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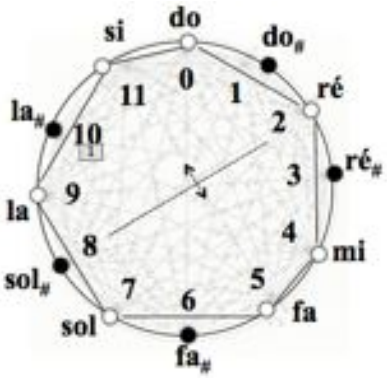
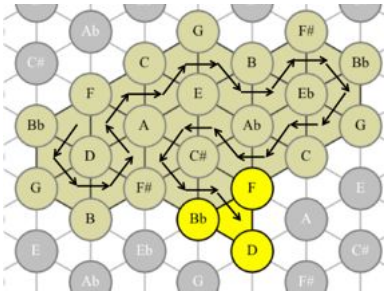
la formalizzazione dell'organizzazione delle altezze nello spazio temperato e la teoria trasformazionale



Fondazione Levi

29 giugno 2016



Moreno Andreatta
Equipe Représentations Musicales
IRCAM/CNRS/UPMC
http://www.ircam.fr/repmus.html

ircam Centre Pompidou

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  - La nascita della musicologia sistematica (Guido Adler, 1885)

- **La rappresentazione circolare del sistema temperato equabile**
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  - Enumerazione dei modi di Messiaen a trasposizione limitata
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- **Elementi di analisi neo-riemanniana**
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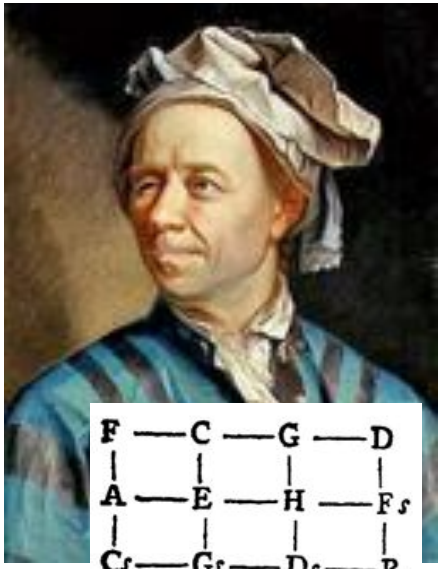
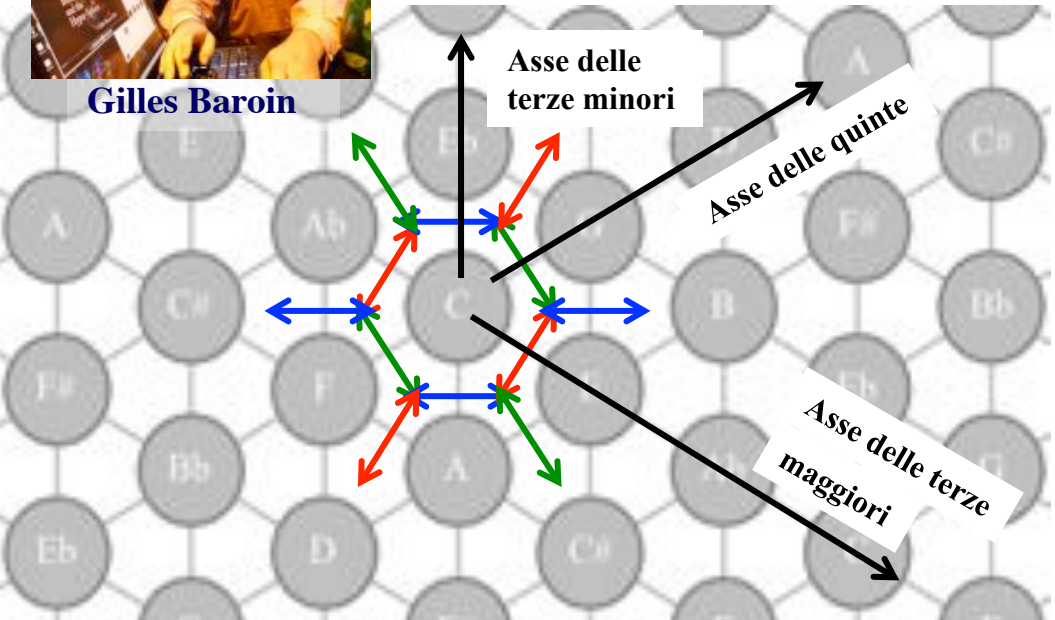
  - Verso una classificazione automatica dello stile musicale
  - Applicazioni alla *popular music* (pop, rock, canzone, ...)

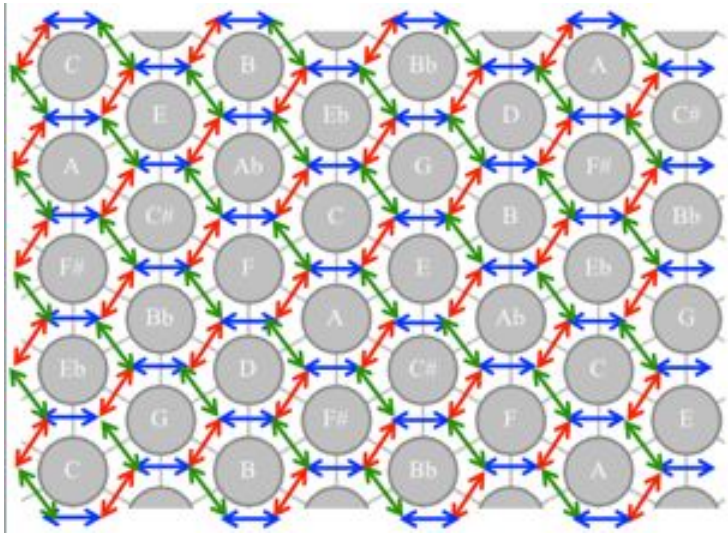
Il *Tonnetz* (o alveare musicale)

Gilles Baroin



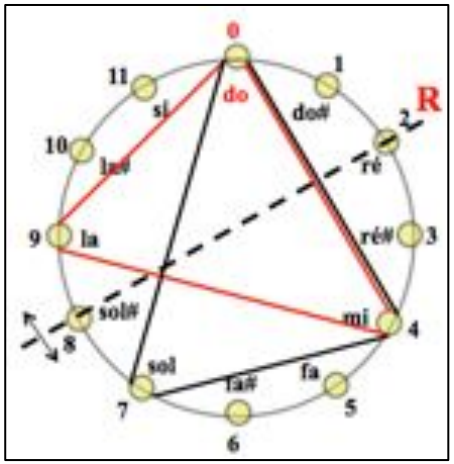
Speculum Musicum (Euler, 1773)

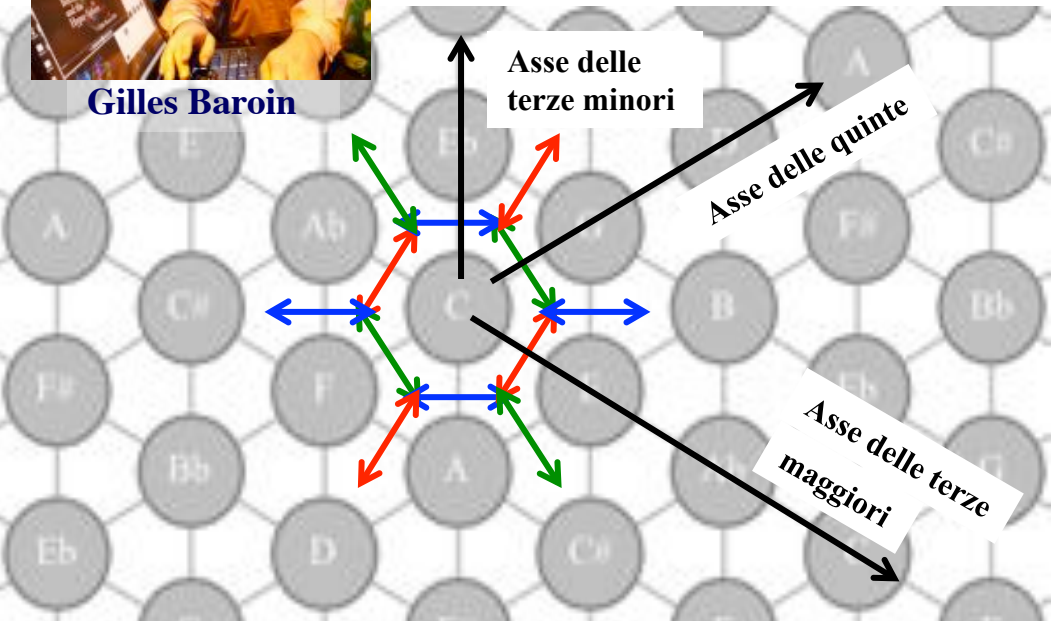


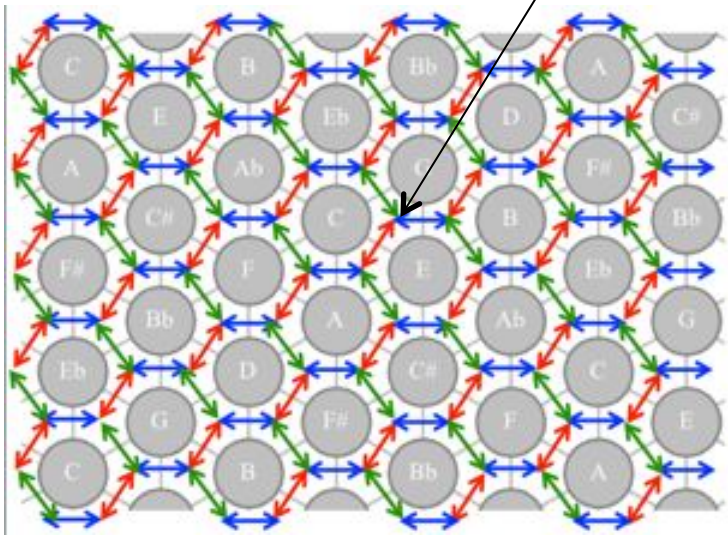


Il *Tonnetz* (o alveare musicale)

Gilles Baroin

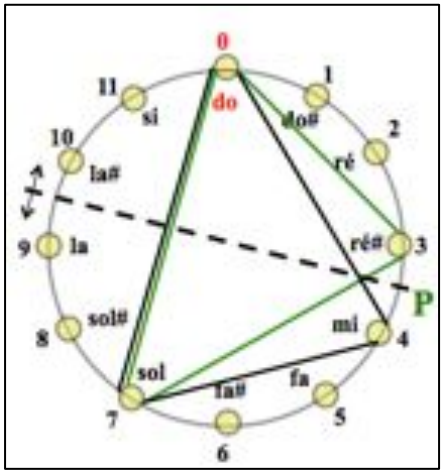


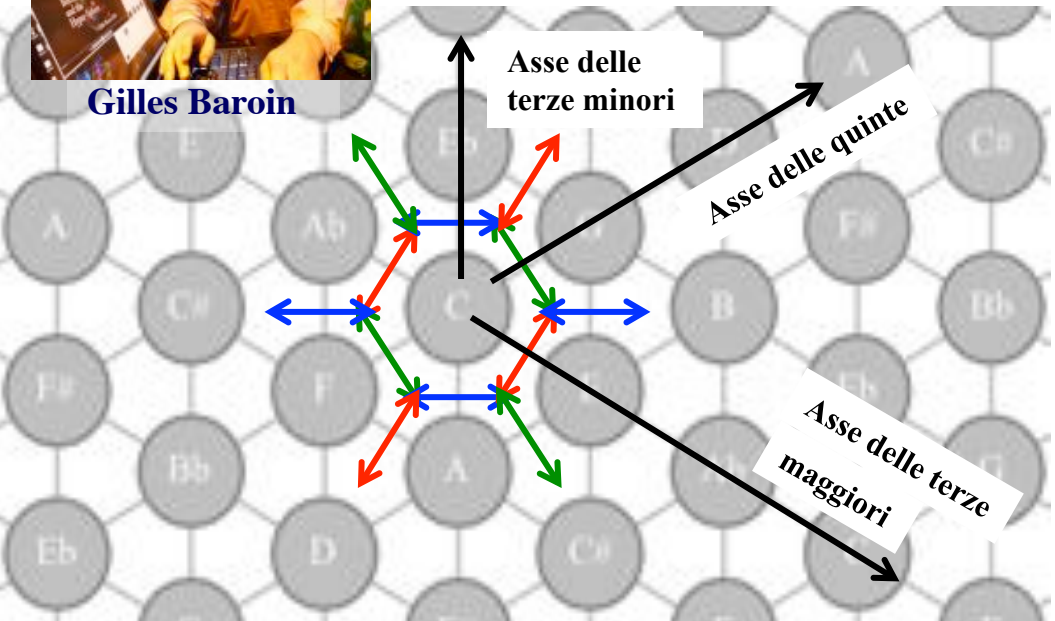


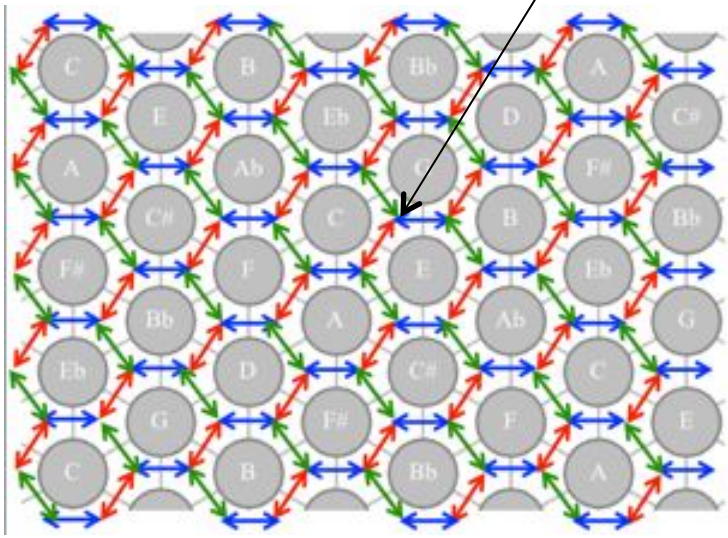


Il *Tonnetz* (o alveare musicale)

Gilles Baroin

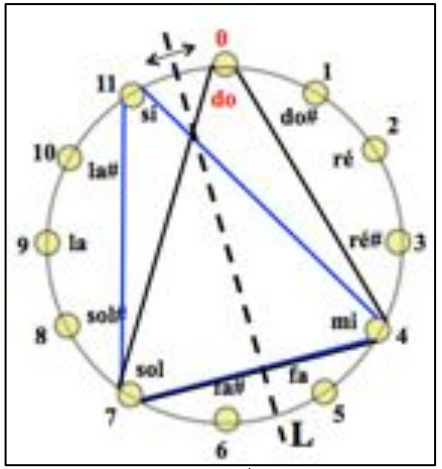


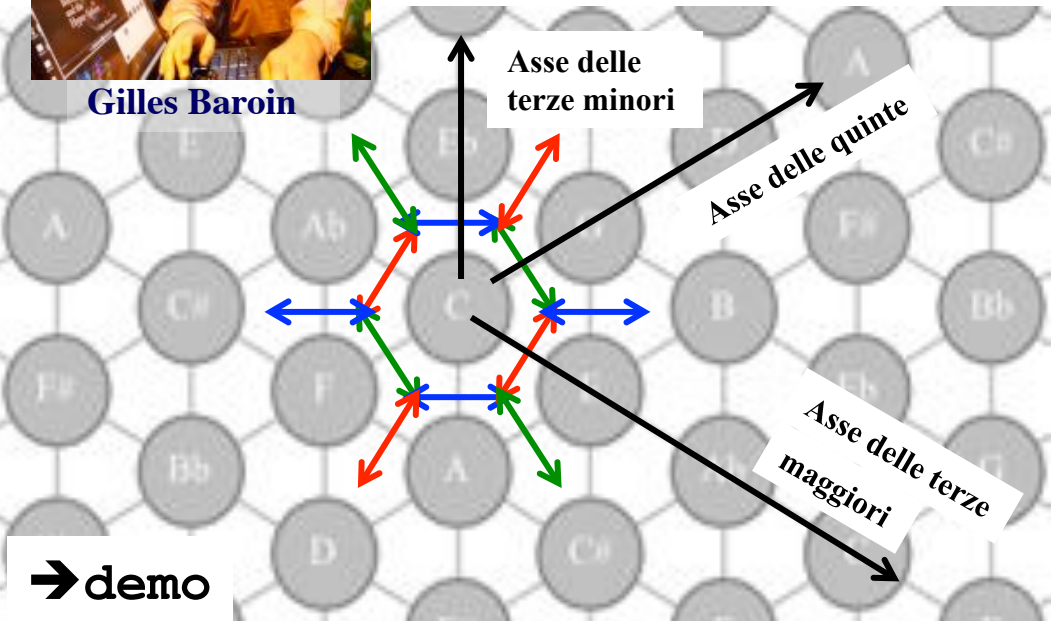


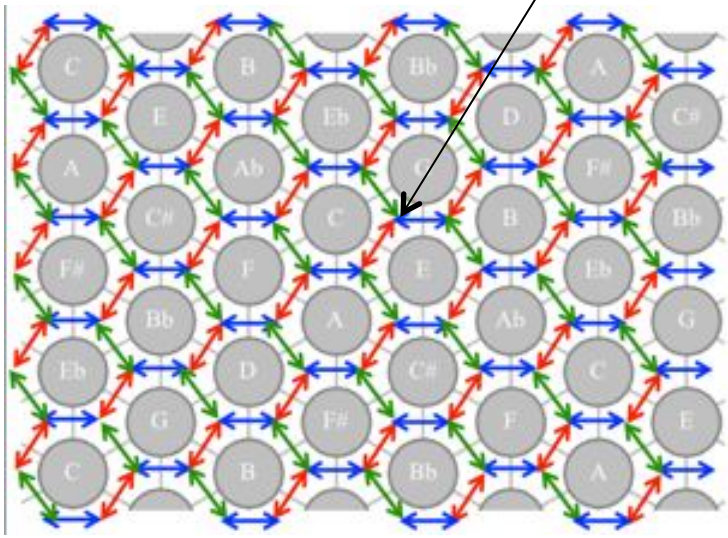


Il *Tonnetz* (o alveare musicale)

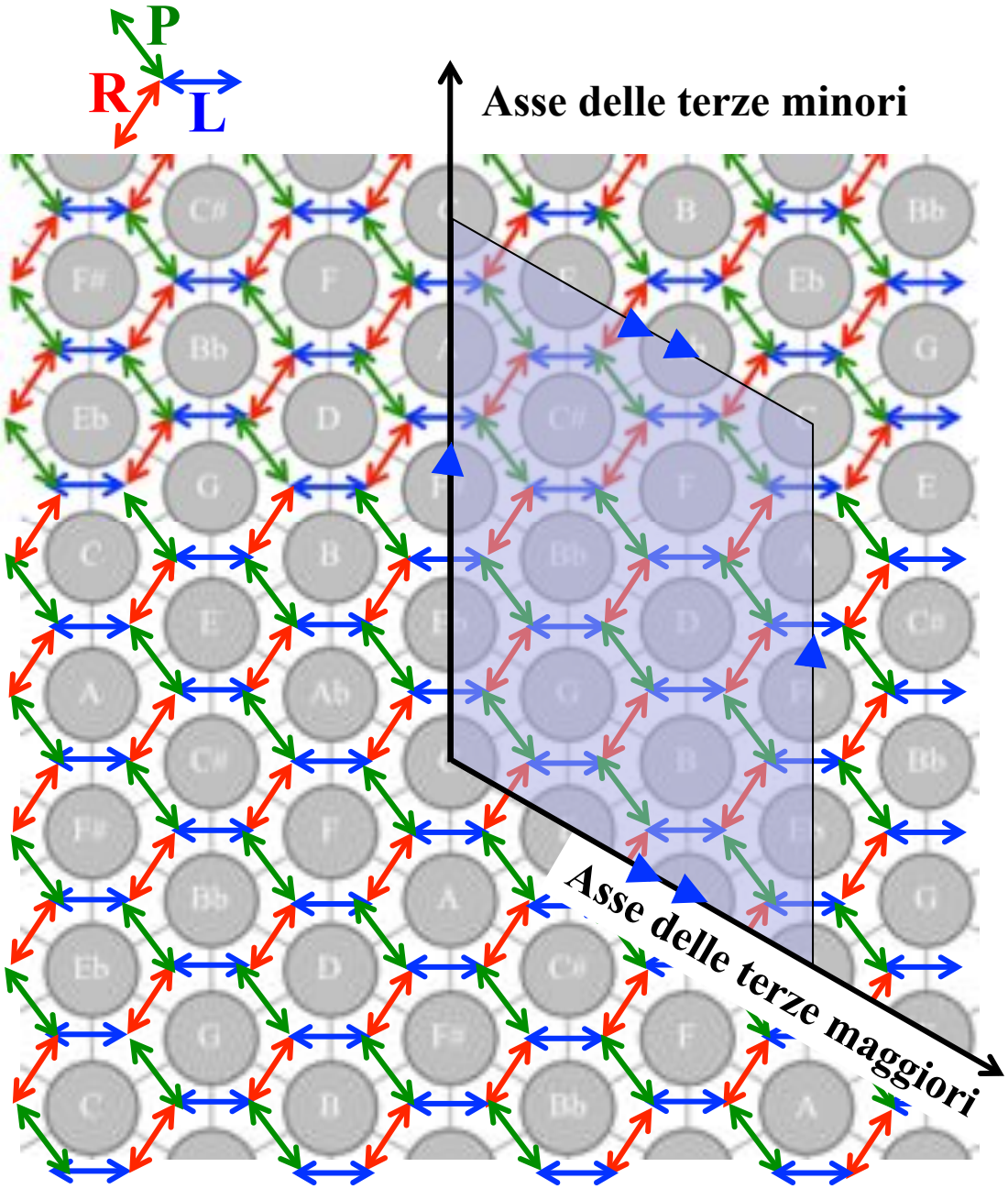
Gilles Baroin

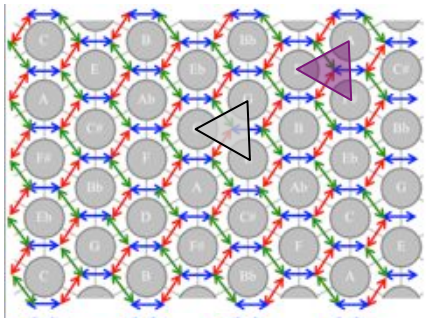


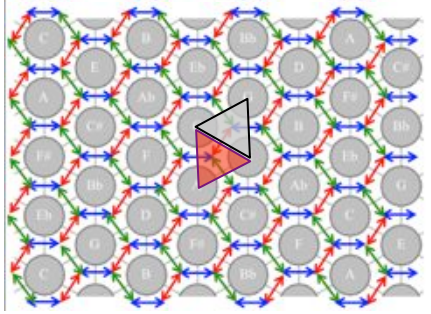


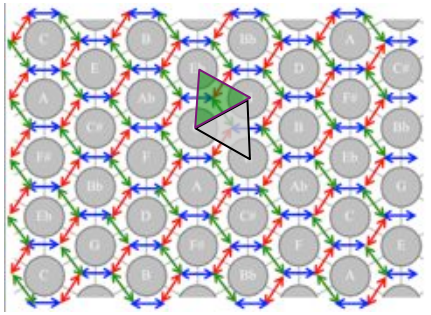


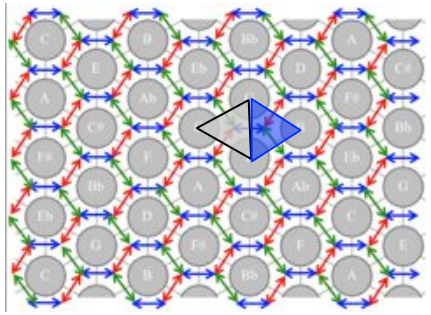
Il *Tonnetz* e le sue simmetrie

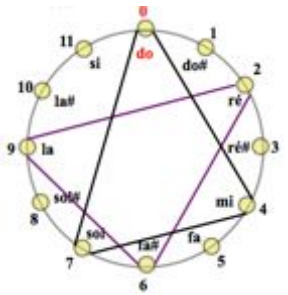


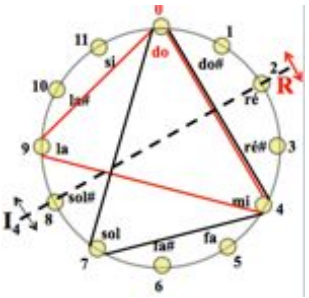


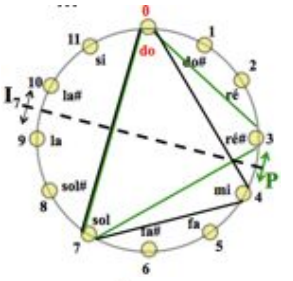


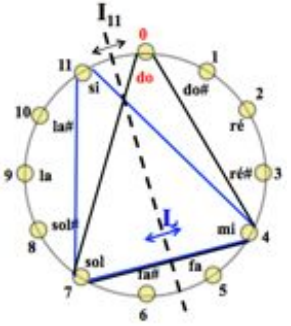




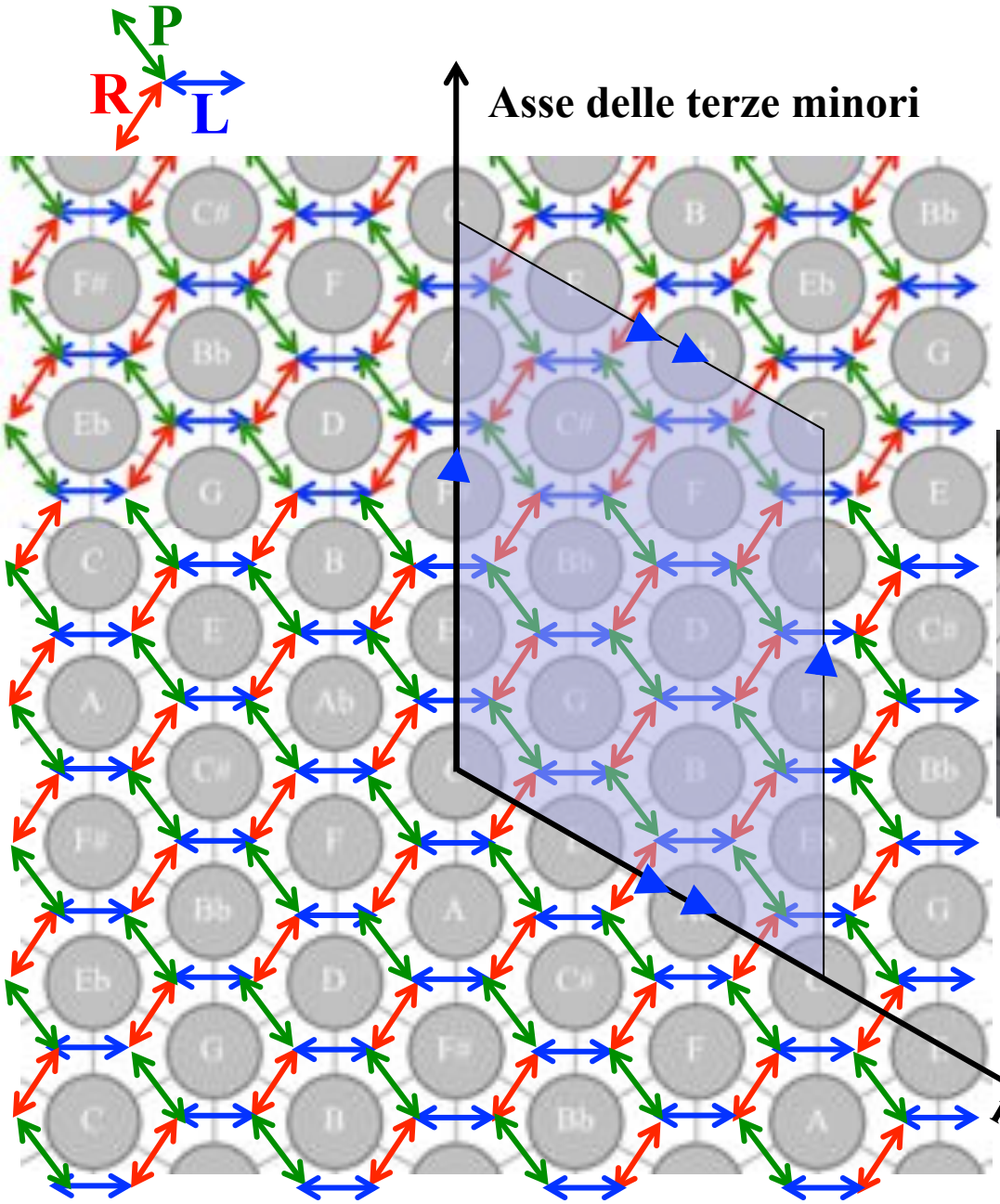


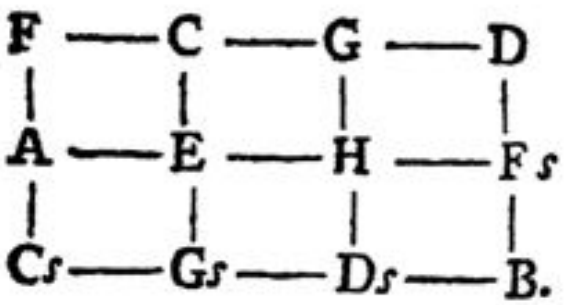




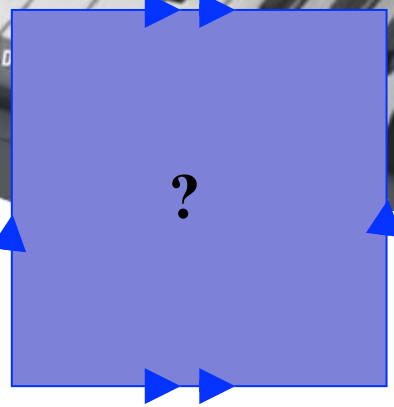


Il *Tonnetz* come struttura topologica





Speculum Musicum (Euler, 1773)



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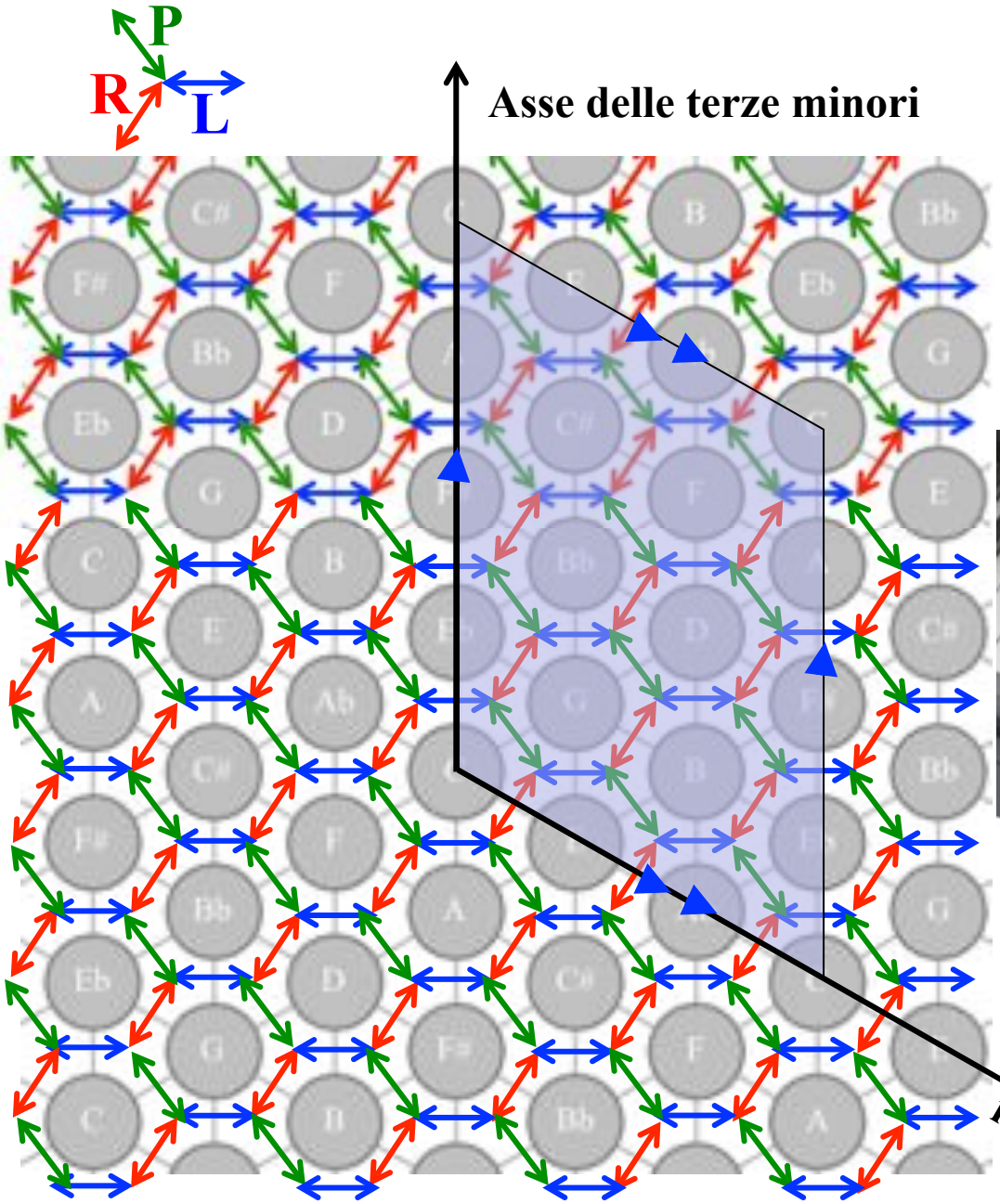
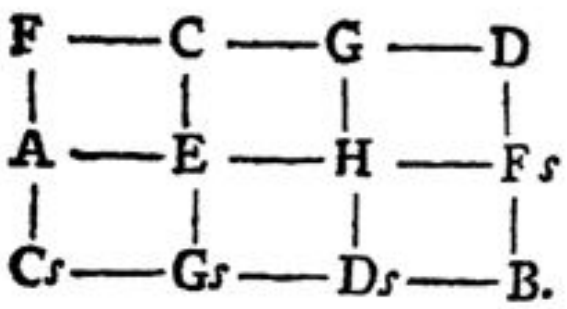


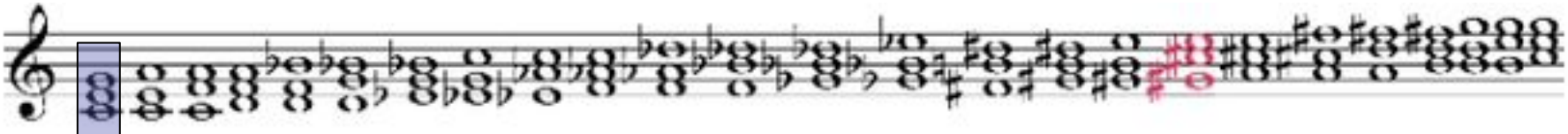


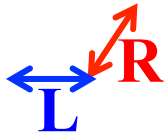
Speculum Musicum (Euler, 1773)

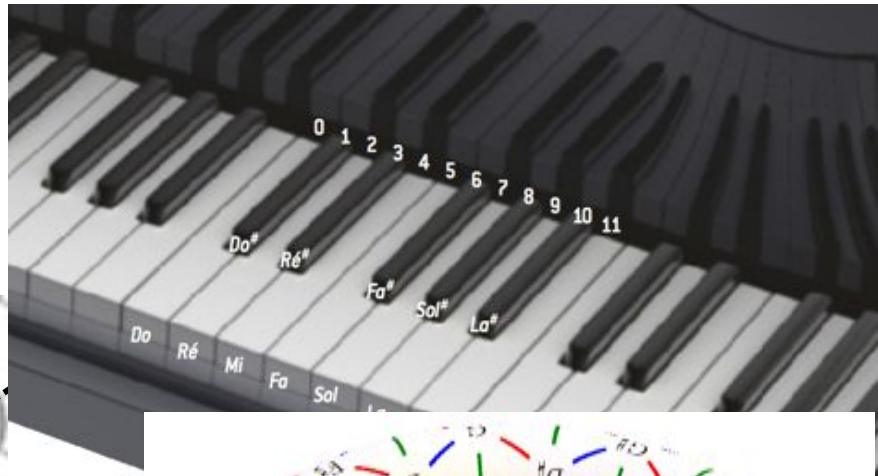
Asse delle terze maggiori

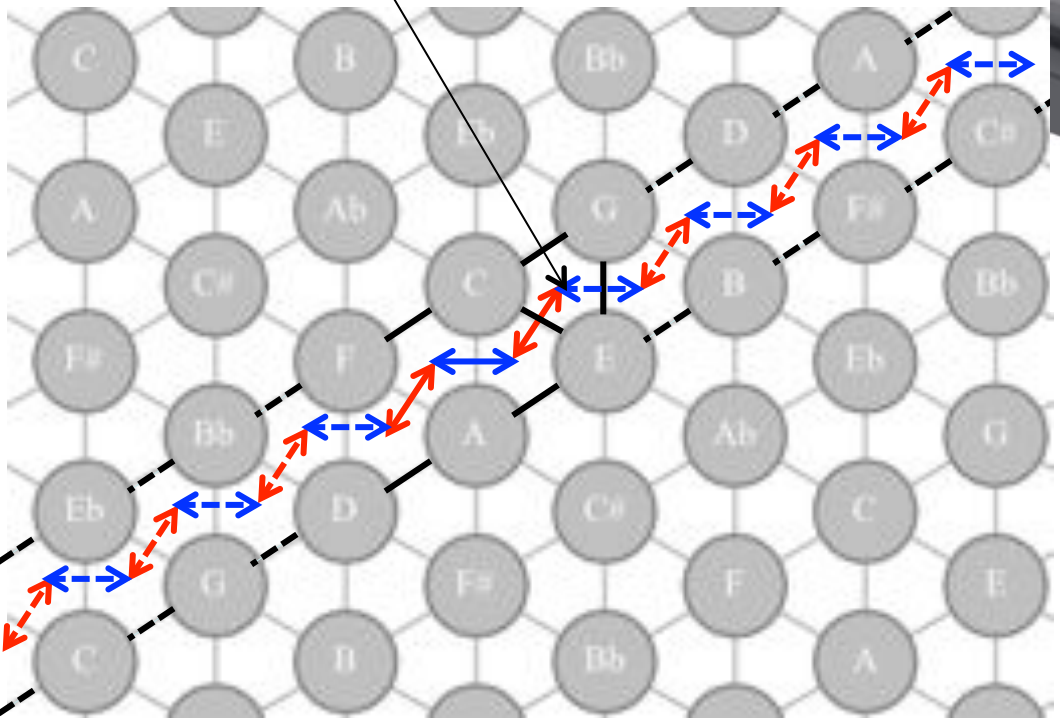
Torus

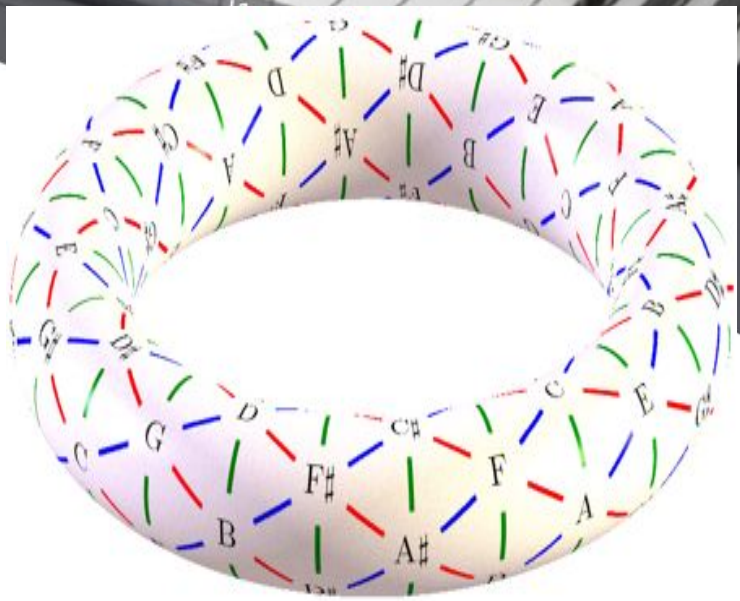
Progressioni armoniche come traiettorie spaziali





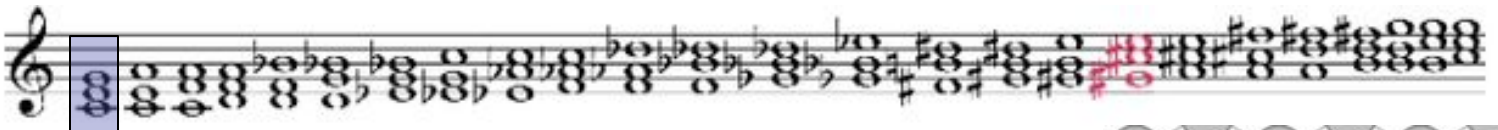


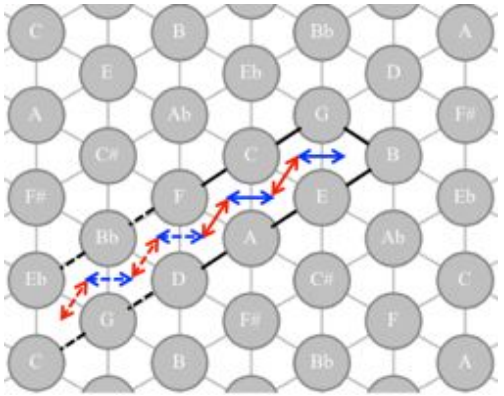


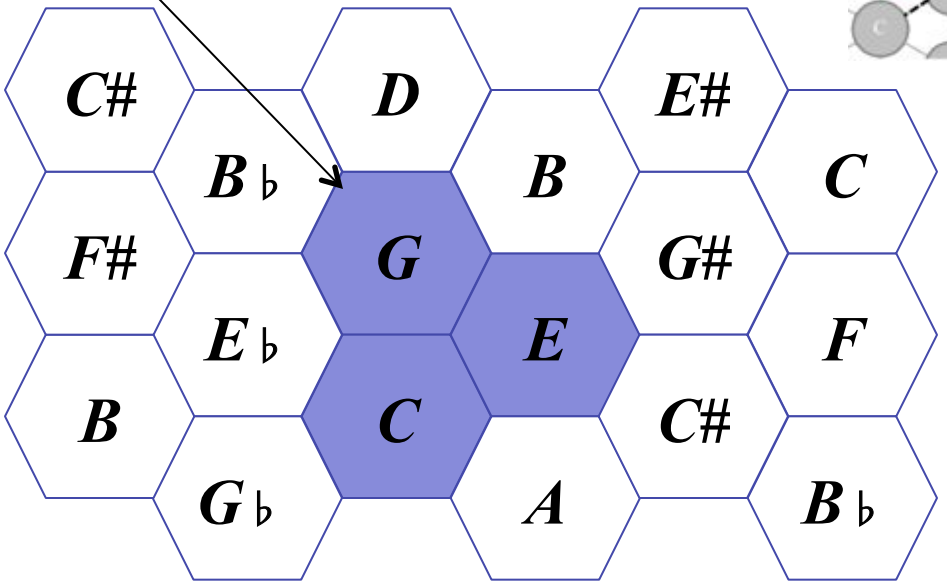


➔ Source : https://upload.wikimedia.org/wikipedia/commons/6/67/TonnetzTorus.gif

Extract of the 2nd movement of the Symphony No. 9 (L. van Beethoven)







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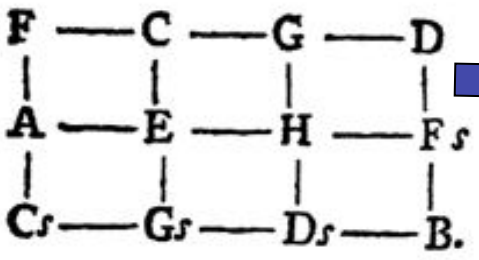
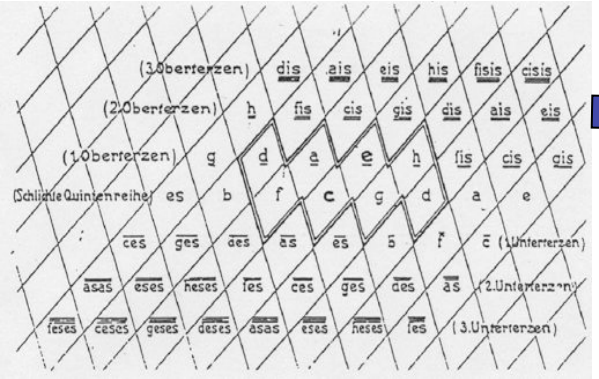
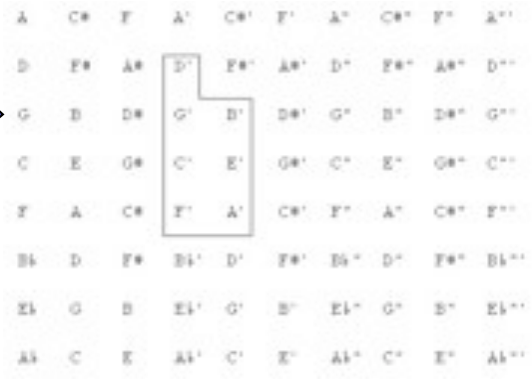
La teoria neo-riemanniana in quanto disciplina analitica



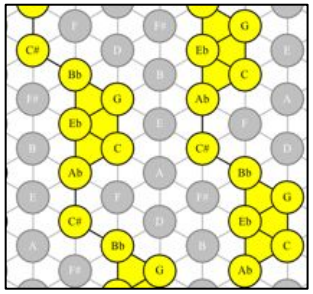
Euler : *Speculum musicum*, 1773



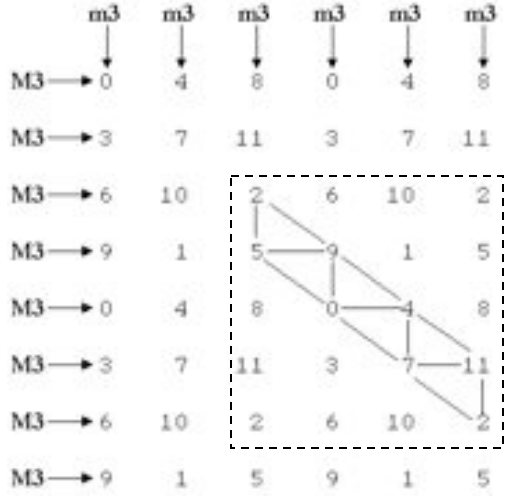
Hugo Riemann : « Ideen zu einer Lehre von den Tonvorstellung », 1914



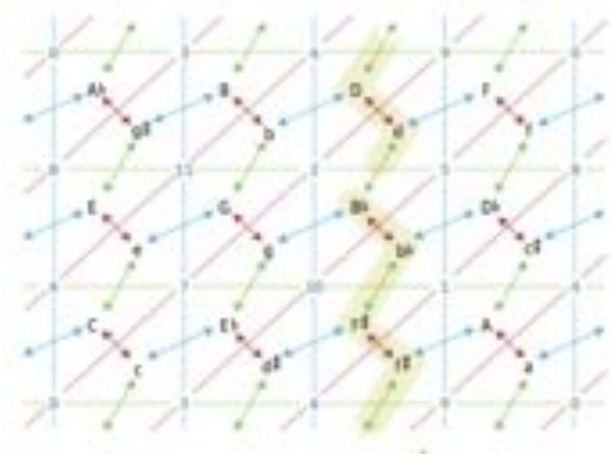
Longuet-Higgins (1962)



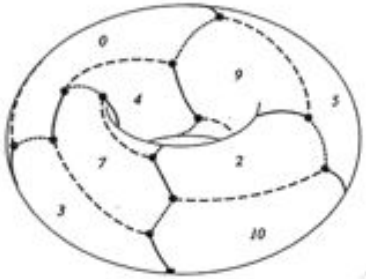
Hexachord (Bigo et al.)



Balzano (1980)

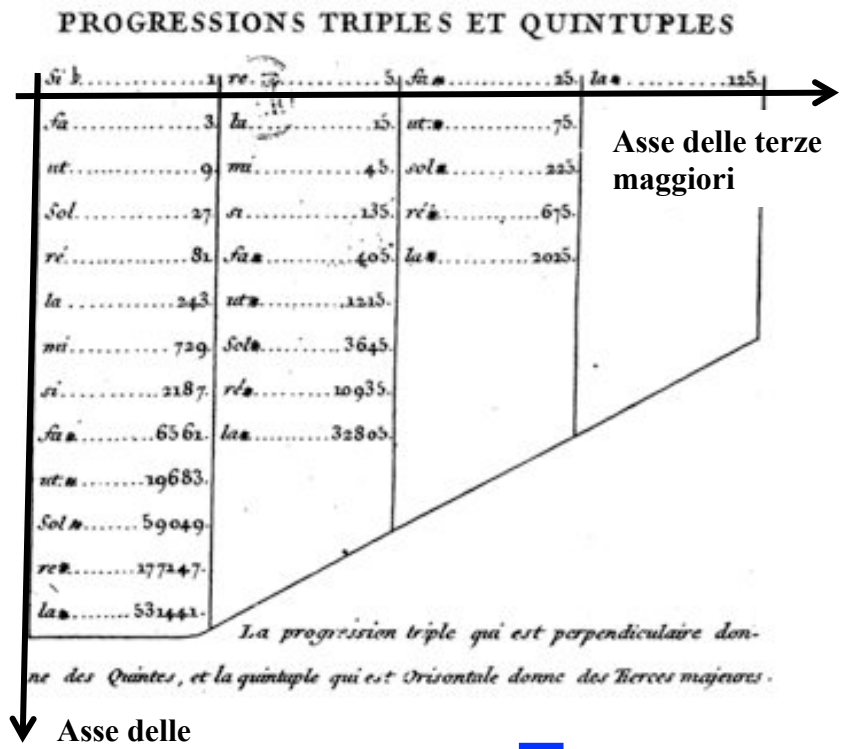


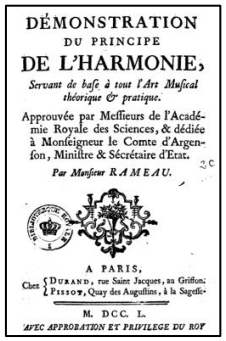
J. Hook, « Exploring Musical Space », *Science*, 2006

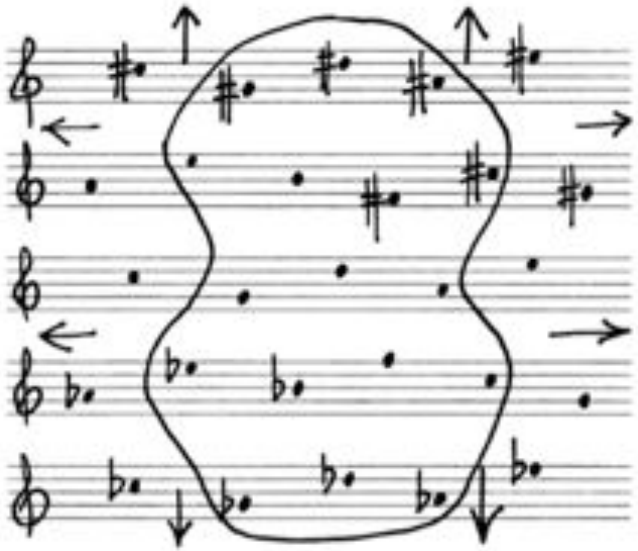


Douthett & Steinbach, *JMT*, 1998

Le origini ramiste del *Tonnetz* (secondo Henri Pousseur)




DÉMONSTRATION
DU PRINCIPE
DE L'HARMONIE,
Servant de base à tout l'Art Musical théorique & pratique.
Approuvée par Messieurs de l'Académie Royale des Sciences, & dédiée à Monseigneur le Comte d'Argenson, Ministre & Sécrétaire d'Etat.
Par Monsieur RAMEAU.
A PARIS,
Chez {DURAND, rue Saint Jacques, au Griffon; PISSOT, Quay des Augustins, à la Sagesse.
M. DCC. L.
AVEC APPROBATION ET PRIVILEGE DU ROY

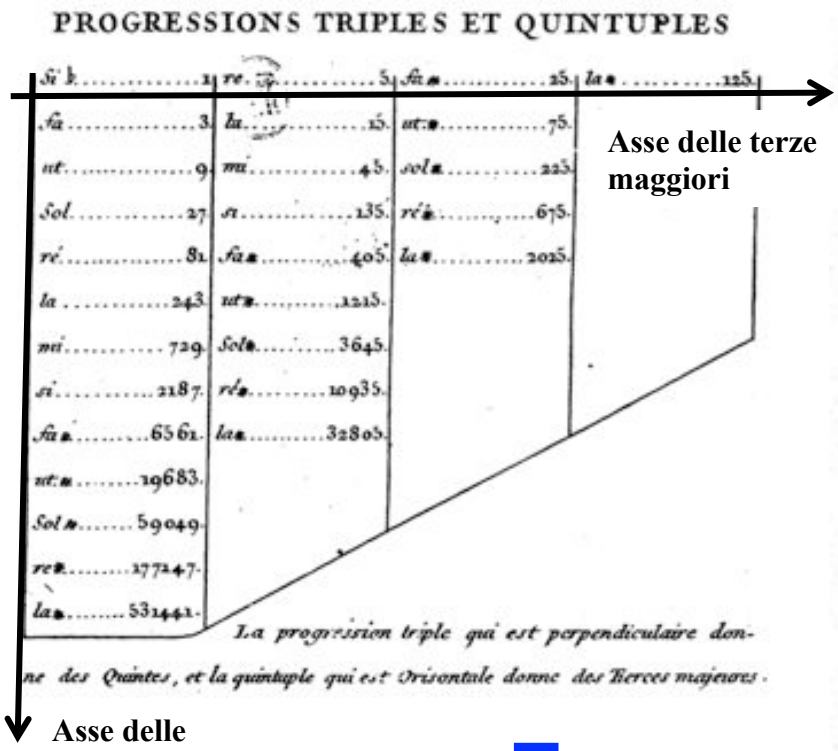


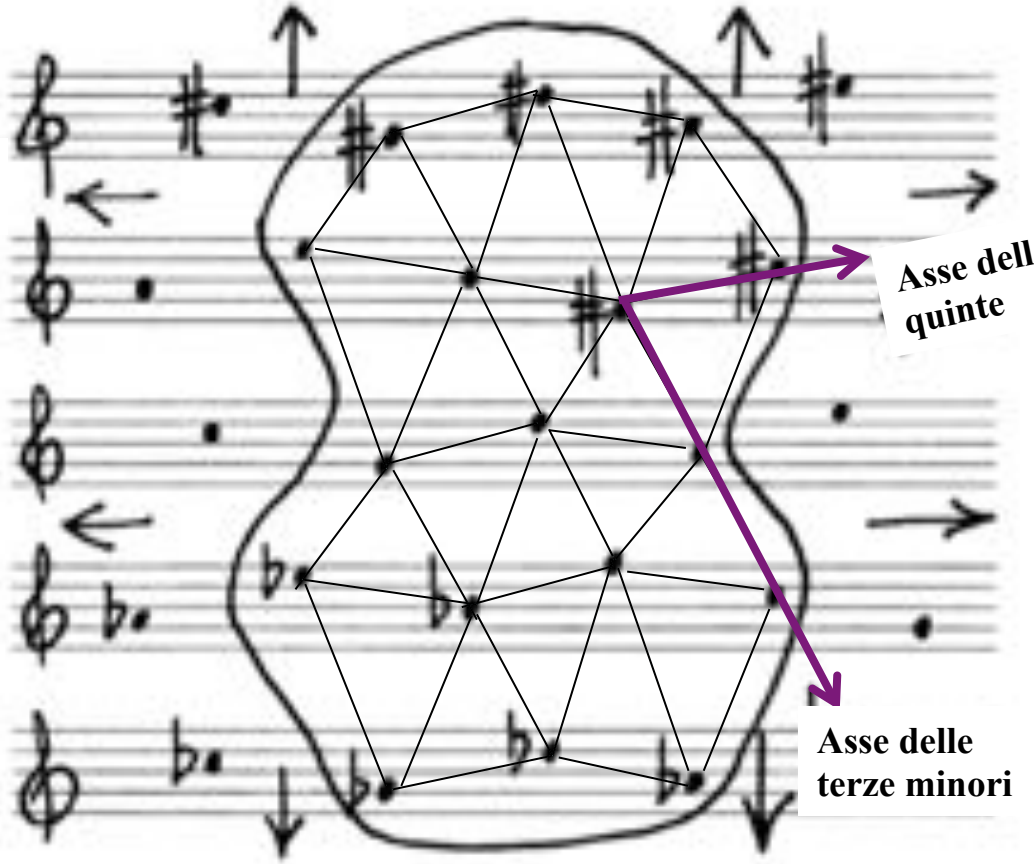
"Un reticolo, nel senso inteso qui, è una distribuzione di note [...] secondo più (a cominciare da due) assi che si caratterizzano ciascuno come una successione d'un medesimo intervallo"

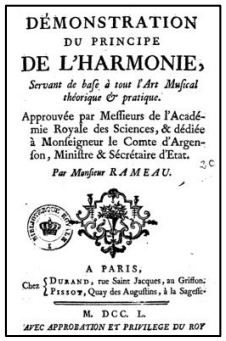
« Applications Analytiques de la 'technique des réseaux' », ***Revue belge de Musicologie*****, Vol. 52, pp. 247-298, 1998**

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

Le origini ramiste del *Tonnetz* (secondo Henri Pousseur)



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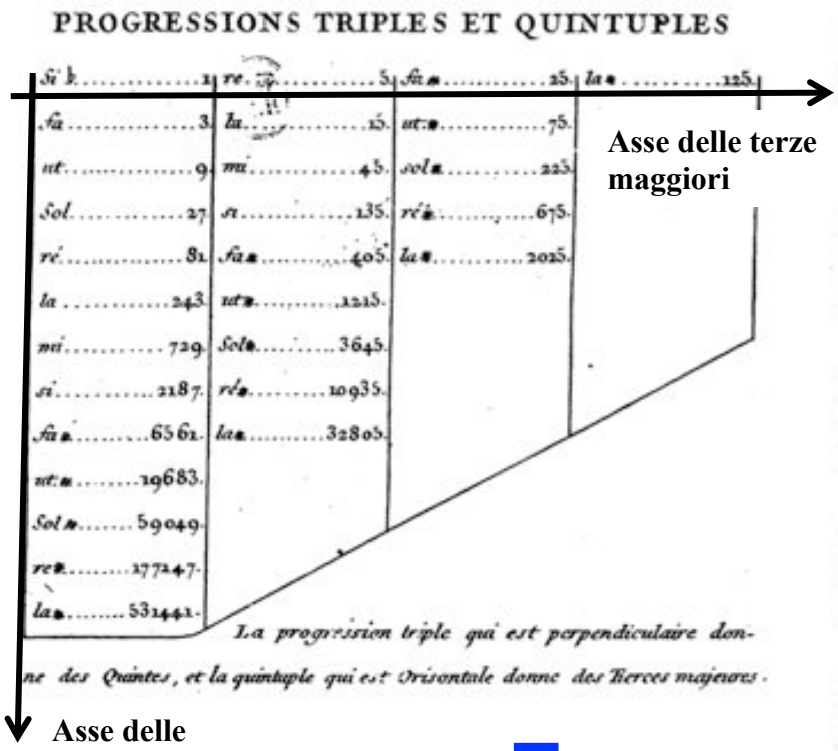
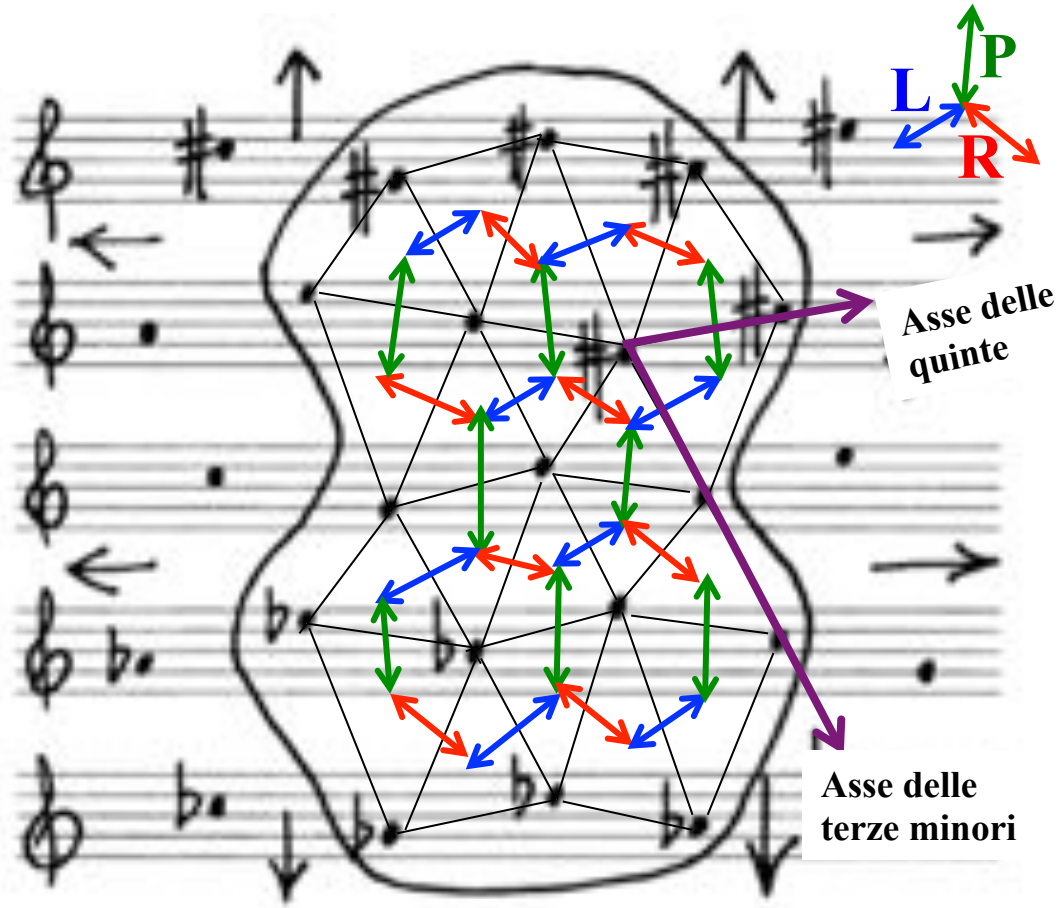
Approuvée par Messieurs de l'Académie Royale des Sciences, & dédiée à Monseigneur le Comte d'Argenson, Ministre & Sécrétaire d'Etat.
Par Monsieur RAMEAU.
A PARIS,
Chez {DURAND, rue Saint Jacques, au Griffon; PISSOT, Quay des Augustins, à la Sagesse.
M. DCC. L.
AVEC APPROBATION ET PRIVILEGE DU ROY

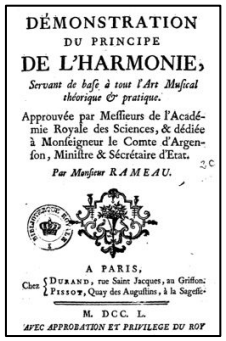
- **J.-Ph. Rameau, *Démonstration du principe de l'harmonie,* 1750**

- **« 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**

Le origini ramiste del *Tonnetz* (secondo Henri Pousseur)






DÉMONSTRATION
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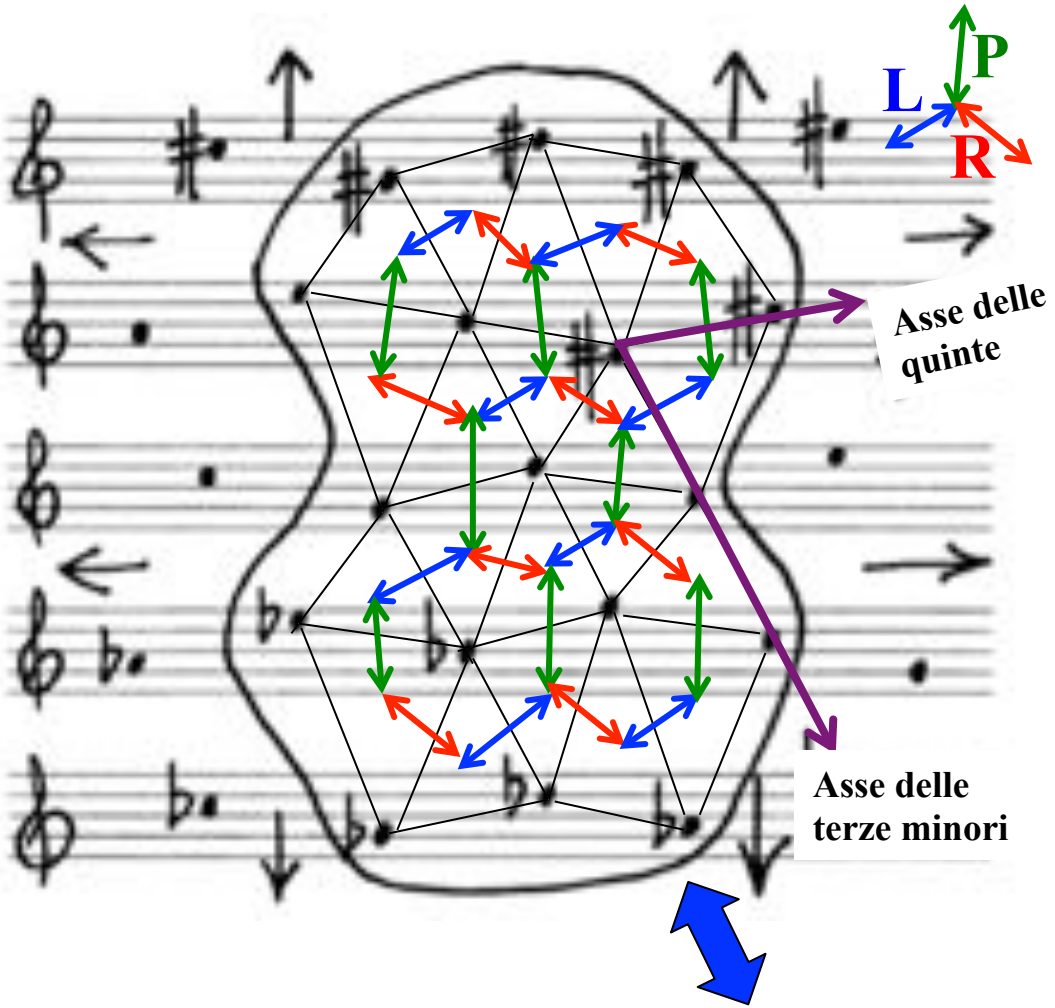
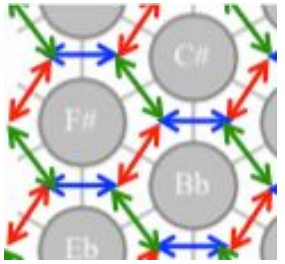
La teoria dei reticoli e la sua componente computazionale

"Non va dimenticato che il principio stesso del metodo [basato sulla teoria dei reticoli] risiede nella possibilità di costruire la griglia in modo tale che le relazioni musicali elementari effettive, quindi 'en-temps', (analizzate o composte, melodiche o armoniche) siano le più **compatte** possibile e s'esprimano principalmente fra note **vicine nel reticolo**, in un senso o nell'altro"





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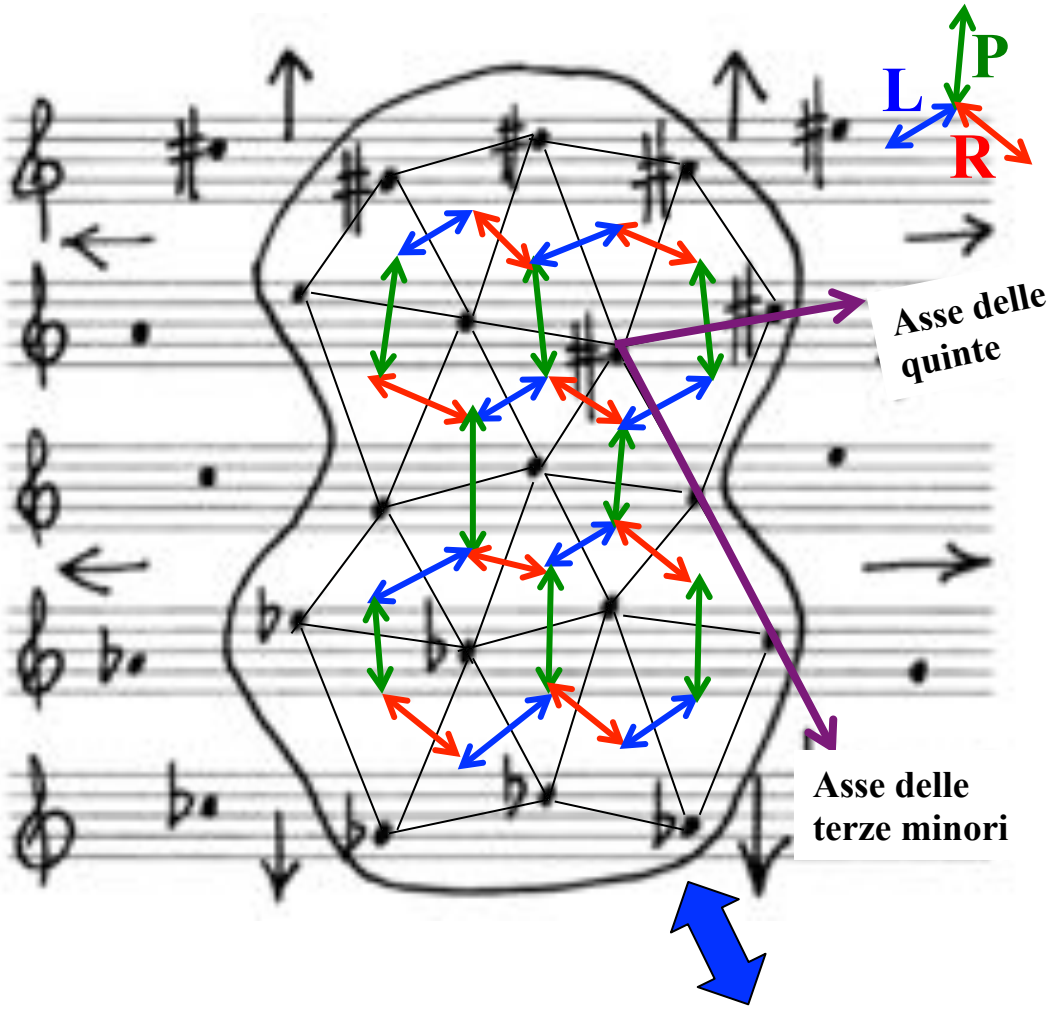
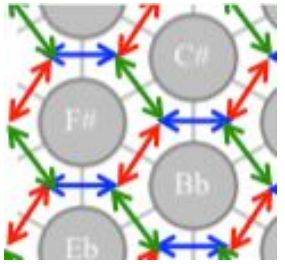
Aggiungiamo che è possibile passare da certi reticoli ad altri per semplice cambio del sistema di riferimento [...] il che modifica i rapporti di prossimità strutturale fra le note e quindi la gerarchia dei rispettivi intervalli"





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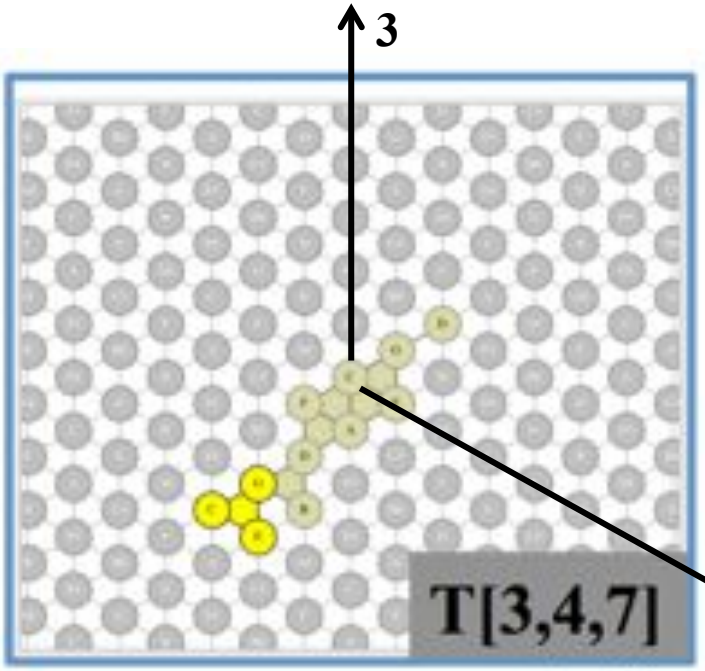
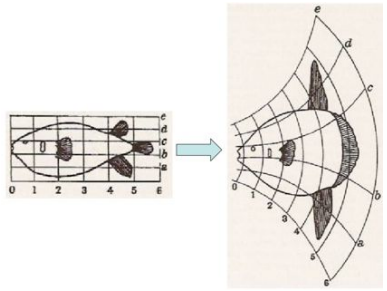
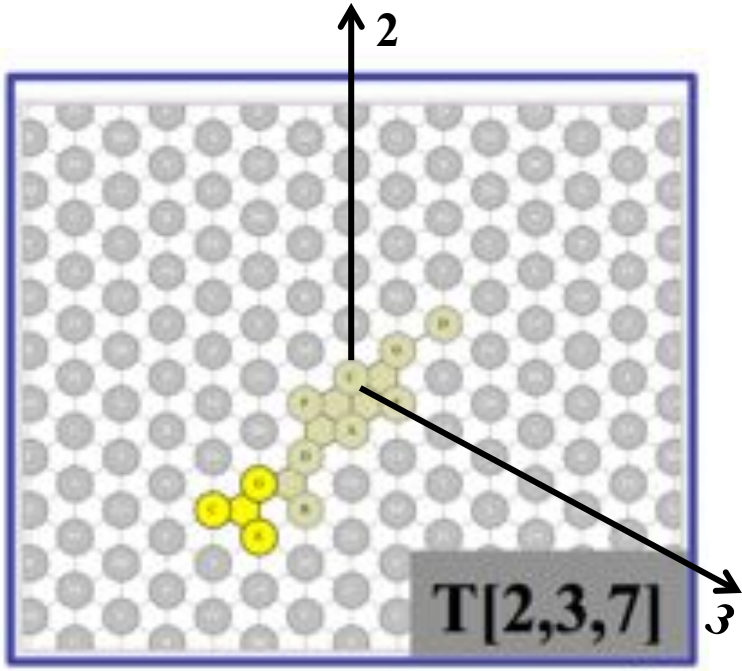
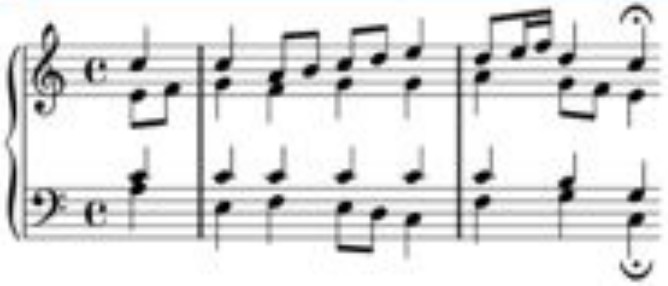
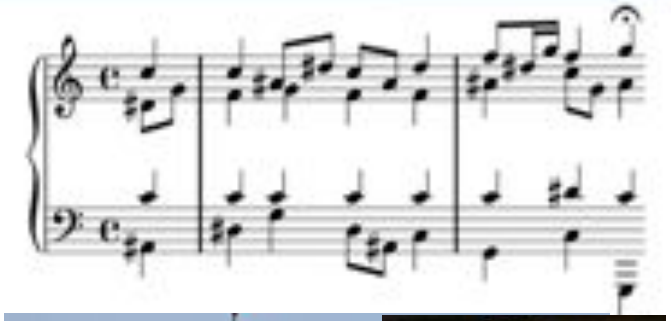
Cambiamento di coordinate e analisi dello stile musicale



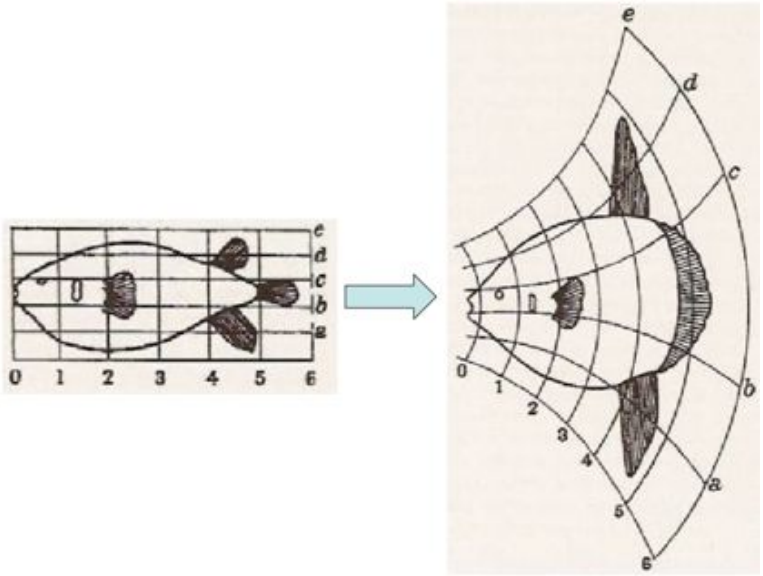






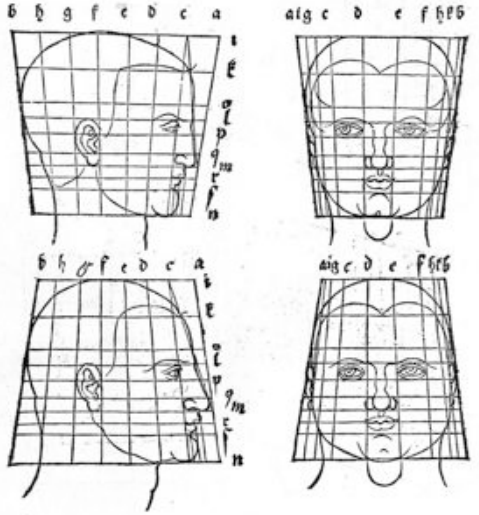


La genealogia morfologico/matematica dello strutturalismo



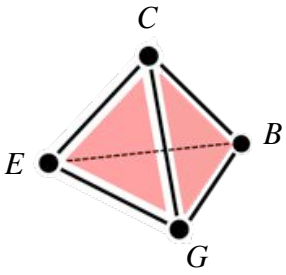
"[La nozione di **trasformazione**] viene da un trattato che ha svolto per me un ruolo molto importante e che ho avuto modo di leggere negli Stati Uniti durante la guerra: *On Growth and Form*, in due volumi, di **D'Arcy Wentworth Thompson**, pubblicato originariamente nel 1917. L'autore (...) propone un'interpretazione delle trasformazioni visive fra diverse specie (animali e vegetali) all'interno di uno stesso genere. Tutto ciò mi affascinò, in particolare perché realizzai rapidamente que questo approccio aveva una lunga tradizione: dietro Thompson c'era la botanica di **Goethe** e dietro Goethe, **Albert Dürer** con il suo *Treatise of human proportions*"

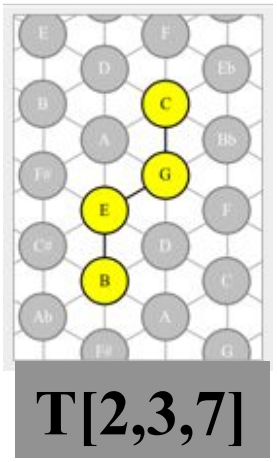
(Claude Lévi-Strauss, conversazione con Eribon, 1988).



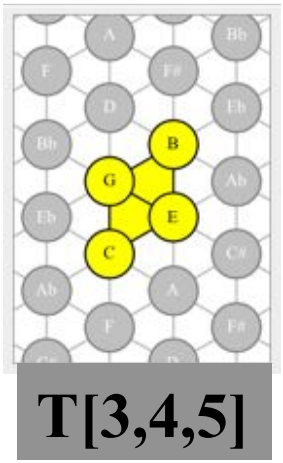
Verso una classificazione automatica dello stile

Bigo L., Andreatta M., "Topological Structures in Computer-Aided Music Analysis", in D. Meredith (ed.), *Computational Musicology*, Springer, 2015





T[2,3,7]



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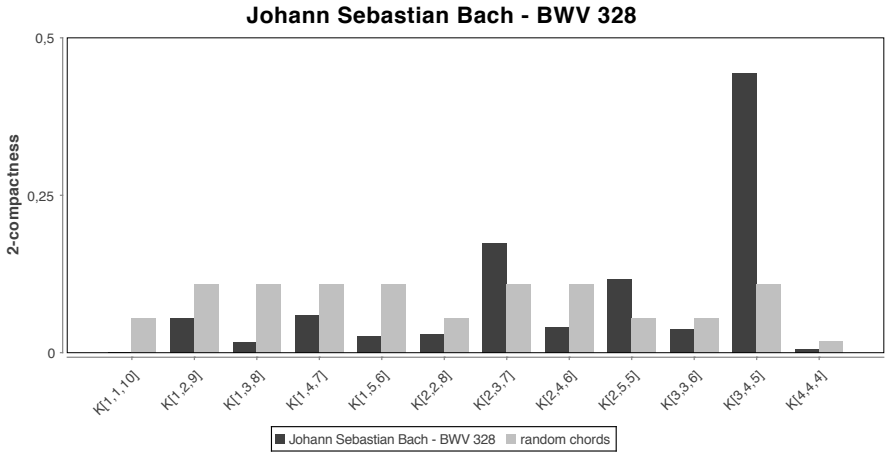
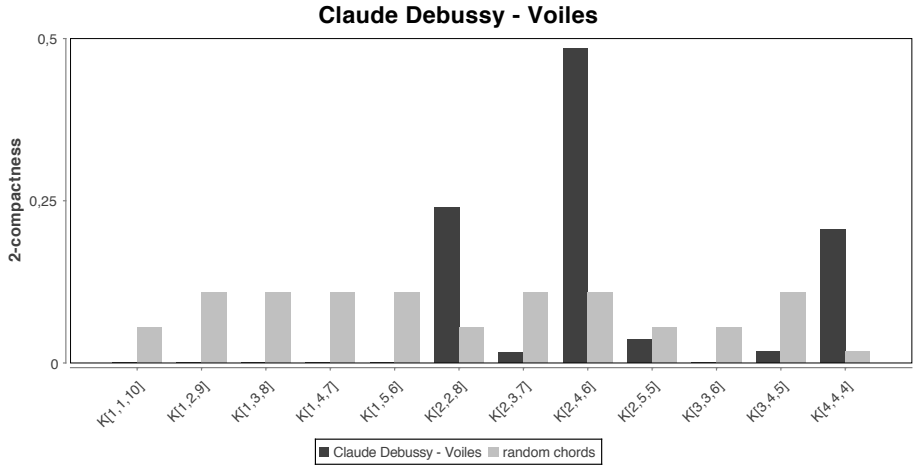
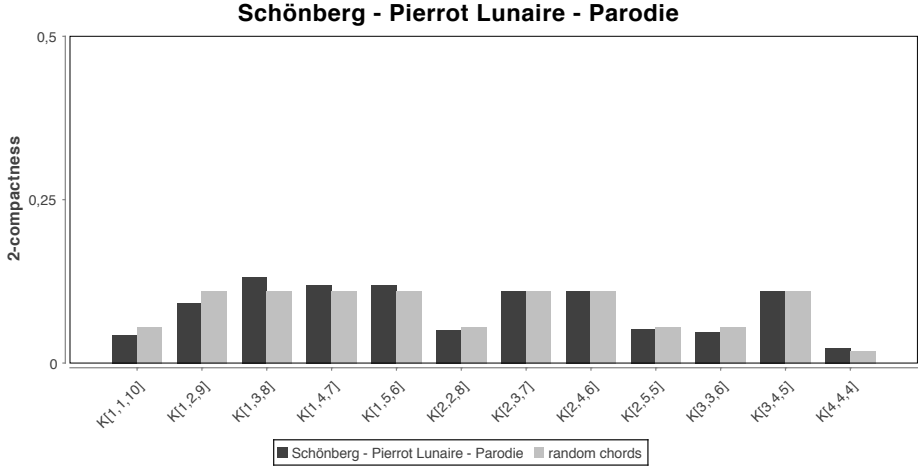
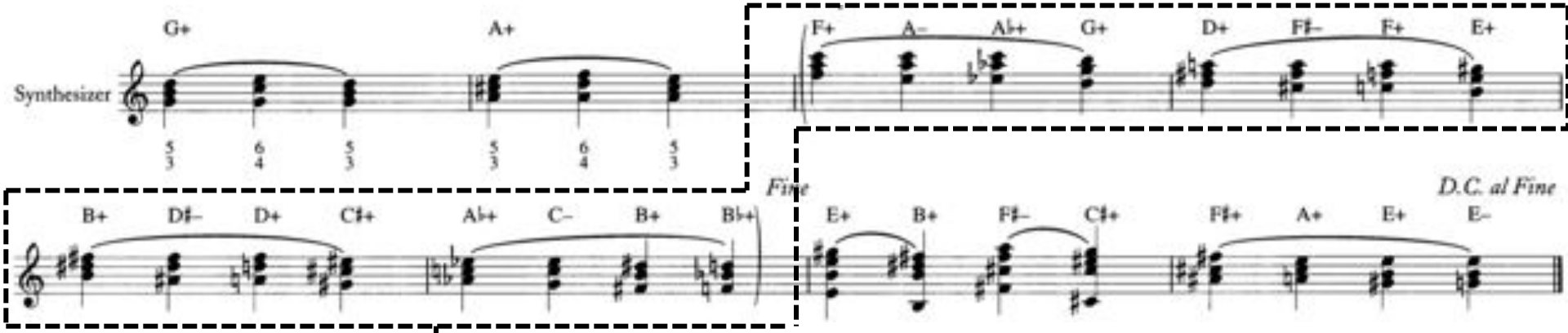




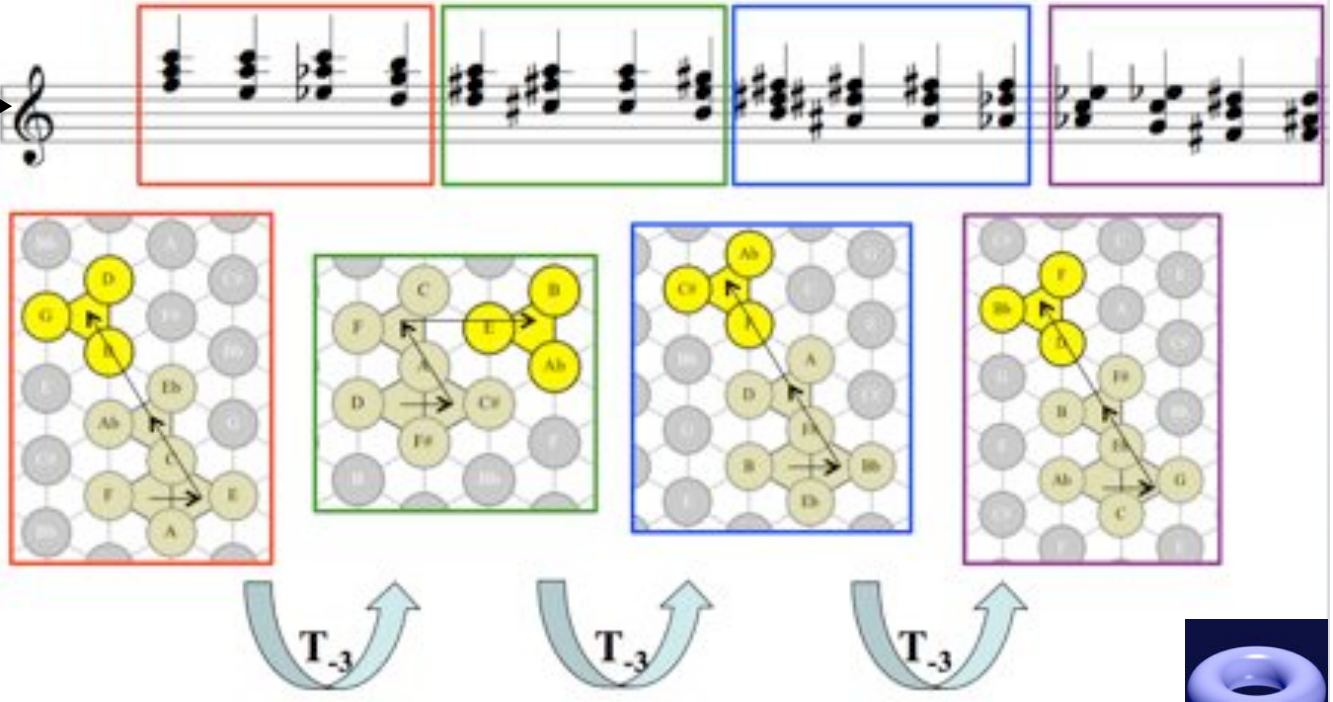


➔ **demo**

Progressioni armoniche e simmetrie nella musica di Zappa



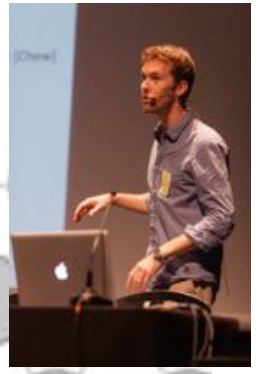
Guy Capuzzo, Neo-Riemannian Theory and the Analysis of Pop-Rock Music, *MTS*, 26/2, 2004, 177–200



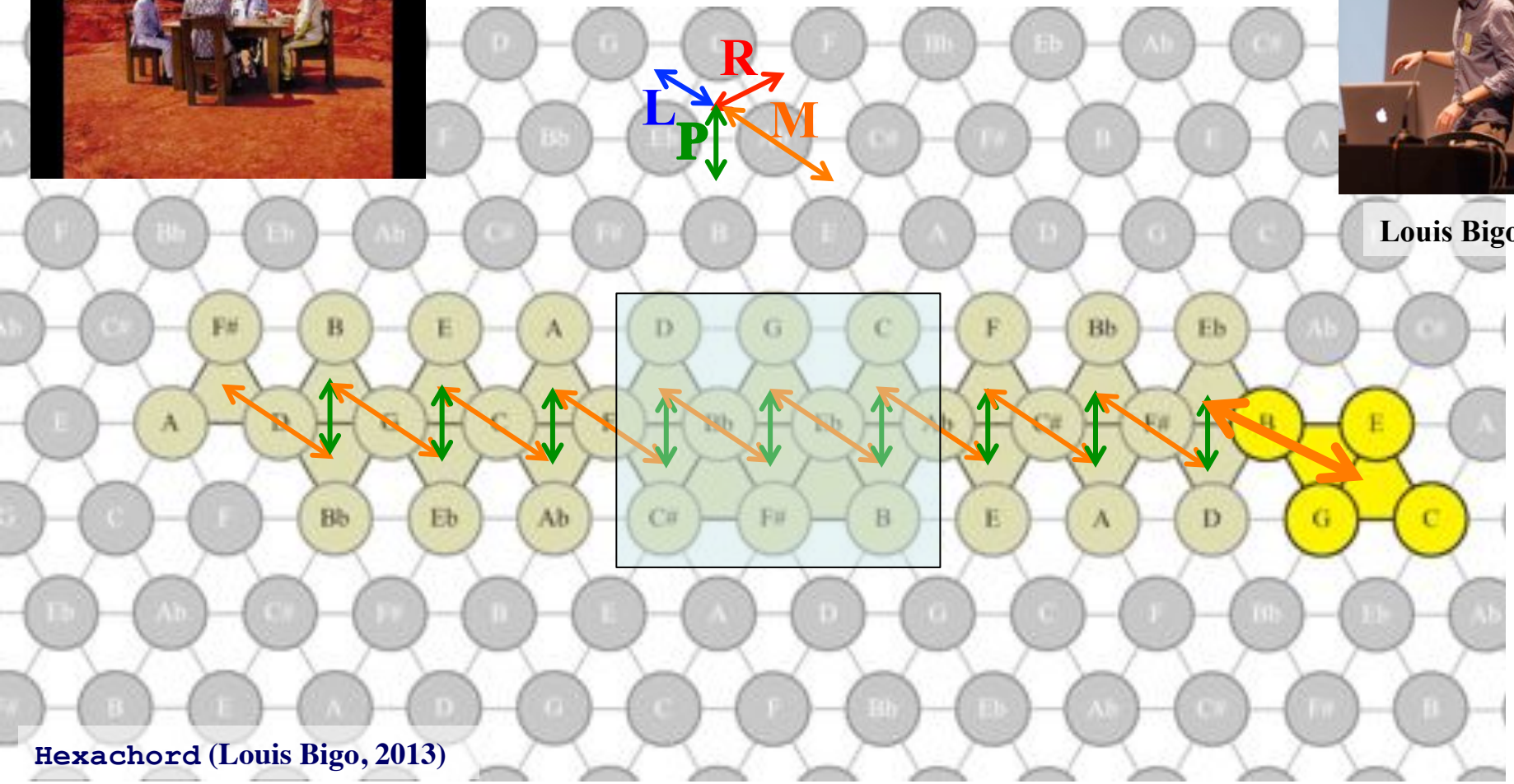
« Easy Meat » - 1981 (F. Zappa)
min. 1'44" – 2'39"

Simmetrie e processi algoritmici nel gruppo *Muse*

"Take a bow" (*Black Holes and Revelations*, 2006)

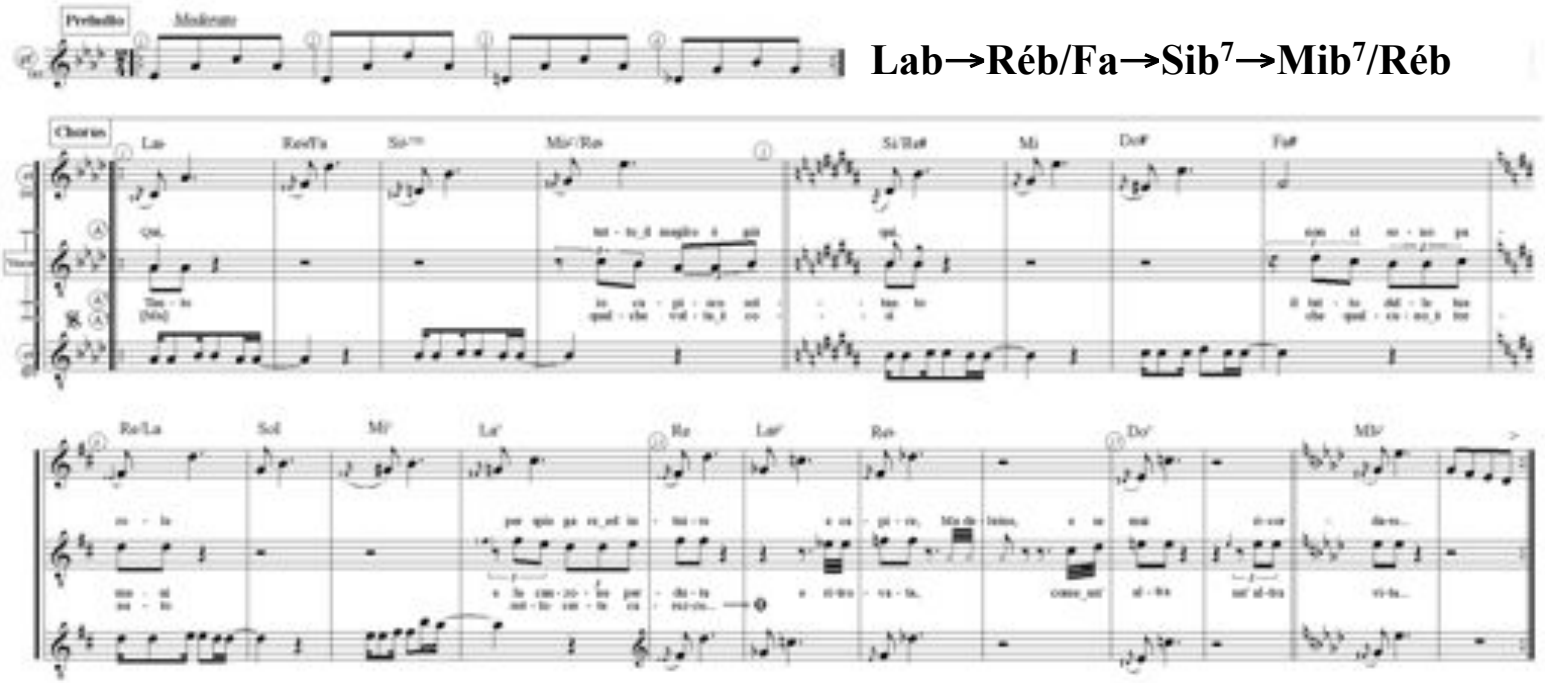


Louis Bigo



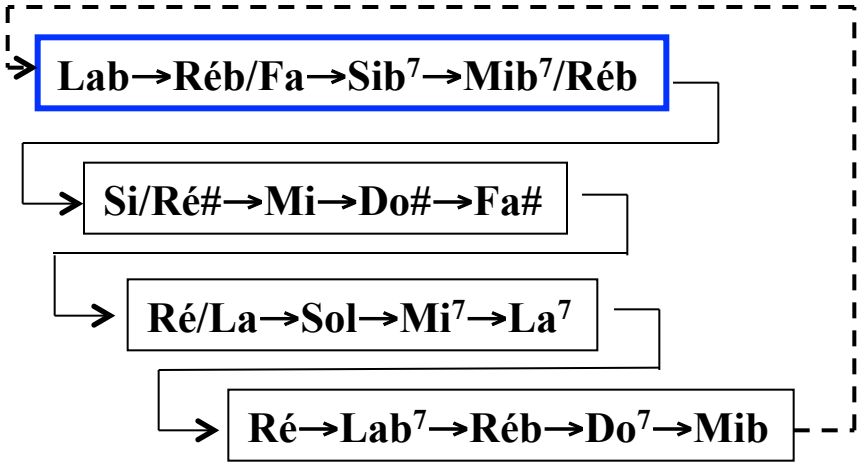
asse temporale

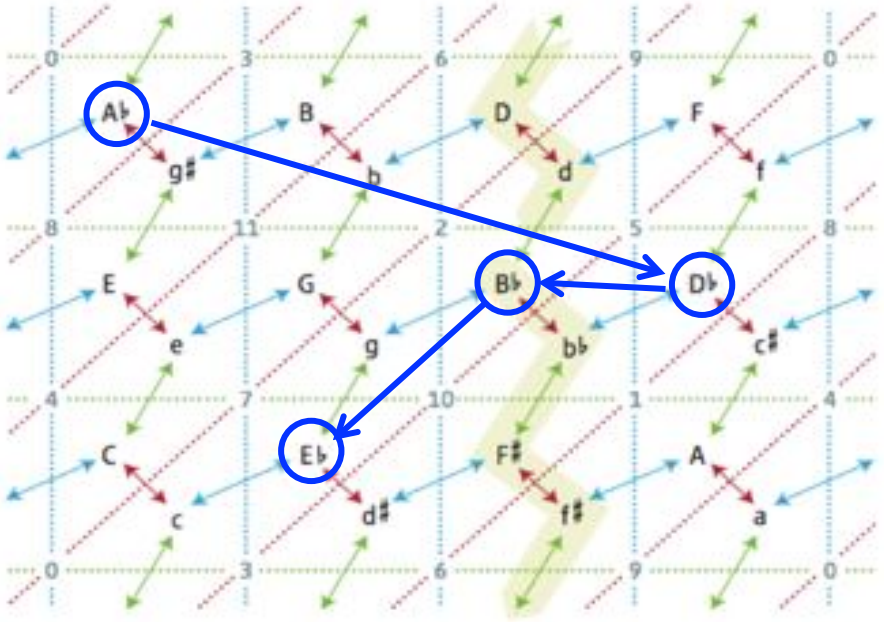
Modulazioni e simmetrie in *Madeleine* di Paolo Conte



Lab→Réb/Fa→Sib^7→Mib^7/Réb

S. La Via, *Poesia per musica e musica per poesia. Dai trovatori a Paolo Conte*, Carocci, 2006





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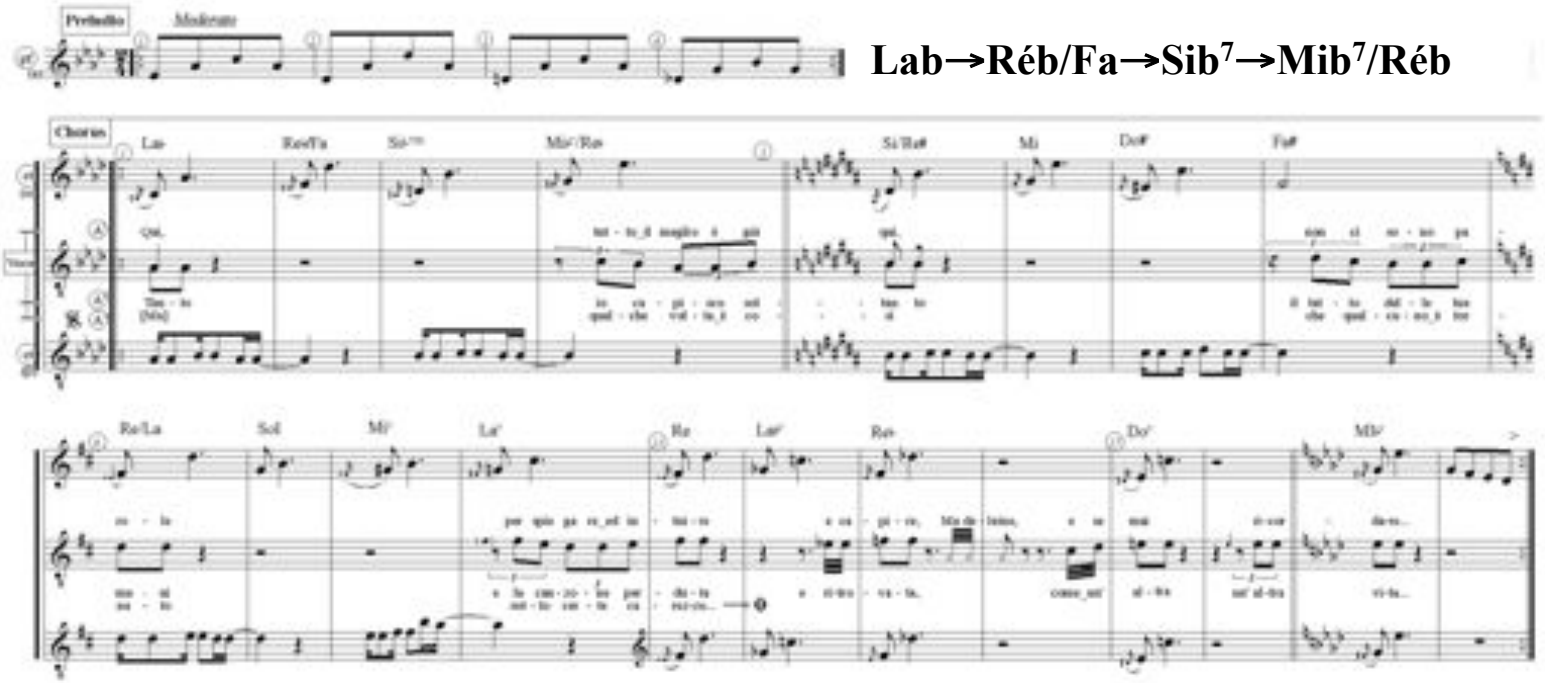

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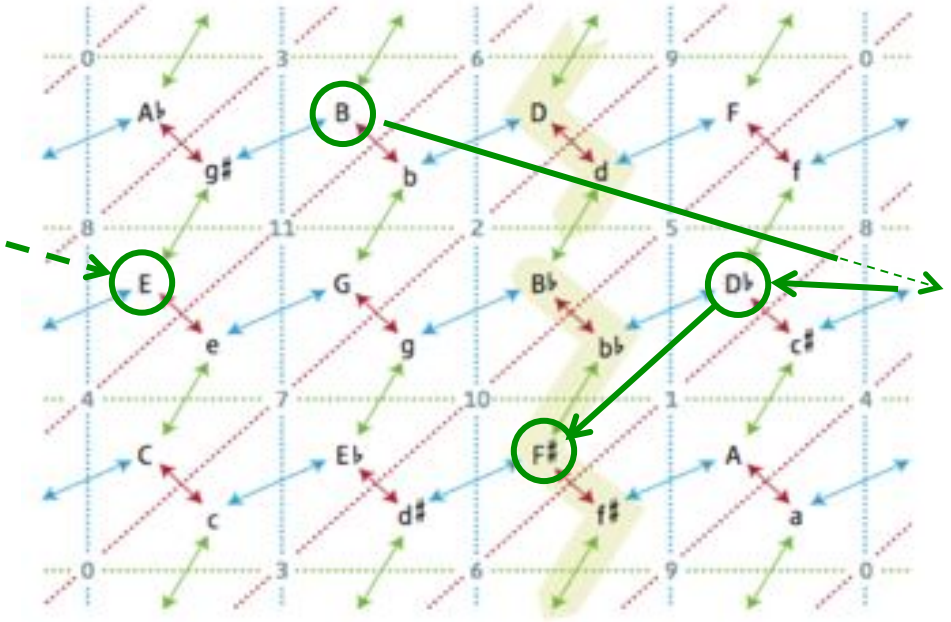
S. La Via, *Poesia per musica e musica per poesia. Dai trovatori a Paolo Conte*, Carocci, 2006

Lab→Réb/Fa→Sib^7→Mib^7/Réb

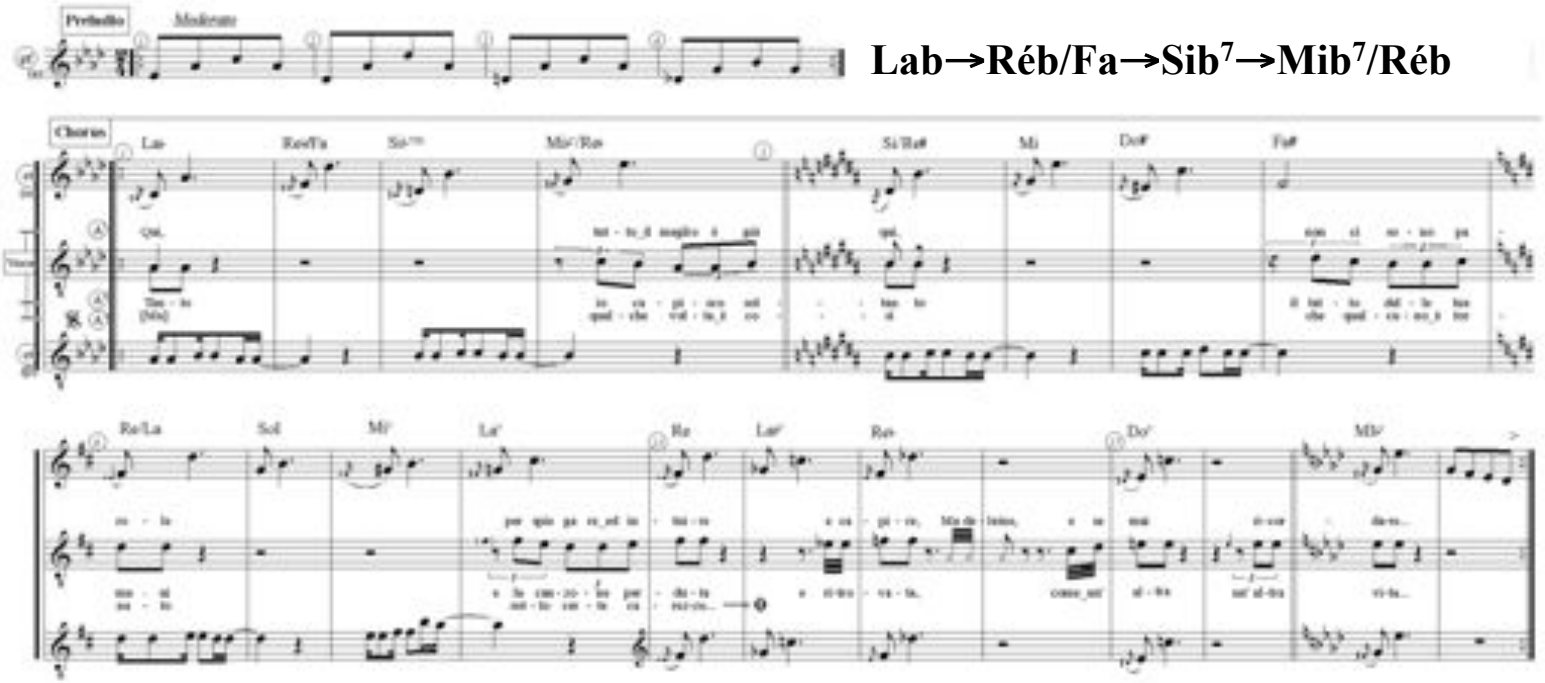
Si/Ré#→Mi→Do#→Fa#

Ré/La→Sol→Mi^7→La^7

Ré→Lab^7→Réb→Do^7→Mib



Modulazioni e simmetrie in *Madeleine* di Paolo Conte



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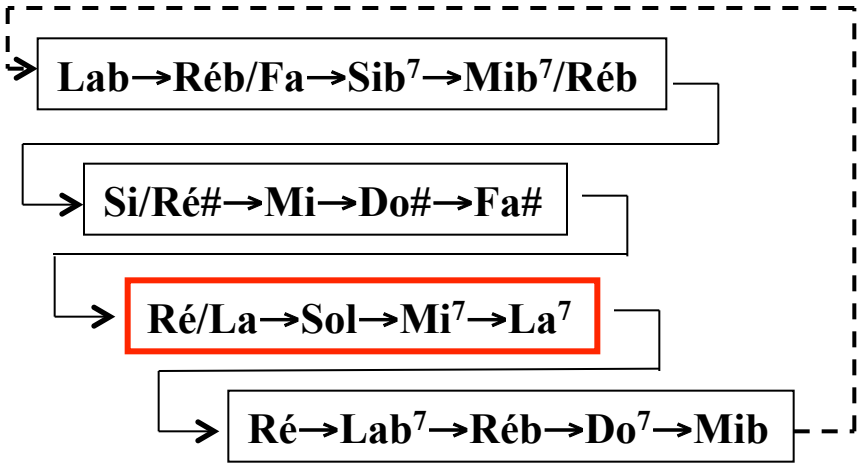
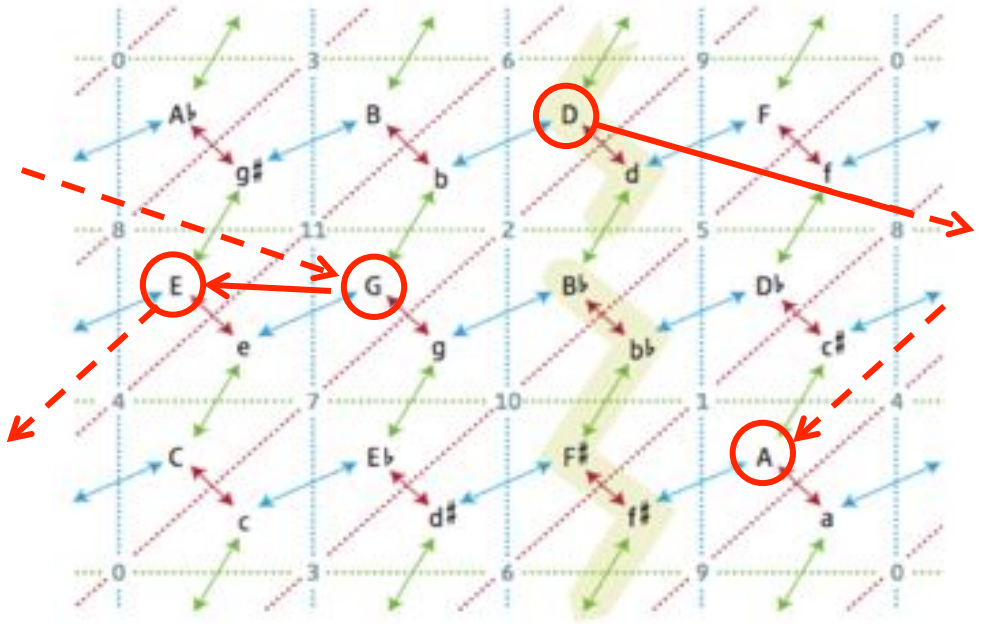
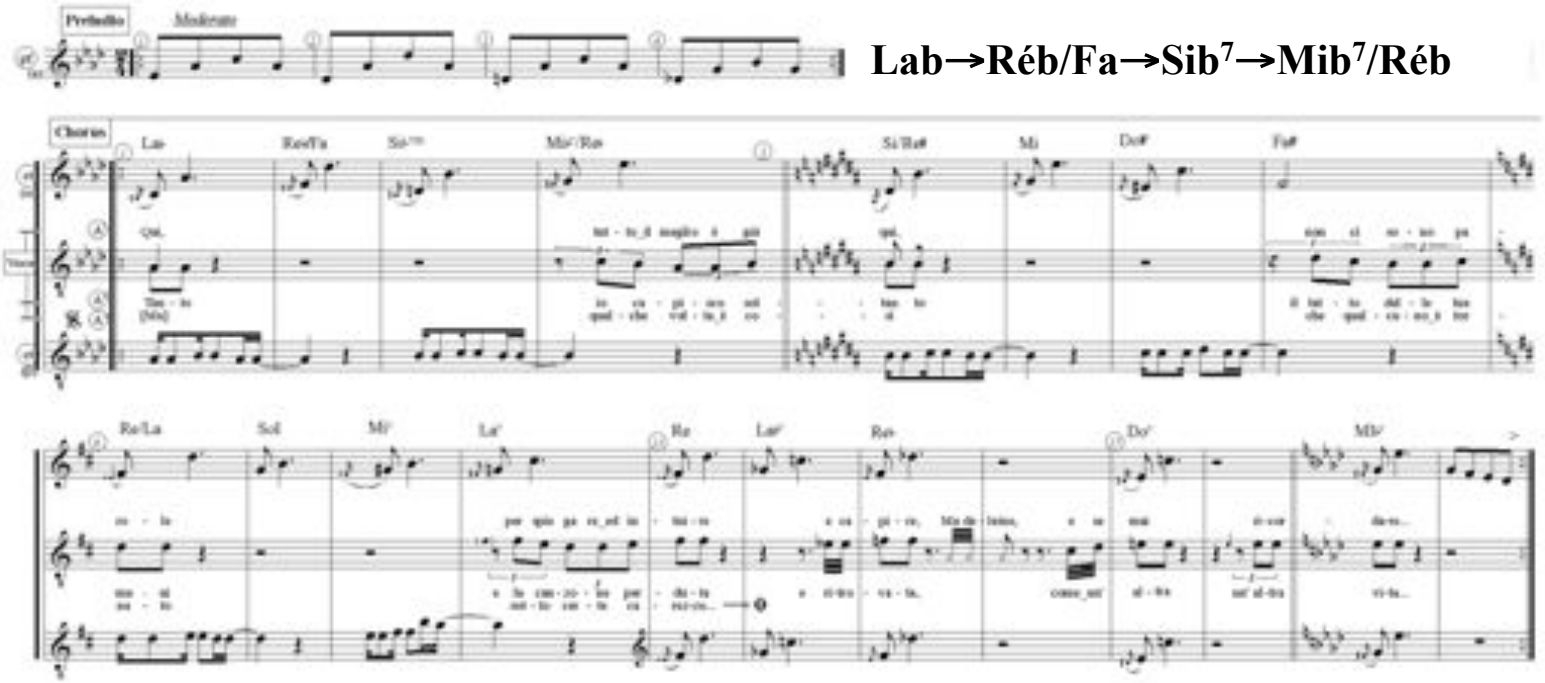




Modulazioni e simmetrie in *Madeleine* di Paolo Conte



Lab→Réb/Fa→Sib^7→Mib^7/Réb

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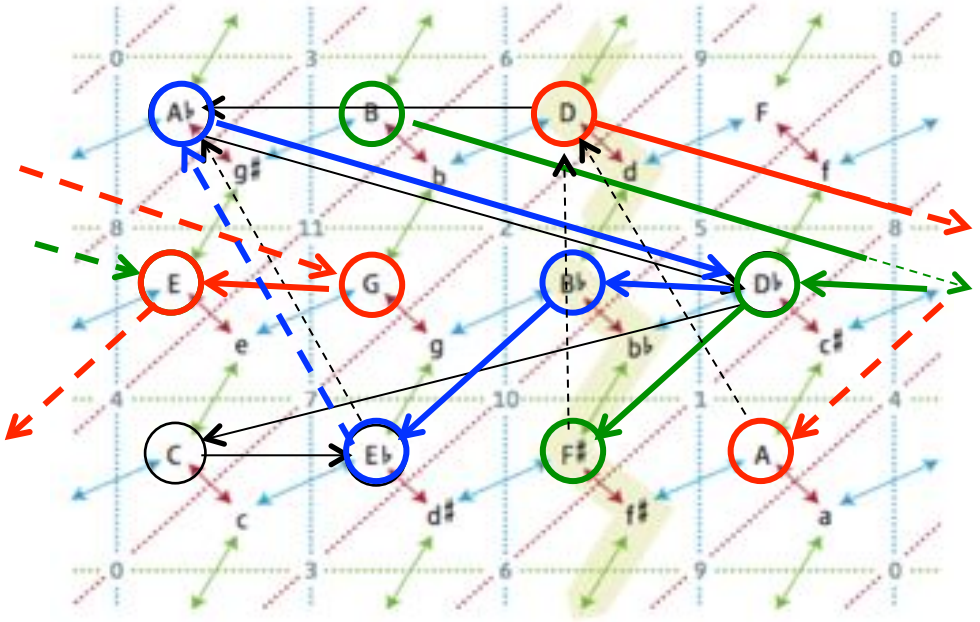
Lab→Réb/Fa→Sib^7→Mib^7/Réb

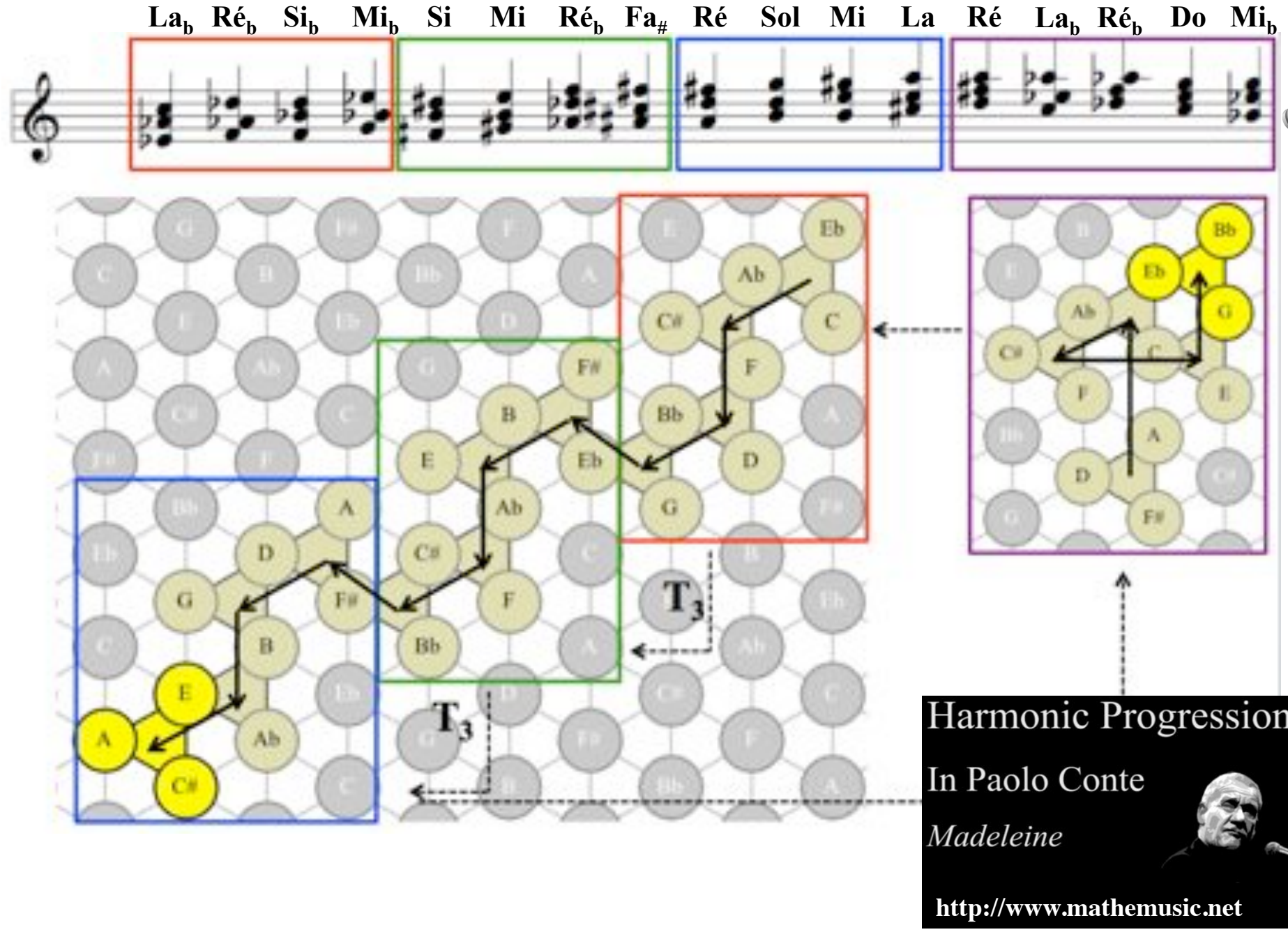
Si/Ré#→Mi→Do#→Fa#

Ré/La→Sol→Mi^7→La^7

Ré→Lab^7→Réb→Do^7→Mib



La traiettoria spaziale di *Madeleine*



Le blé en herbe

(Polo/Moreno/Dieu)

Plonger comme un enfant, cheveux au vent
Sous l'océan du blé en herbe
Marée d'épis couleur d'amande
Qui tendent à caresser le ciel

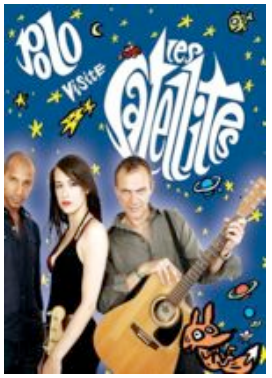
Algues tendres de mille plages
Frôlant le ventre des nuages
Cheveux de pluie, dos de poissons
Qui frissonnent à l'unisson

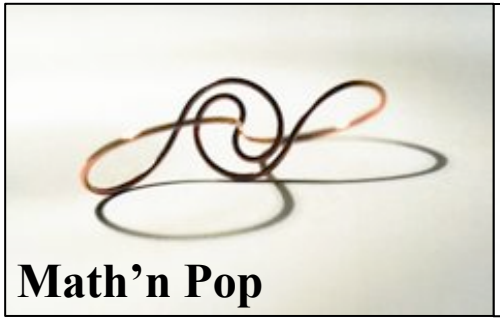
Suivre le bord des continents
Dans l'océan du blé en herbe
Pécher le corail du pavot
Dans le sang des coquelicots

Croiser matin dans l'herbe folle
Deux tourterelles qui s'envolent
Suivre les jeux des hirondelles
Sur le paysage éternel
Nager comme un enfant, cheveux au vent
Sous l'océan
Du blé en herbe

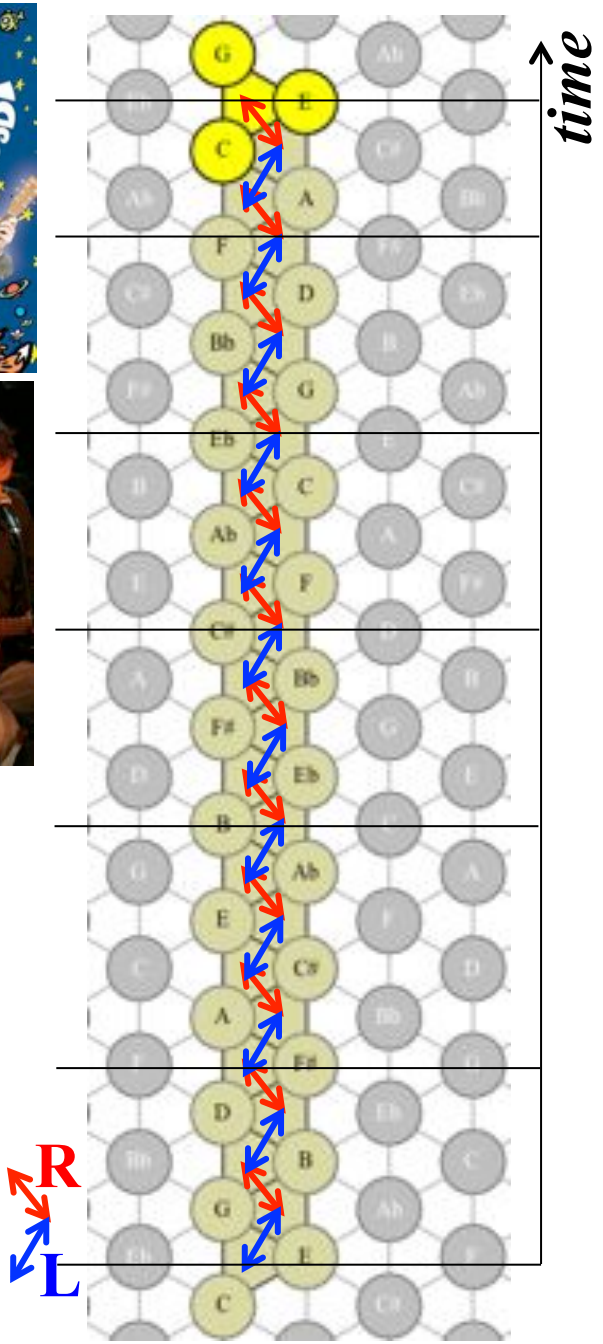
Marée de fruits au goût amer
Acide et salée comme la mer

Vers l'îlôt d'un petit village
Vers un château d'eau sur la plage
Quand tout s'éteint avant l'orage
Quand se lève le vent du large
Sur le blé vert





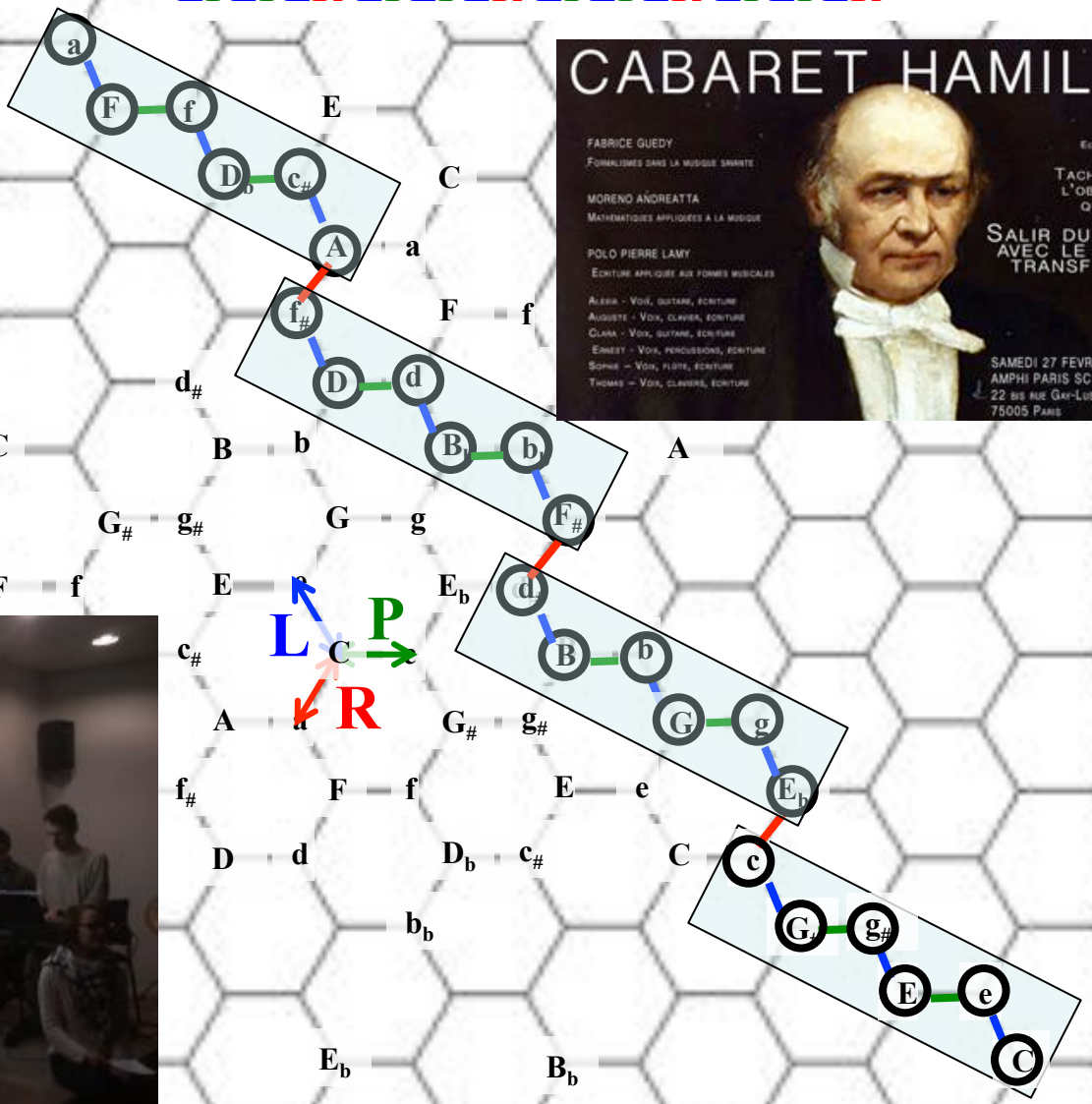
Bpi

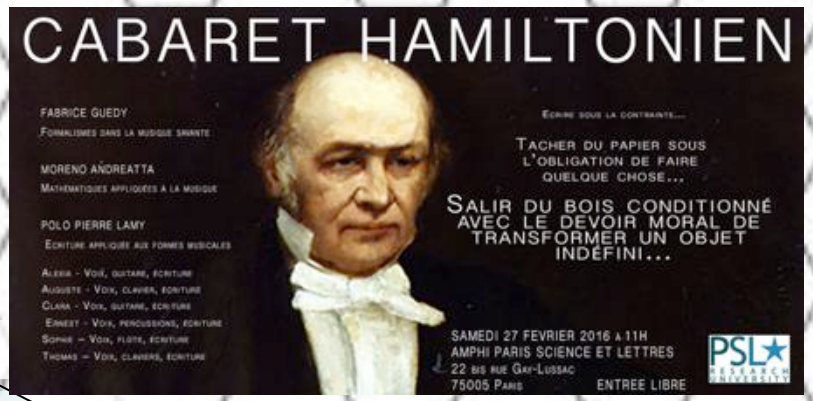


BALLADE MARABOUT COLLECTIVE

A lire de haut en bas, puis de bas en haut, sans pause.

C-e-E-a_b-A_b-c-E_b-g-G-b-B-e_b-F#-b_b-Bb-d-D-$f_\#$-A-$c_\#$-C#-f-F-a–
LPLPLR-LPLPLR-LPLPLR-LPLPLR





Aprile, canzone hamiltoniana decadente

Do←do_m←Sol#←fa_m←Fa←la_m←La←$fa\#_m$←Fa#←sib_m←Do#←$do\#_m$

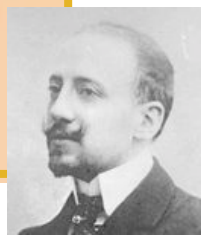
mi_m→Sol→si_m→Ré→$ré_m$→Sib→sol_m→Mib→mib_m→Si→$sol\#_m$→Mi

La

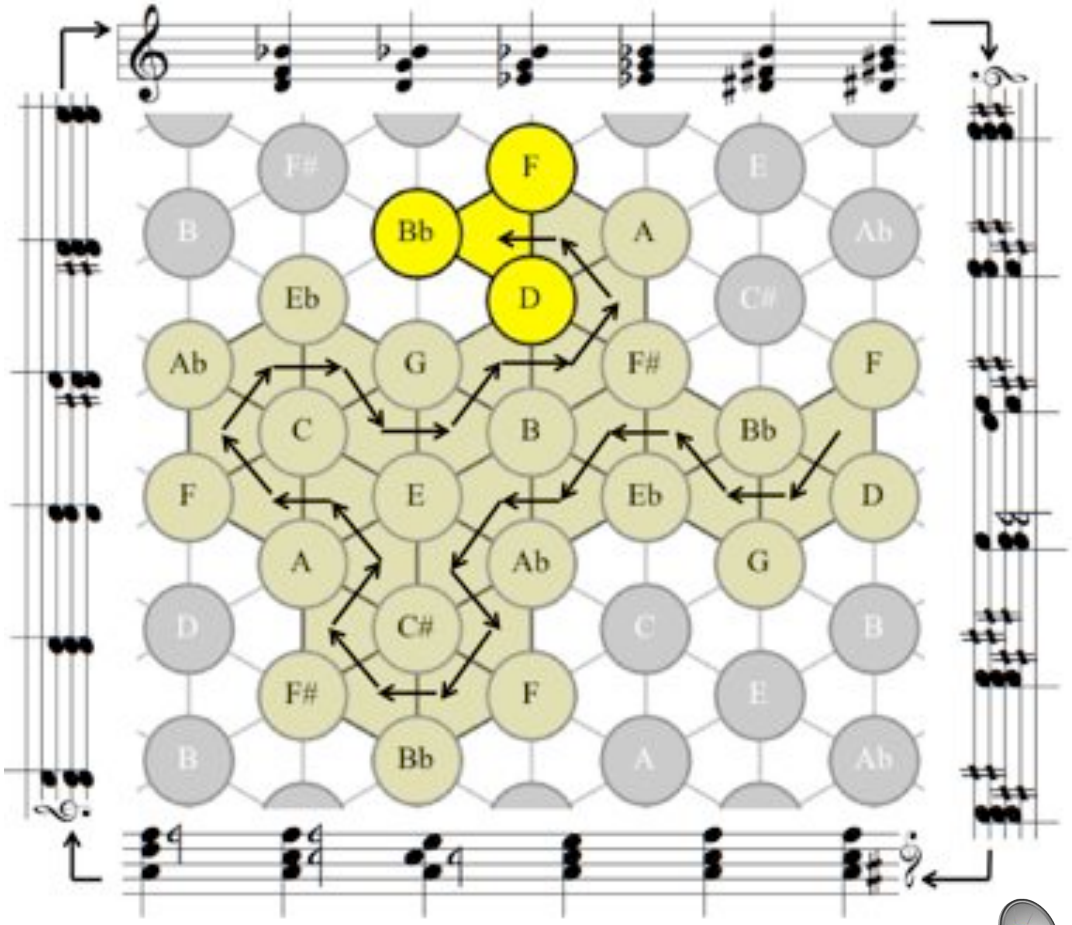
Socchiusa è la finestra, sul giardino.
Un'ora passa lenta, sonnolenta.
Ed ella, ch'era attenta, s'addormenta
A quella voce che già si lamenta,
Che si lamenta in fondo a quel giardino.

Non è che voce d'acque su la pietra:
E quante volte, quante volte udita!
Quell'amore e quell'ora in quella vita
S'affondan come ne l'onda infinita
Stretti insieme il cadavere e la pietra.

Ella stende l'angoscia sua nel sonno.
L'angoscia è forte, e il sonno è così lieve!
(Par la luce d'april quasi una neve
che sia tiepida.)
Ed ella certo deve soffrire,
Vagamente, anche nel sonno.



G. D'Annunzio (1863-1938)

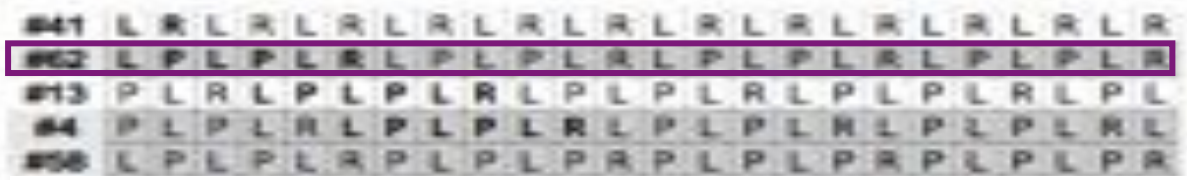


Aprile (d'après Gabriele D'Annunzio)

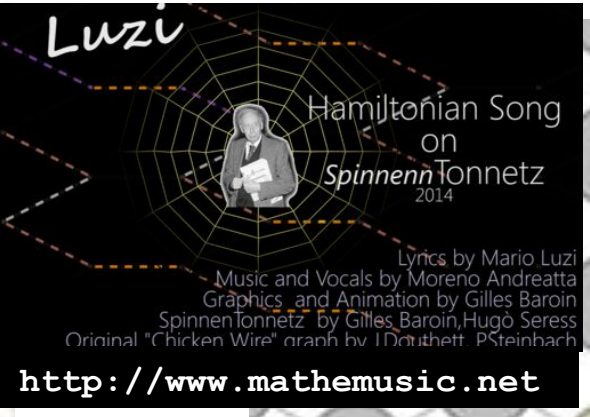
Tangente pour mieux comprendre le monde
L'aventure mathématique

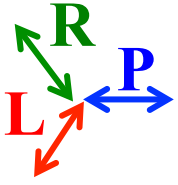
M. Andreatta, « Math'n pop : symétries et cycles hamiltoniens en chanson », *Tangente*

Cicli hamiltoniani con periodicità interne



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





La sera non è più la tua canzone
(Mario Luzi, 1945, tratto da *Poesie sparse*)

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.

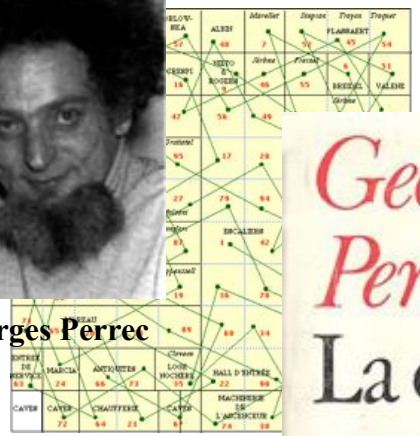
Ah questa luce viva e chiara viene
solo da te, sei tu così vicina
al vero d'una cosa conosciuta,
per nome hai una parola ch'è passata
nell'intimo del cuore e s'è perduta.

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.

L'utilizzazione di vincoli nell'attività artistica

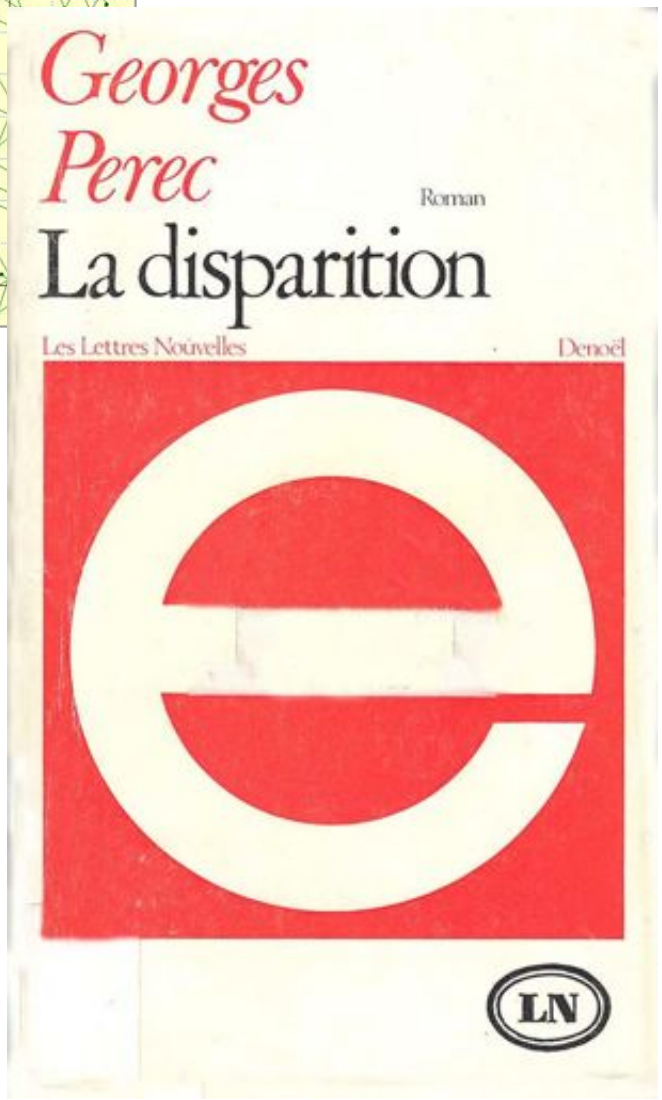
Cent mille milliards de poèmes, 1961



Georges Perrec

La vie mode d'emploi,

OuLiPo (Ouvroir de Littérature Potentielle)

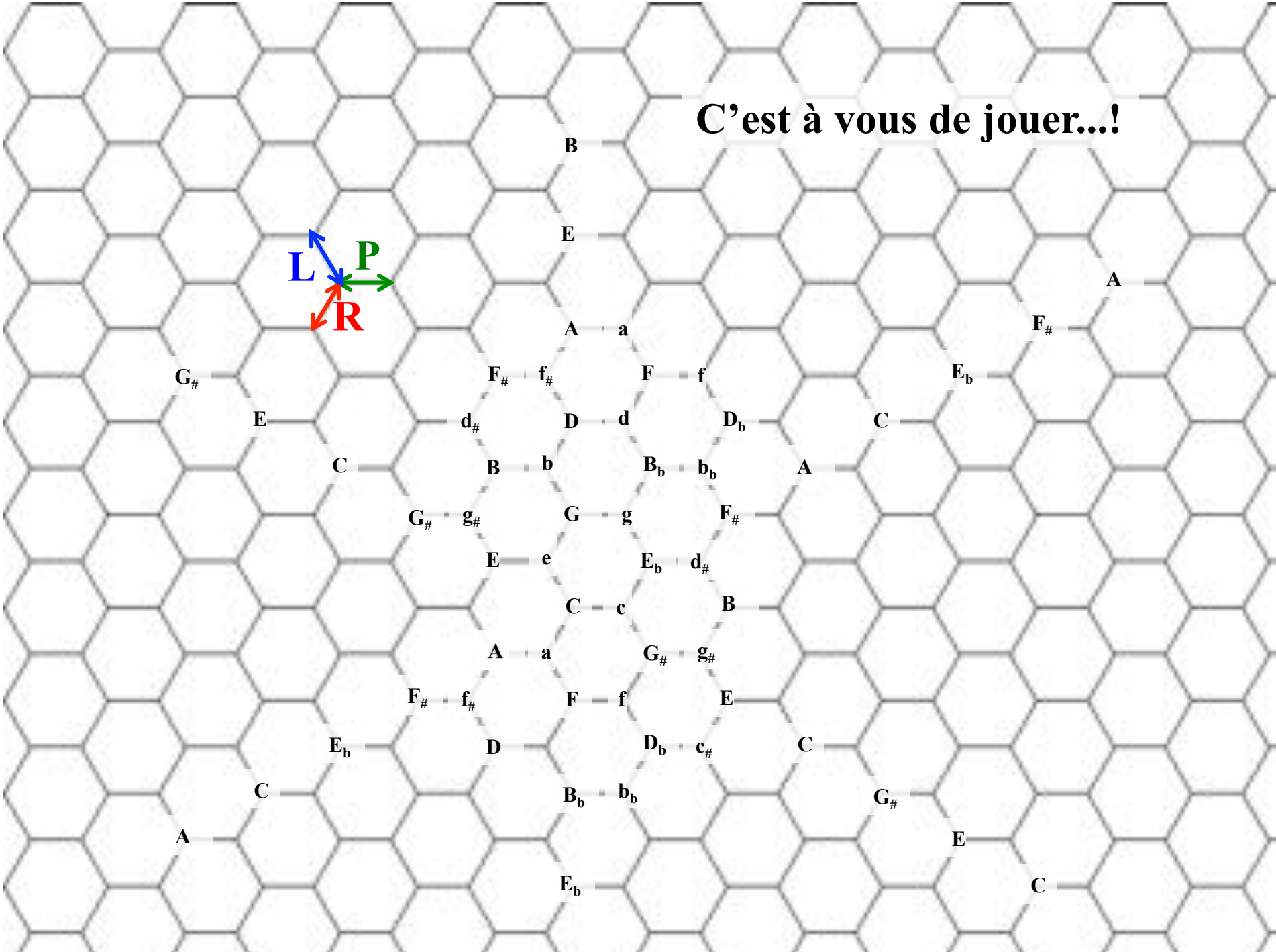


Raymond Queneau

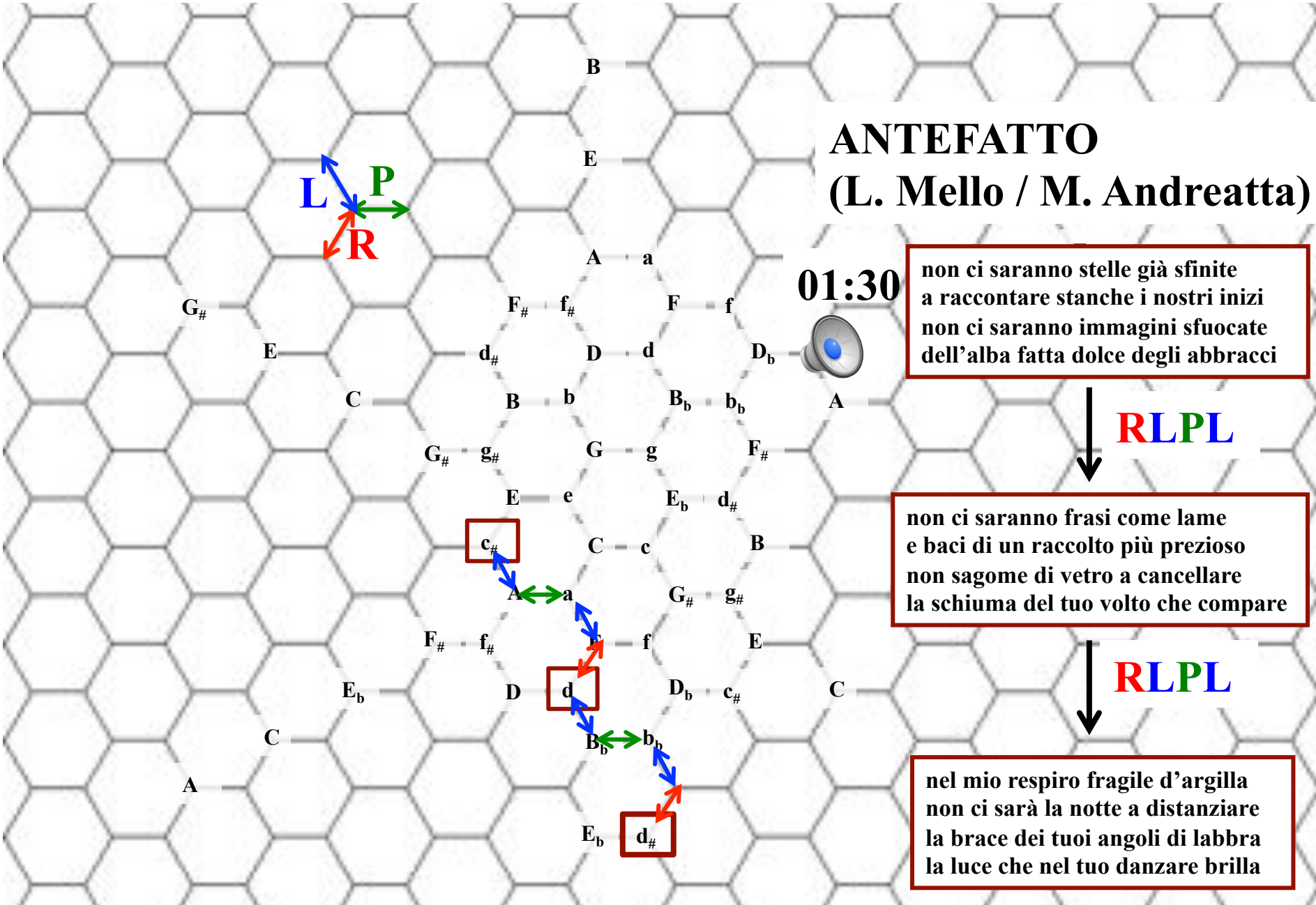
Italo Calvino

Il castello dei destini incrociati, 1969

C’est à vous de jouer...!



Modulazioni e simmetrie locali nella canzone



ANTEFATTO
(L. Mello / M. Andreatta)

01:30

non ci saranno stelle già sfinite
a raccontare stanche i nostri inizi
non ci saranno immagini sfuocate
dell'alba fatta dolce degli abbracci

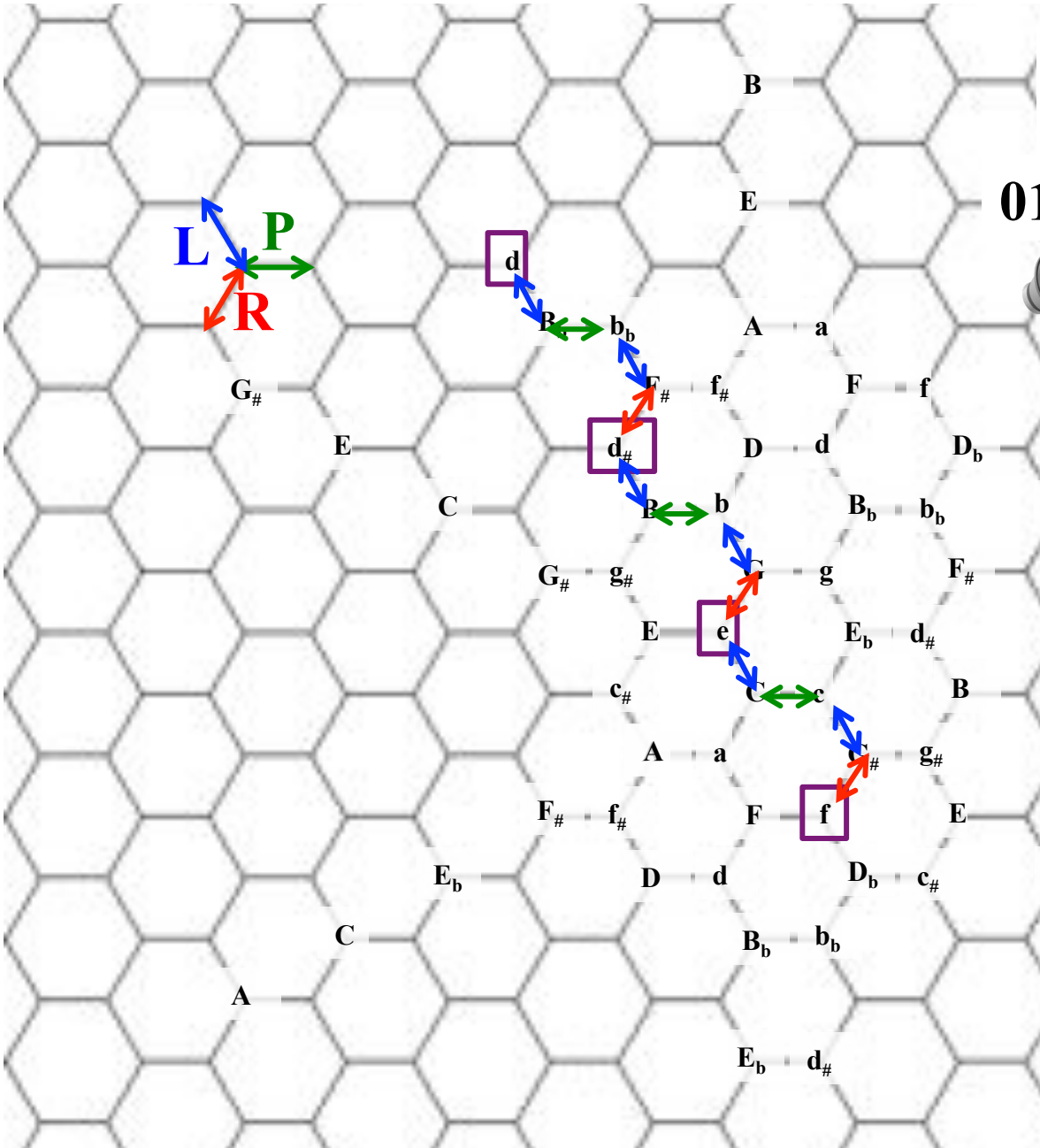
RLPL

non ci saranno frasi come lame
e baci di un raccolto più prezioso
non sagome di vetro a cancellare
la schiuma del tuo volto che compare

RLPL

nel mio respiro fragile d'argilla
non ci sarà la notte a distanziare
la brace dei tuoi angoli di labbra
la luce che nel tuo danzare brilla

Modulazioni e simmetrie locali nella canzone



FRANGIFLUTTI
(L. Mello / M. Andreatta)

01:29

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

RLPL

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

RLPL

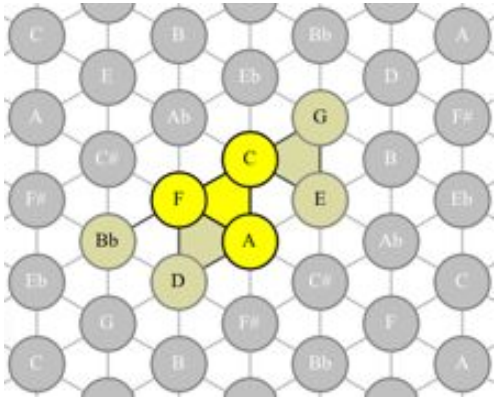
Eva cenno di ribellione
Eva fascio pronto all'addio
Eva donna che sa parlare
Al silenzio fatto d'oblio.

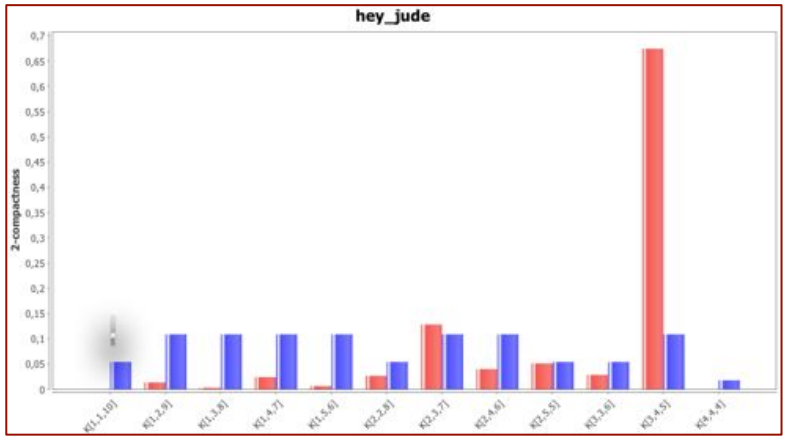
RLPL

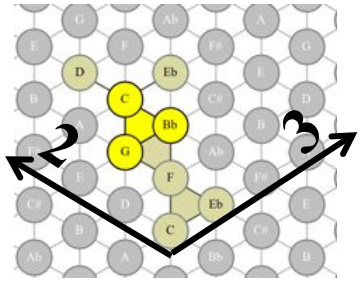
Sai parole da incatenare
sai sorridere per piacere
sai scappare senza tornare
sai ferire e sai far l'amore.

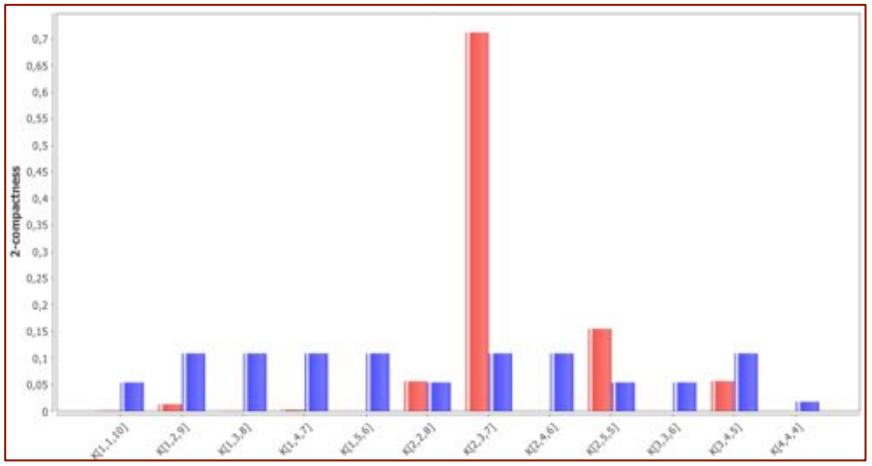
Alcune esperienze “oumupiane” sui Beatles

The Beatles,
Hey Jude



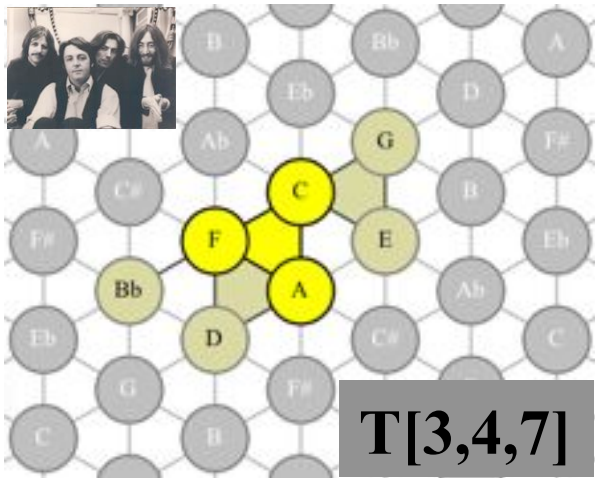


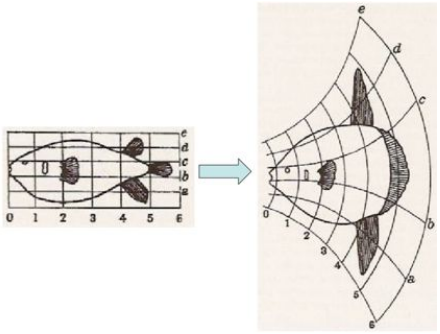


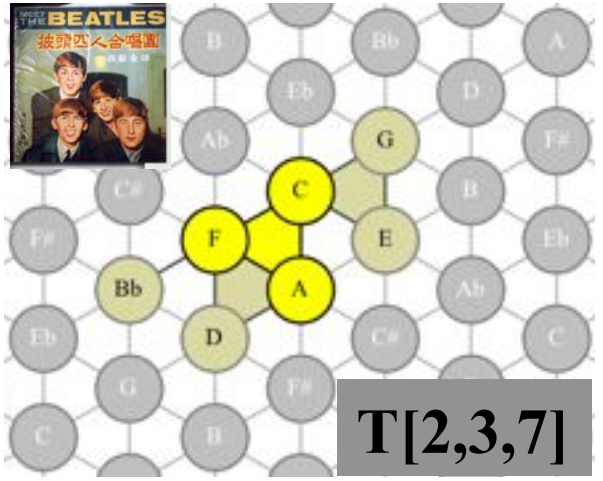


Alcune esperienze “oumupiane” sui Beatles

La trasformazione “M”



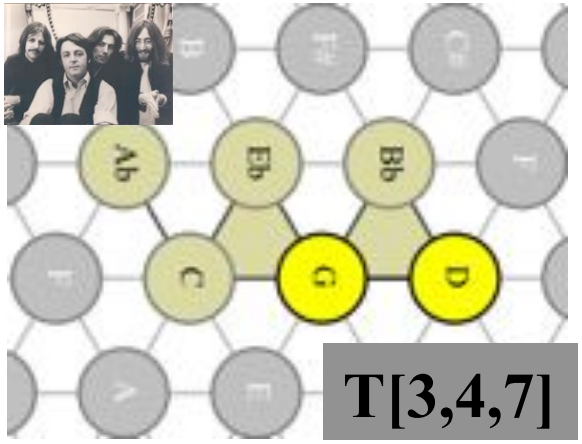




M

M

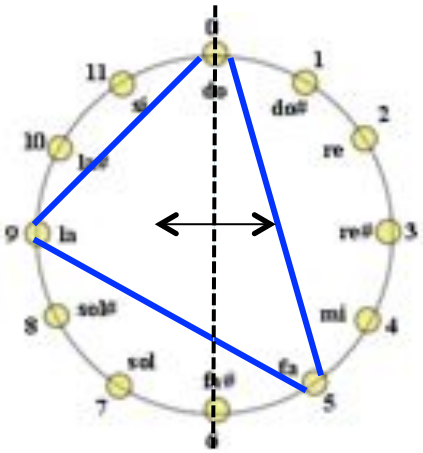
M



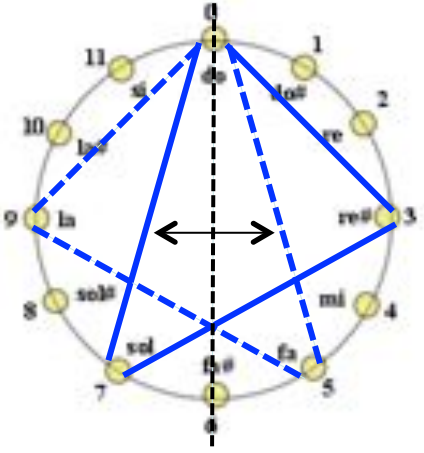
Alcune esperienze “oumupiane” sui Beatles

Rotazione dello spazio geometrico

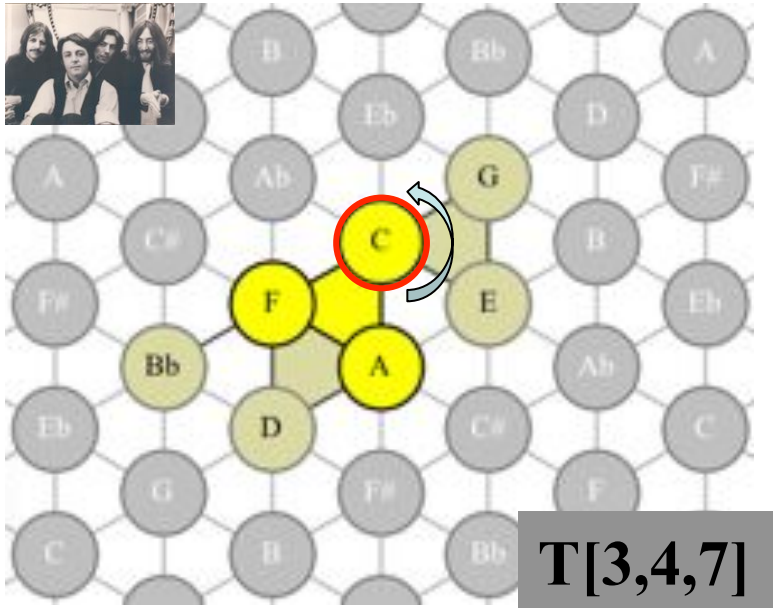
F Maj



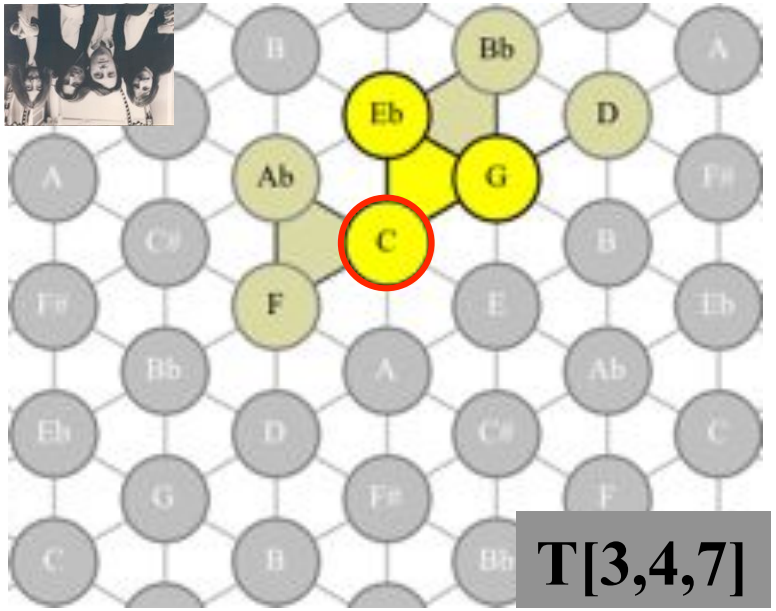
inversione



Cm



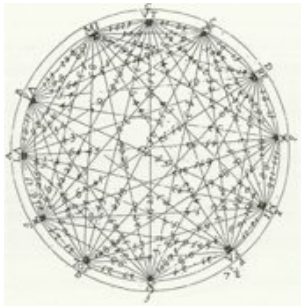
Rotazione
(attorno al *do*)

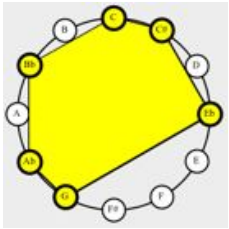


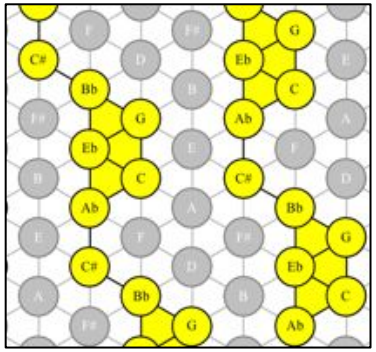
Beatles, Hey Jude
(versione originale)

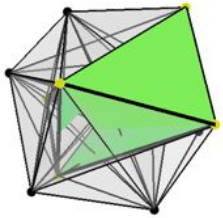
Beatles, Hey Jude
(versione trasformata)

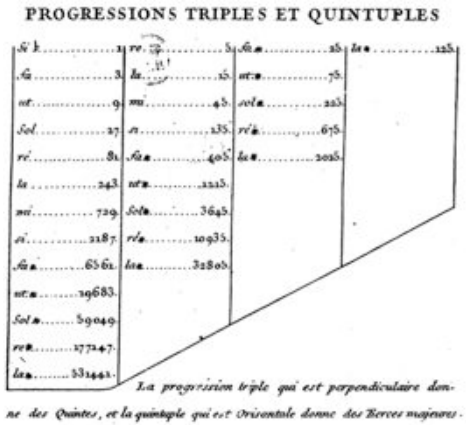
In guisa di conclusione

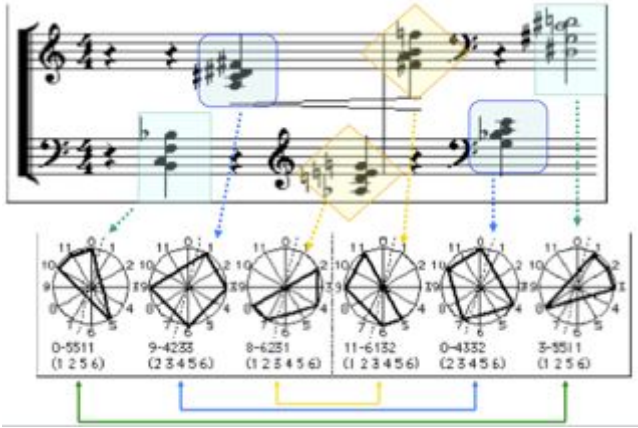


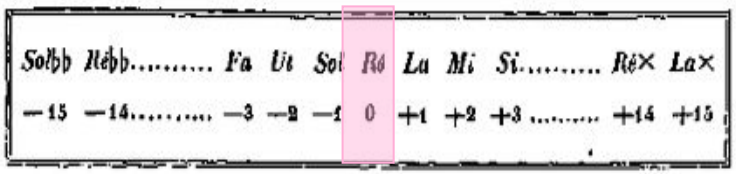












"La musica, **attività ludica a carattere combinatorio**, riuscirà ad affrancarsi, in un futuro più o meno lontano, da coloro che la affrontano esclusivamente da un punto di vista artigianale e empirico, tanto sul piano della composizione che sul piano dell'esecuzione, per dare origine a delle **ricerche** le cui finalità saranno molto più generali rispetto a quelle assegnate sino a presente a questa disciplina e i cui **metodi** saranno più scientifici? Ci è permesso di crederlo"

(P. Barbaud, *Schoenberg*, Editions Main d'Œuvre, 1997, p. 181. Orig. 1963)

Grazie per l'attenzione!

Hexachord (by Louis Bigo, 2013)