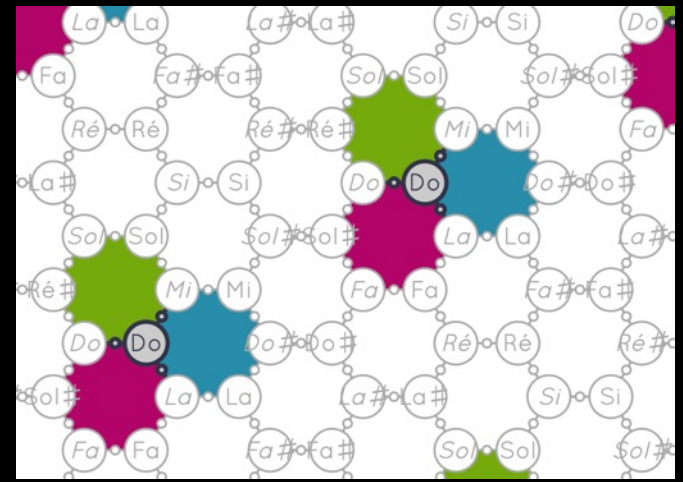
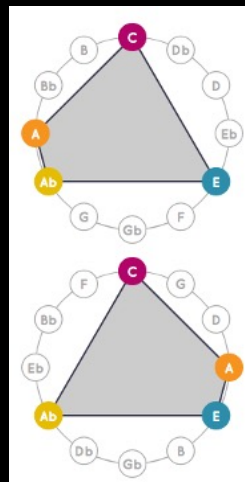
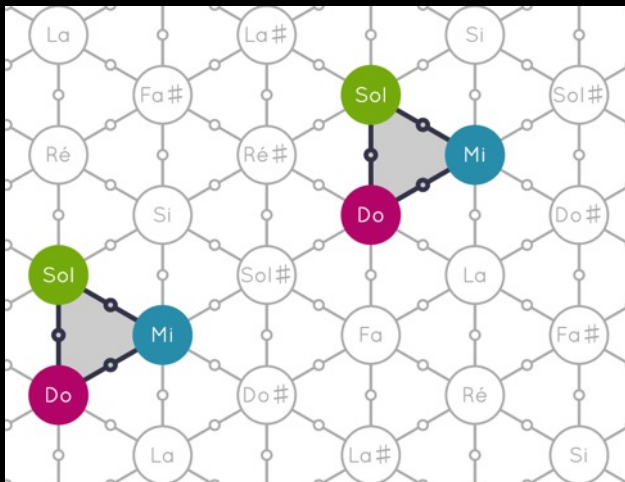


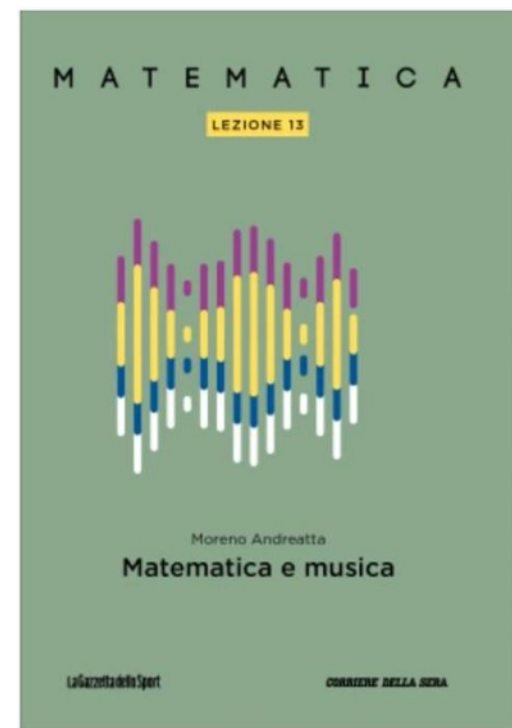
Software



The generalized Tonnetz environment

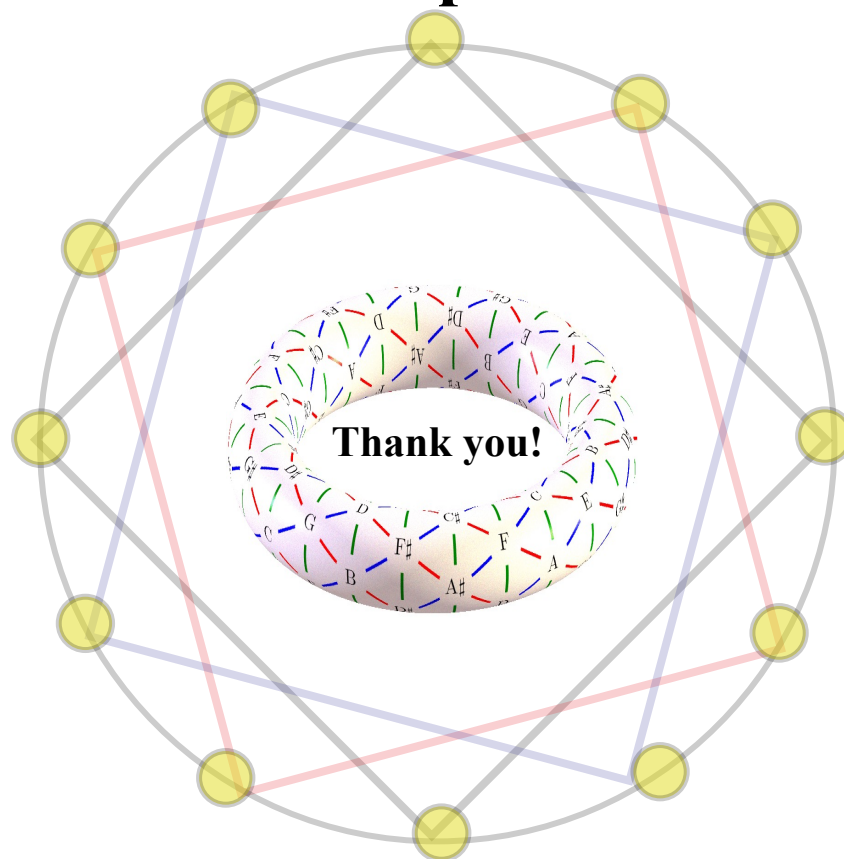
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Che legame c'è fra la matematica e la musica? La riflessione sui rapporti fra queste due discipline, che possiamo affermare cominci con **Pitagora** (almeno per quanto riguarda la storia del pensiero filosofico in Occidente), ha di fatto attraversato i secoli per giungere sino a noi incorporando, di volta in volta, dei campi della matematica dove il legame ha potuto trovare un fondamento teorico e nuove possibilità di applicazioni in ambito non solo musicale ma nella matematica stessa. La musica ha in effetti contribuito attraverso le riflessioni di **teorici della musica, analisti e compositori** ad aprire nuovi orizzonti di ricerca all'interno della matematica, come storicamente è avvenuto per il **calcolo combinatorio** e la **teoria dei grafi** rispettivamente nel XVII e XVIII secolo e come continua a fare oggi nei laboratori di **ricerca matematica** di tutto il mondo.

Some thoughts on new forms of contamination between contemporary and popular music: the role of mathematical formalization and computer-aided modelling



Interview

Moreno Andreatta & Fabio Cifariello Ciardi