

La musique, art du temps ou de l'espace ?



Moreno Andreatta & Laurent Mandeix
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IRCAM / CNRS UMR 9912 / Sorbonne Université
Equipe Représentations Musicales

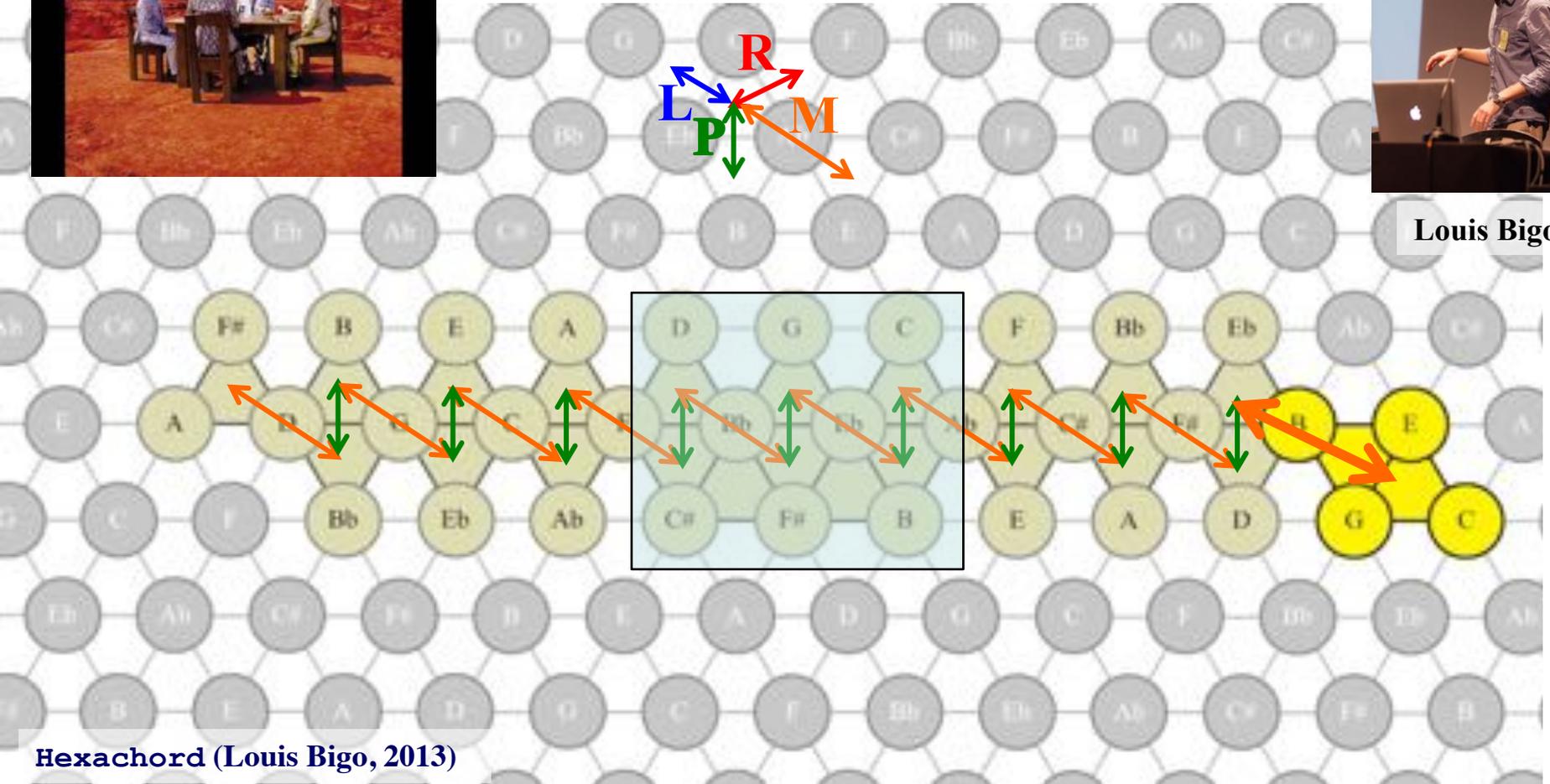
Symétries et procédés algorithmiques chez *Muse*



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

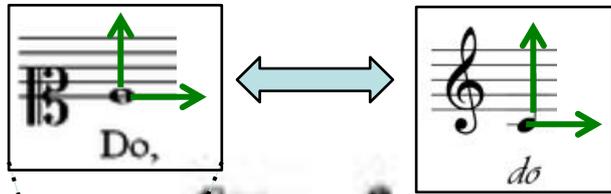
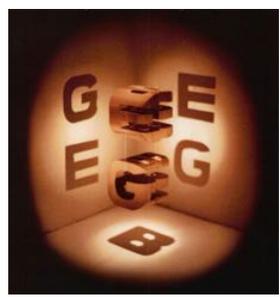


Louis Bigo



Hexachord (Louis Bigo, 2013)

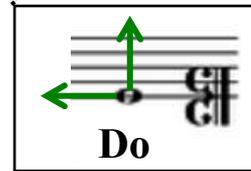
Temps et espace chez Bach



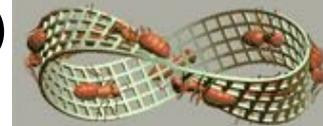
Canones diversi
super thema regium

Canon a 2

1.



Ma fin est mon début (mais renversé !)



Canones diversi super thema regium:

1. Canon a 2

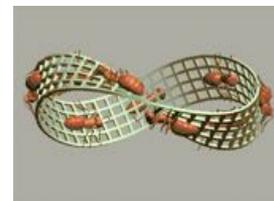
Canones diversi super thema regium:

1. Canon a 2



<http://www.josleys.com/Canon/Canon.html>

[min. 1'14"]



Temps et espace chez Steve Reich

CLAPPING MUSIC

FOR TWO PERFORMERS

① J. 644-168

CLAP 1
CLAP 2

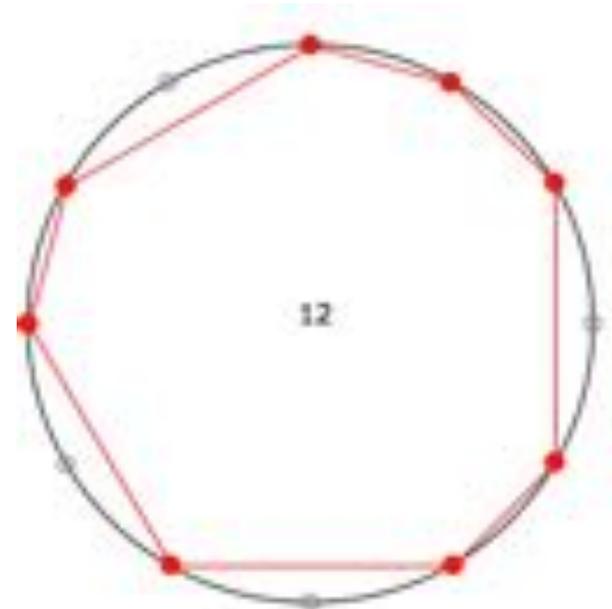
Repeat back to 1, then end

The performers begin and end with both performers in unison at bar ①. The number of repeats of each bar should be fixed at twelve repeats per bar. Since the first performer part does not change, it is up to the second performer to ease from one bar to the next. The second performer should try to keep his or her clapping where it is written, i.e. on the first beat of each measure (not on the first beat of the group of three claps), so that his clapping always falls on a new beat of his or her unchanging pattern.

The choice of a particular clapping sound, i.e. with cupped or flat hands is left up to the performers, whichever sound is chosen, both performers should try to get the same one so that their two parts will blend to produce one overall exciting pattern.

Clapping Music de Steve Reich (1972)

Steve Reich 1972
12 repeats 1972



Le « cercle rythmique » et ses rotations

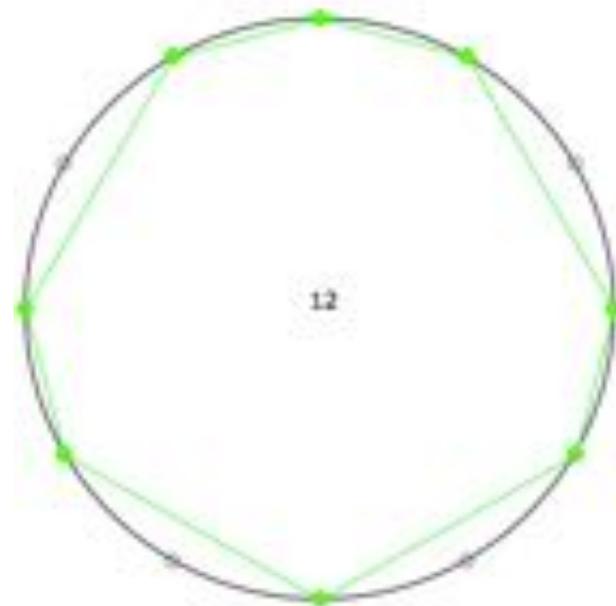
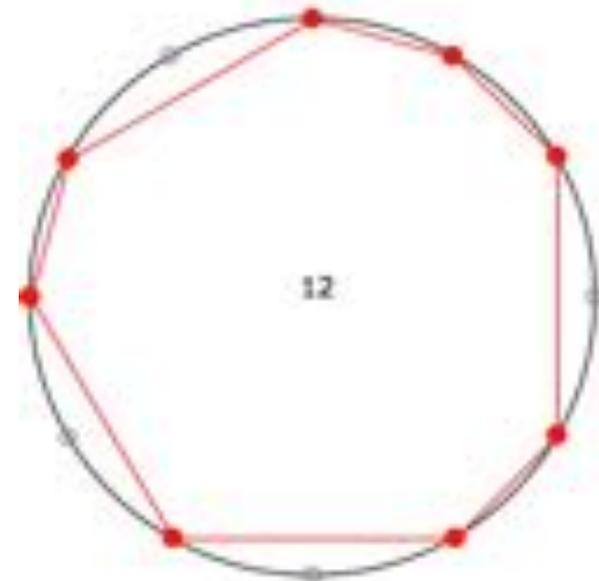
CLAPPING MUSIC

FOR TWO PERFORMERS

Handwritten musical notation for two clappers. The first system is highlighted with a red box and a green box. The notation includes a tempo marking "J. 164-168" and a dynamic marking "f". The notation is organized into systems, with the first system containing two staves (CLAP 1 and CLAP 2) and subsequent systems continuing the piece. The notation consists of rhythmic patterns represented by vertical stems and horizontal lines, indicating the timing and duration of claps for each performer.

The performers begin and end with both performers in unison at bar ①. The number of repeats of each bar should be fixed at twelve repeats per bar. Since the first performer part does not change, it is up to the second performer to ease from one bar to the next. The second performer should try to keep his or her clapping where it is written, i.e. on the first beat of each measure (not on the first beat of the group of three claps), so that his clapping always falls on a new beat of his or her unchanging pattern.

The choice of a particular clapping sound, i.e. with cupped or flat hands is left up to the performers, whichever sound is chosen, both performers should try to get the same one so that their two parts will blend to produce one overall rhythmic pattern.



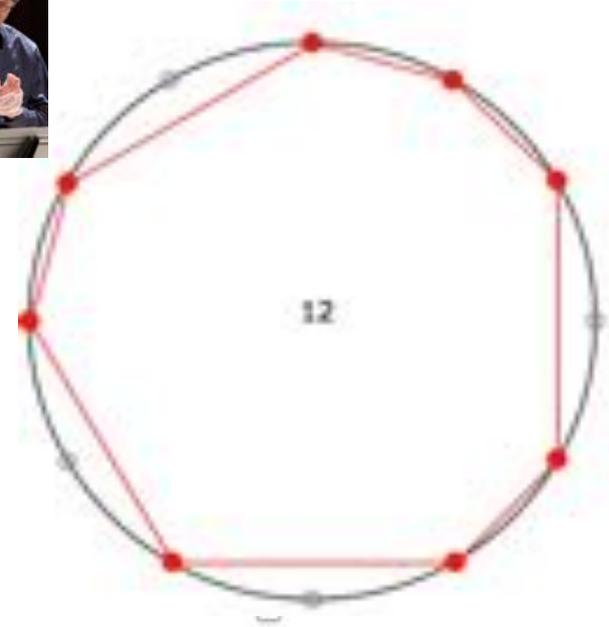
Le « cercle rythmique » et ses rotations

CLAPPING MUSIC

FOR TWO PERFORMERS



Handwritten musical notation for two clappers (CLAP 1 and CLAP 2). The notation is organized into measures, with some measures highlighted by colored boxes: a red box around the first measure, a green box around the second measure, and an orange box around the third measure. The notation includes rhythmic patterns and bar lines.



Handwritten musical notation for two clappers (CLAP 1 and CLAP 2) with a red vertical bar between them. The notation is organized into measures, with the first measure highlighted by a red box. The number '12' is written above the first measure. Below the notation, the word '(SHIFT)' is written.

The performers begin and end with both performers in unison at bar ①. The number of repeats of each bar should be fixed at twelve repeats per bar. Since the first performer part does not change, it is up to the second performer to ease from one bar to the next. The second performer should try to keep his or her drumbeat where it is written, i.e. on the first beat of each measure (not on the first beat of the group of three claps), so that his drumbeat always falls on a new beat of his or her unchanging pattern.

The choice of a particular clapping sound, i.e. with cupped or flat hands is left up to the performers, whereas tempo is chosen, both performers should try to get the same one so that their two parts will blend to produce one overall exciting pattern.

Clapping Music (1972)

Steve Reich 1972
revised 1979

Gerubach's Scrolling Score Project
<http://www.gerubach.com>

L'algèbre (le temps) et la géométrie (l'espace) en musique

MATH / MUSIC MEETINGS

Creativity in Music and Mathematics

Pierre Boulez & Alain Connes

Encounter with two major figures of musical creation and contemporary mathematical research: Pierre Boulez and Alain Connes.

What is the role of intuition in mathematical reasoning and in artistic activities? Is there an aesthetic dimension to mathematical activity? Does the notion of elegance of a mathematical demonstration or of a theoretical construction in music play a role in creativity?



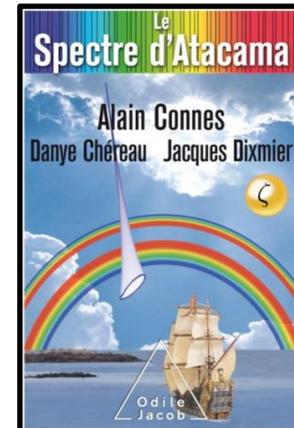
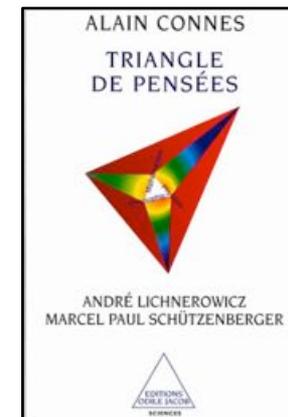
Gérard Assayag, director of the CNRS/IRCAM Laboratory for The Science and Technology of Music and Sound, will lead this dialogue on invention in the two disciplines.

Photo: Pierre Boulez © Jean Radel

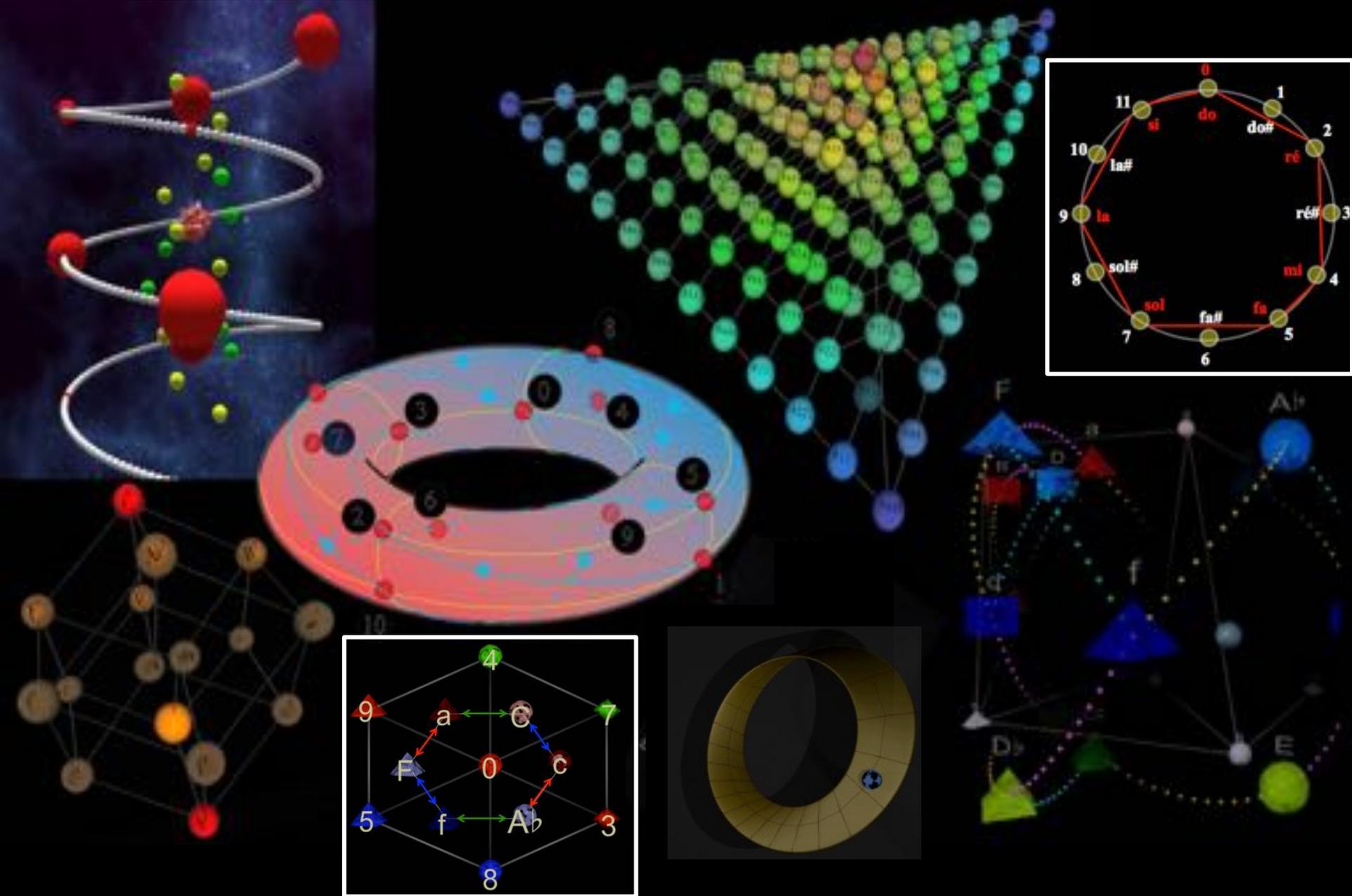
Wednesday, June 15, 2011, 6:30pm / IRCAM, Espace de projection

« La **musique** s'inscrit dans le temps exactement comme l'**algèbre** : dans les mathématiques, il y a cette dualité fondamentale entre d'un côté la **géométrie** qui correspond aux arts visuels, aux images mentales ; et de l'autre côté l'**algèbre**, qui inscrit une temporalité. Cela s'inscrit dans le temps, c'est le **calcul**, quelque chose qui est très proche du langage, et qui en a la précision diabolique. »

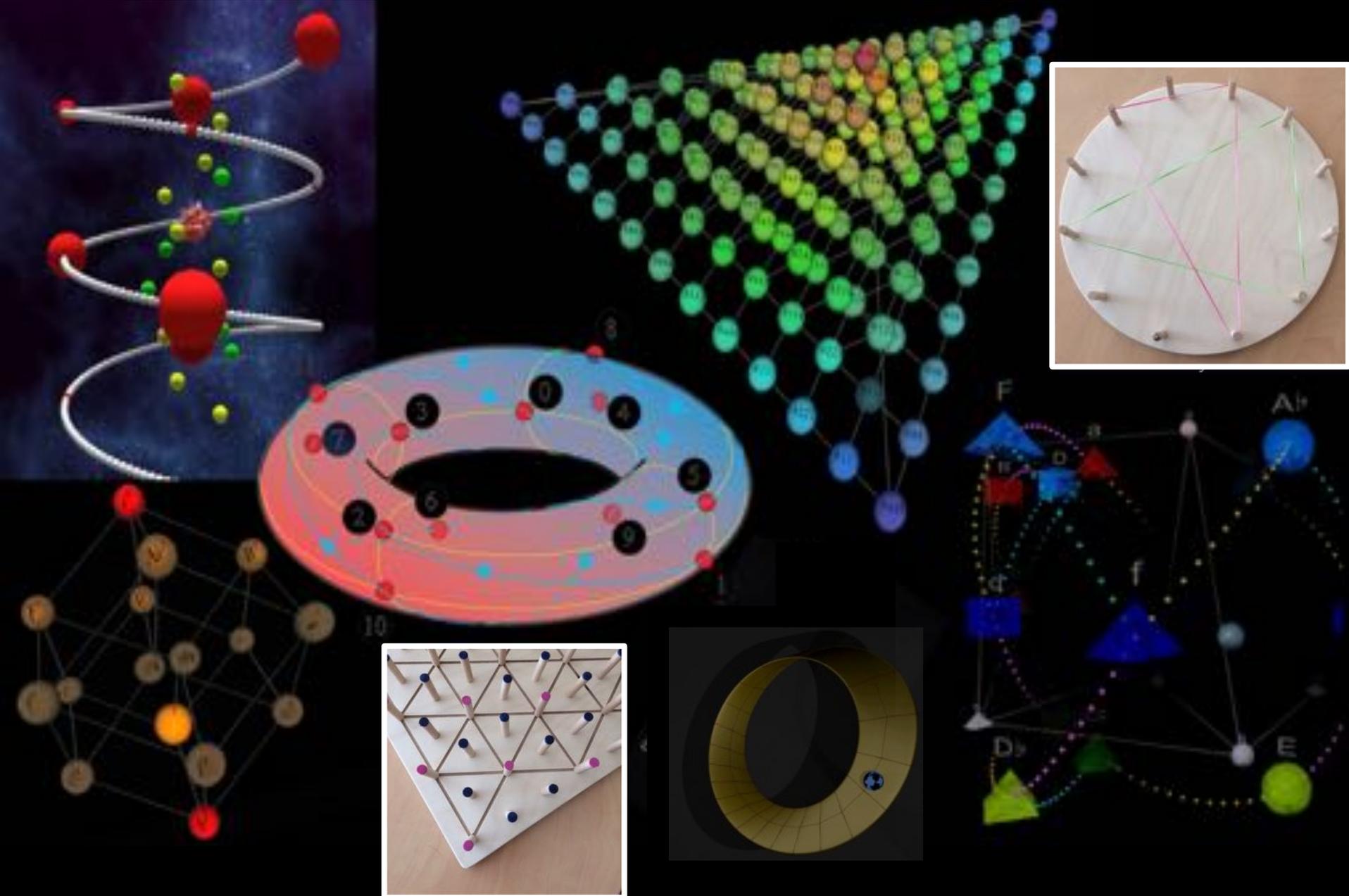
(Alain Connes, dans “Créativité en musique et en mathématiques”, Ircam, Conférence MCM, juin 2011).



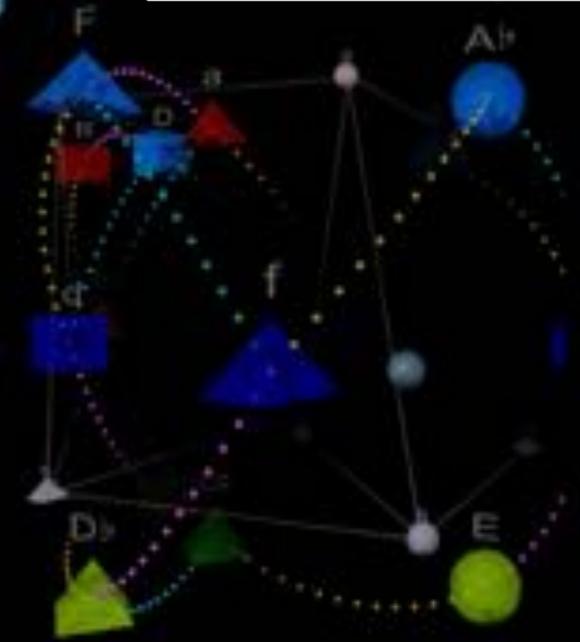
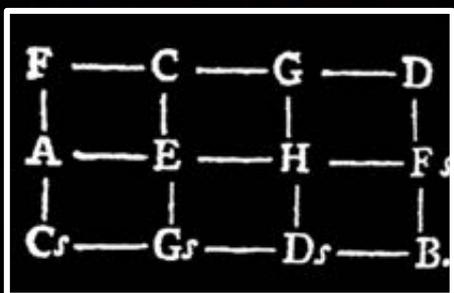
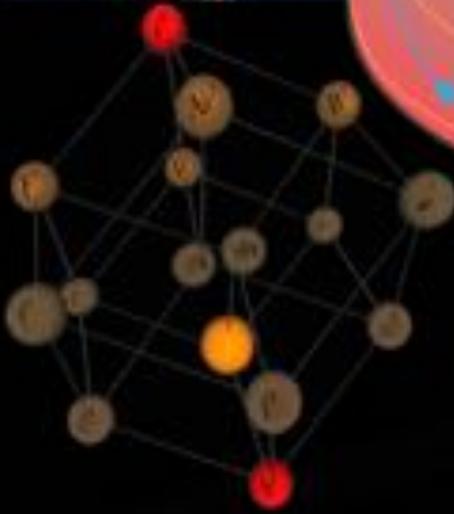
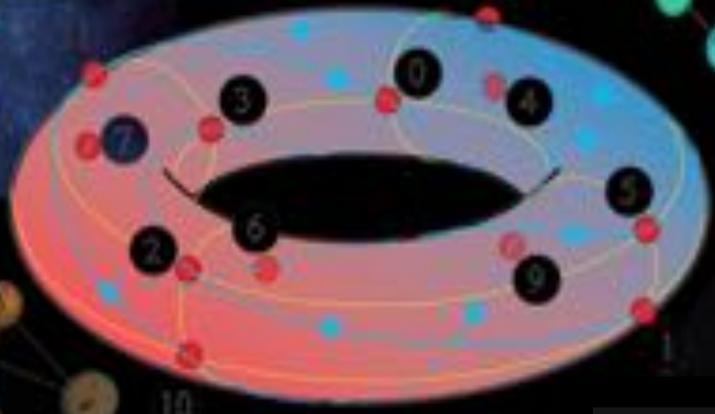
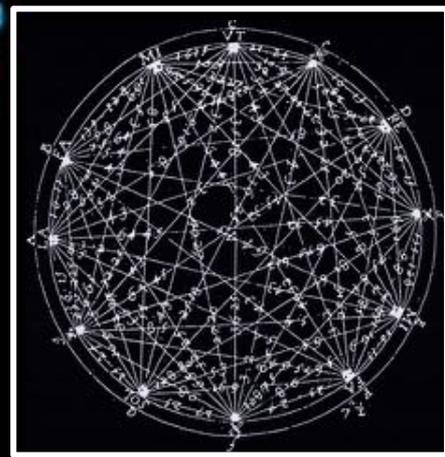
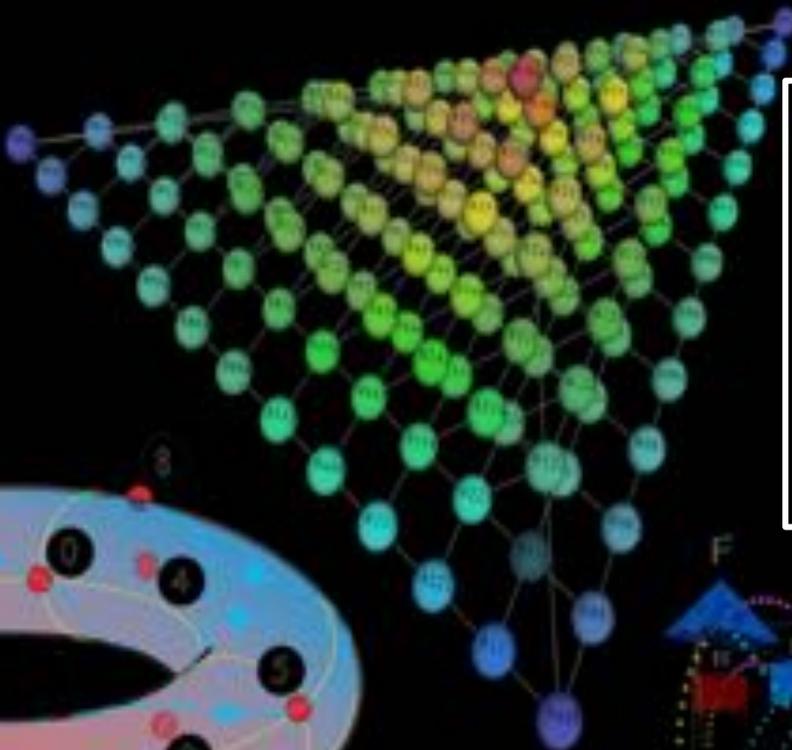
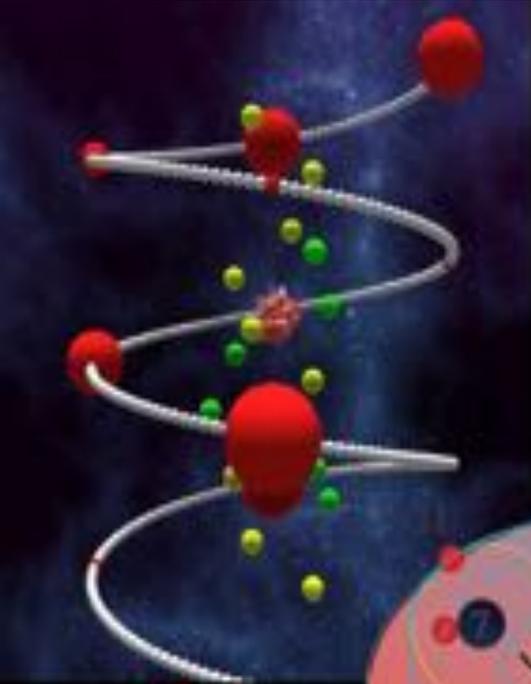
La galaxie des espaces « mathémusicaux »...



La galaxie des espaces « mathémusicaux »...



La galaxie des espaces « mathémusicaux »...



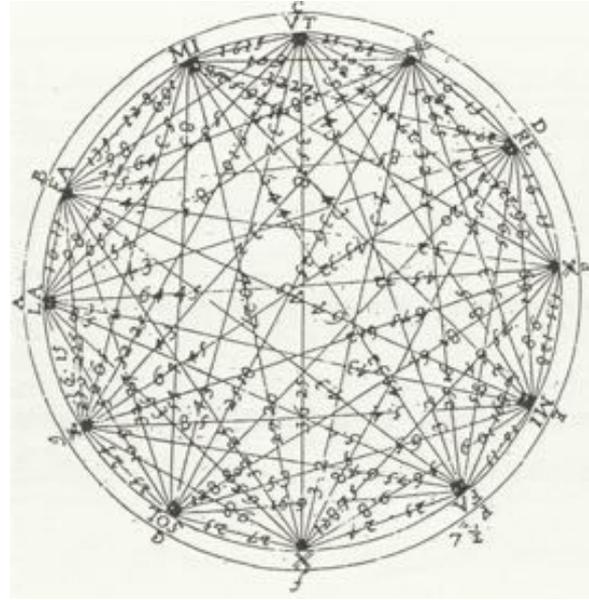
Mersenne et la naissance de la combinatoire



Mersenne et la naissance de la combinatoire

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

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



Marin Mersenne

Tabula Combinationis ab 1 ad 22.

I	1
II	2
III	6
IV	24
V	110
VI	710
VII	3040
VIII	40310
IX	361880
X	3618800
XI	39916800
XII	479001600
XIII	6127016800
XIV	87178291200
XV	1307674368000
XVI	20911789888000
XVII	315687418096000
XVIII	6401373705718000
XIX	121648100408811000
XX	2431301008176640000
XXI	5090941171709440000
XXII.	1114000717777607480000



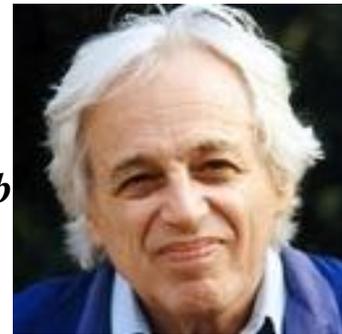
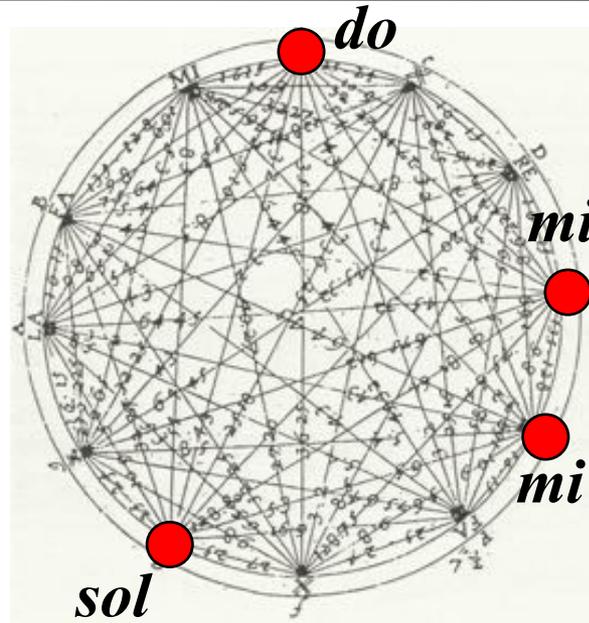
Avec quatre notes on peut faire de la musique !

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

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

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III	6
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V	110
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VII	3040
VIII	40310
IX	361380
X	3613800
XI	39916800
XII	479001600
XIII	6127016800
XIV	87178120000
XV	1307674968000
XVI	20911789888000
XVII	315687418096000
XVIII	6401373705718000
XIX	121648100408810000
XX	24313010081766400000
XXI	50909411717094400000
XXII	111400071777607480000



Six Bagatelles
(G. Ligeti, 1953)

Varietas, seu Combinatio quatuor notarum.

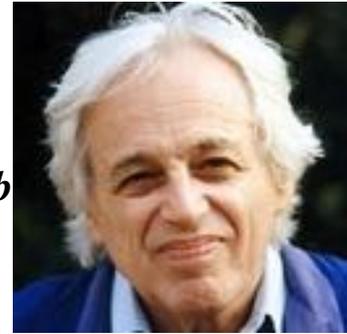
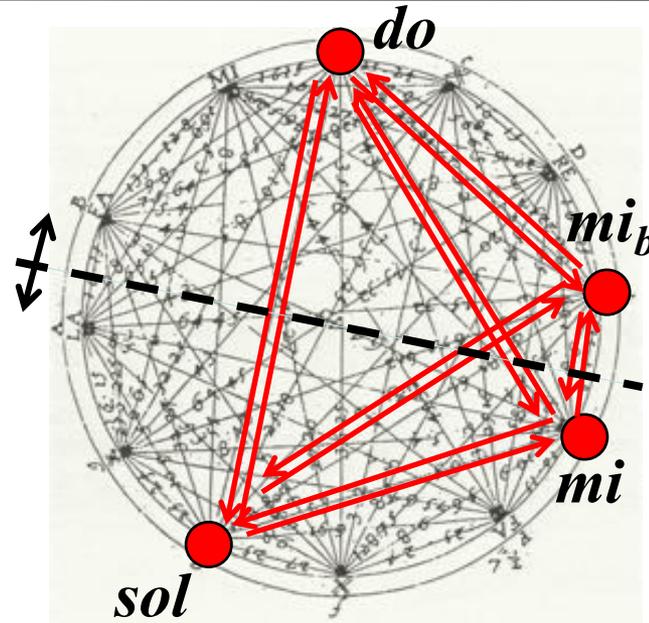
A la recherche des symétries cachées dans la musique

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

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

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XIV	87178120000
XV	1307674968000
XVI	20912789888000
XVII	315687418096000
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XXII	1114000717777607480000



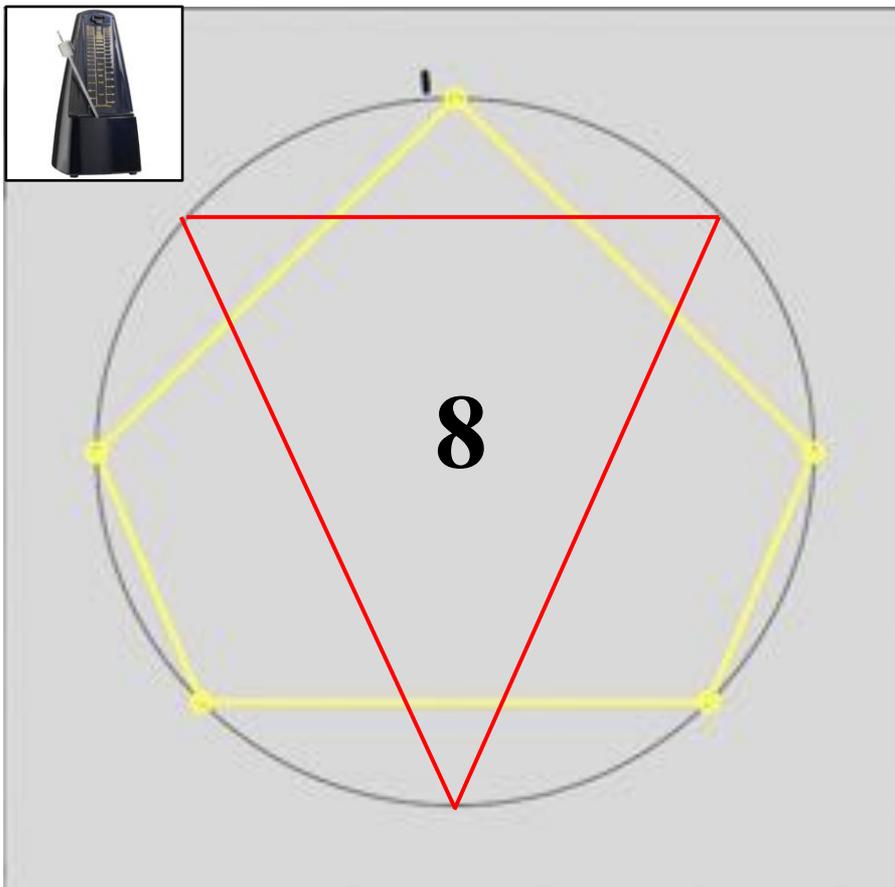
Six Bagatelles
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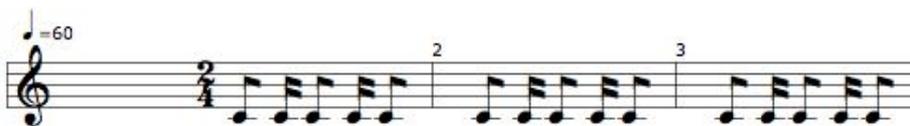
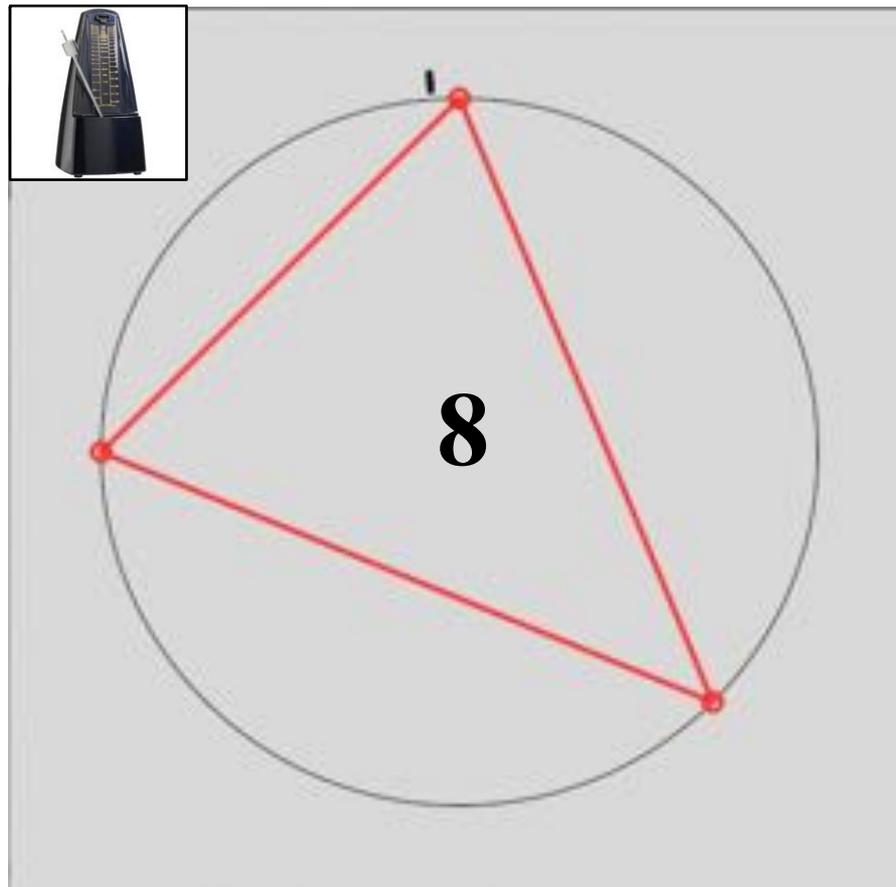
Musical score for "Varietas, seu Combinatio quatuor notarum" by György Ligeti, showing 24 numbered measures of rhythmic patterns.

Représentation circulaire des rythmes

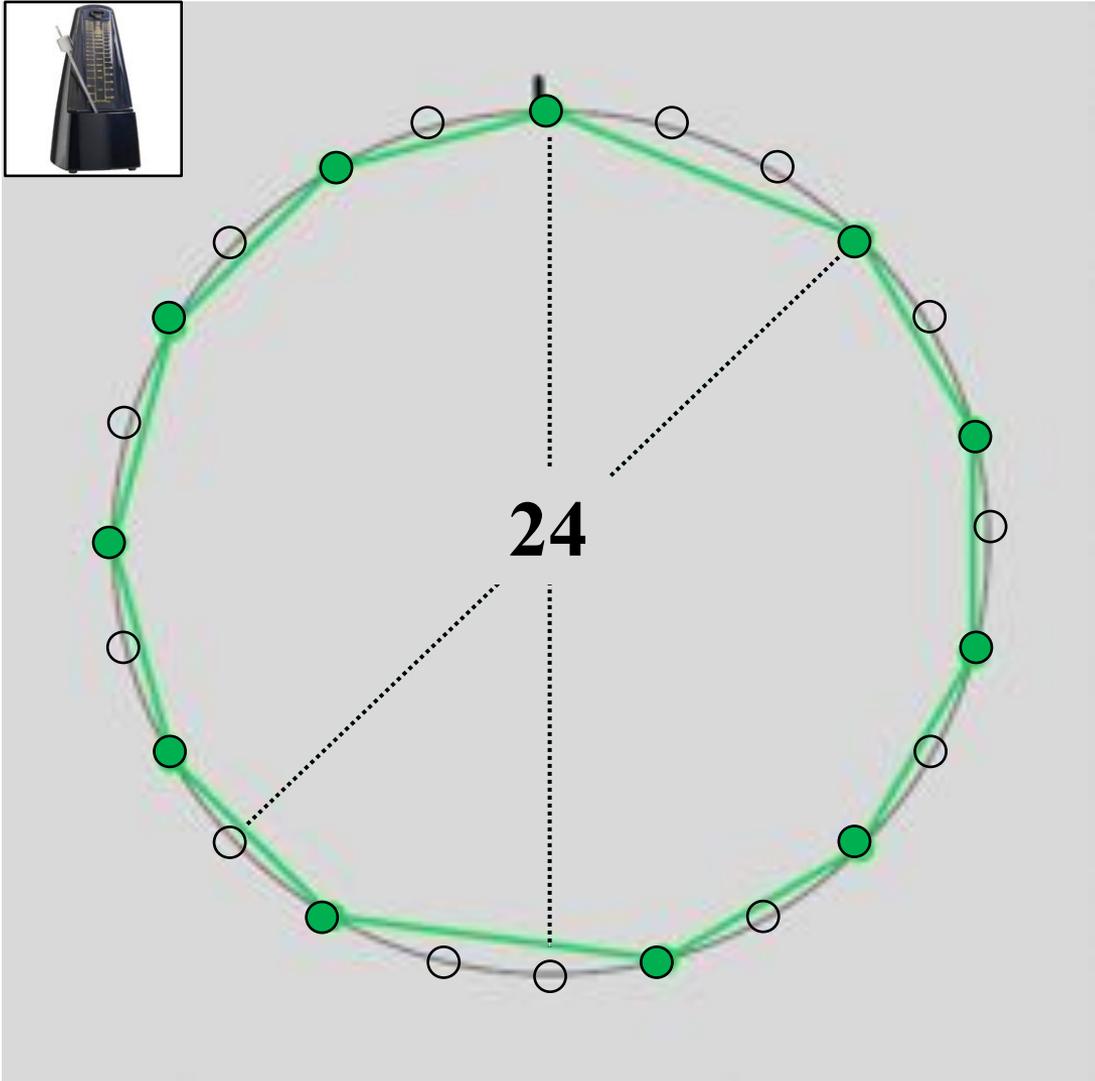
El cinquillo



El trecillo



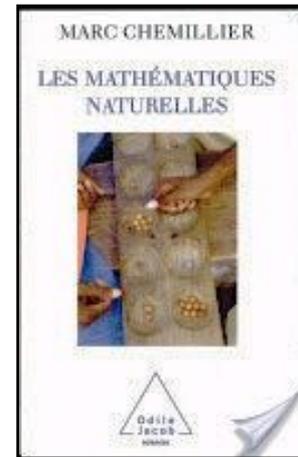
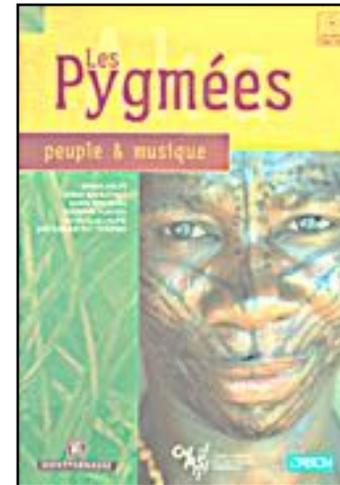
Imparité rythmique et traditions orales



Simha Arom



Marc Chemillier

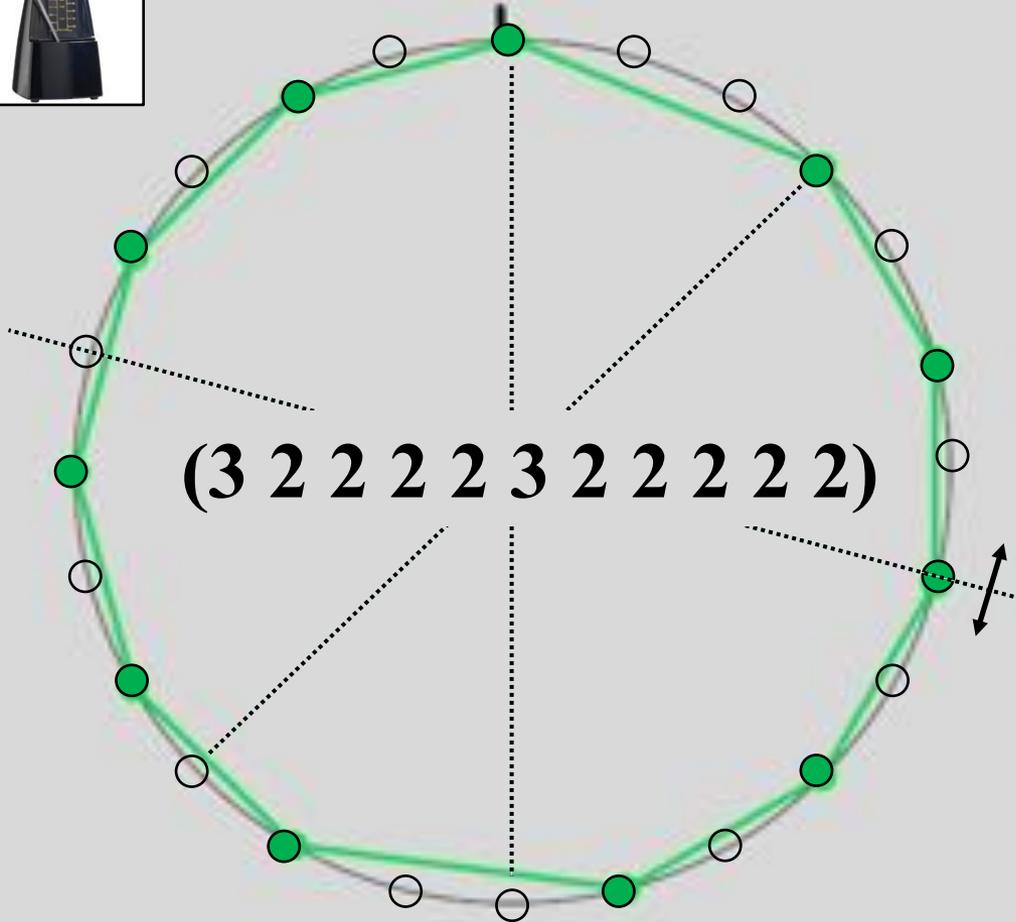


musimédiane

publiée avec le concours de la SFAM

revue audiovisuelle et multimédia d'analyse musicale

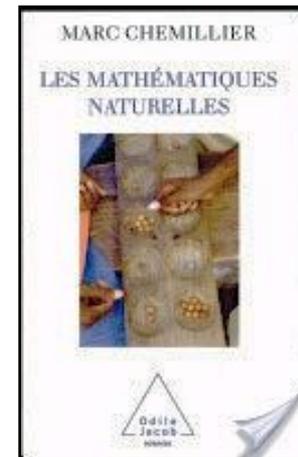
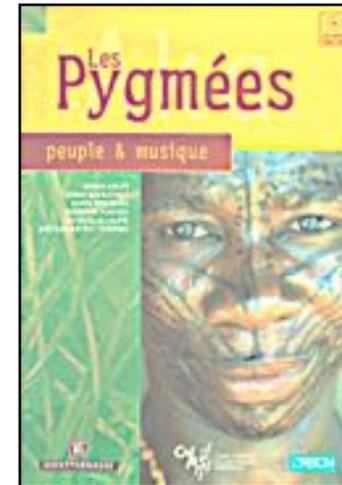
Imparité rythmique et traditions orales



Simha Arom



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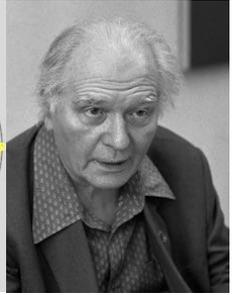
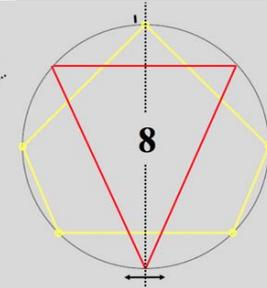
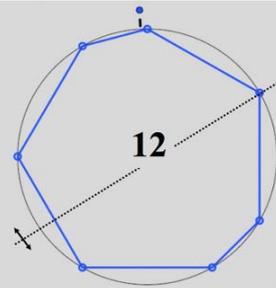
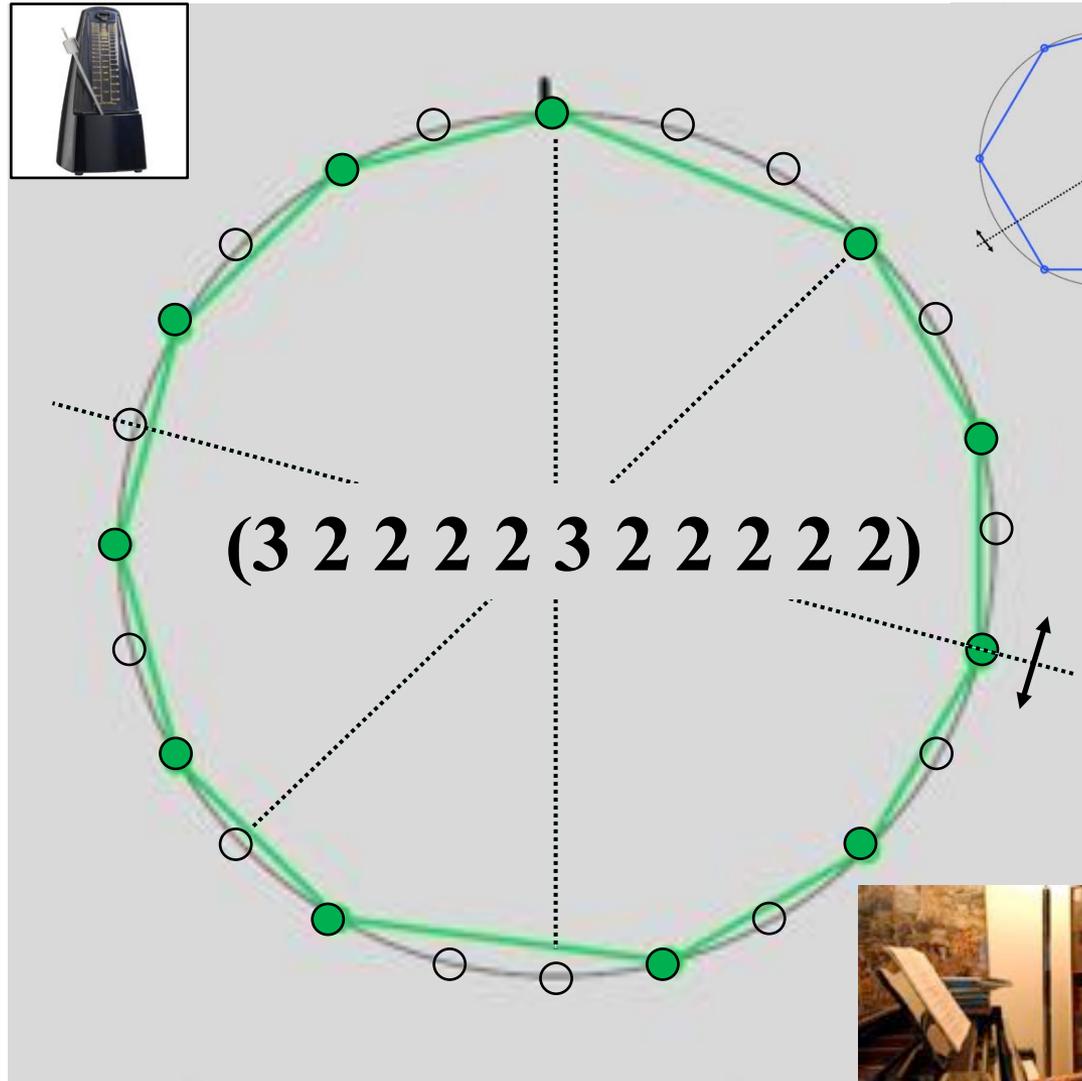


musimédiane

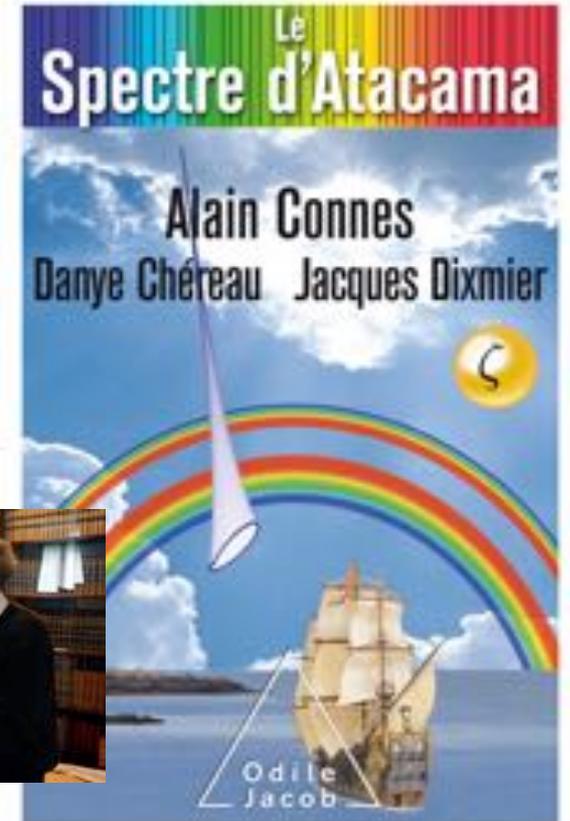
publiée avec le concours de la SFAM

revue audiovisuelle et multimédia d'analyse musicale

Rythmes non-retrogradables d'Olivier Messiaen

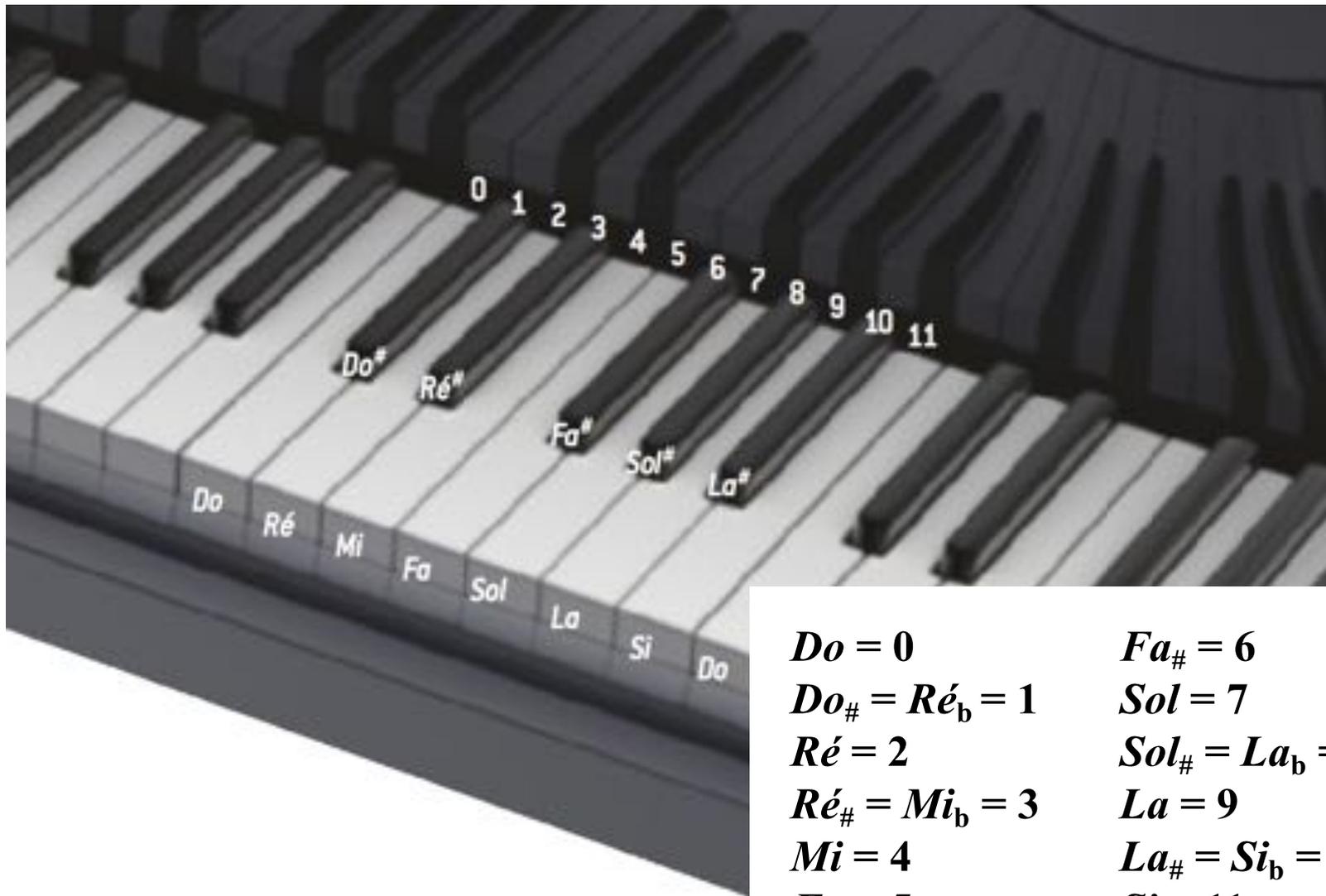


Olivier Messiaen



Alain Connes

Le piano : douze notes = douze nombres



Do = 0

Do# = Ré_b = 1

Ré = 2

Ré# = Mi_b = 3

Mi = 4

Fa = 5

Fa# = 6

Sol = 7

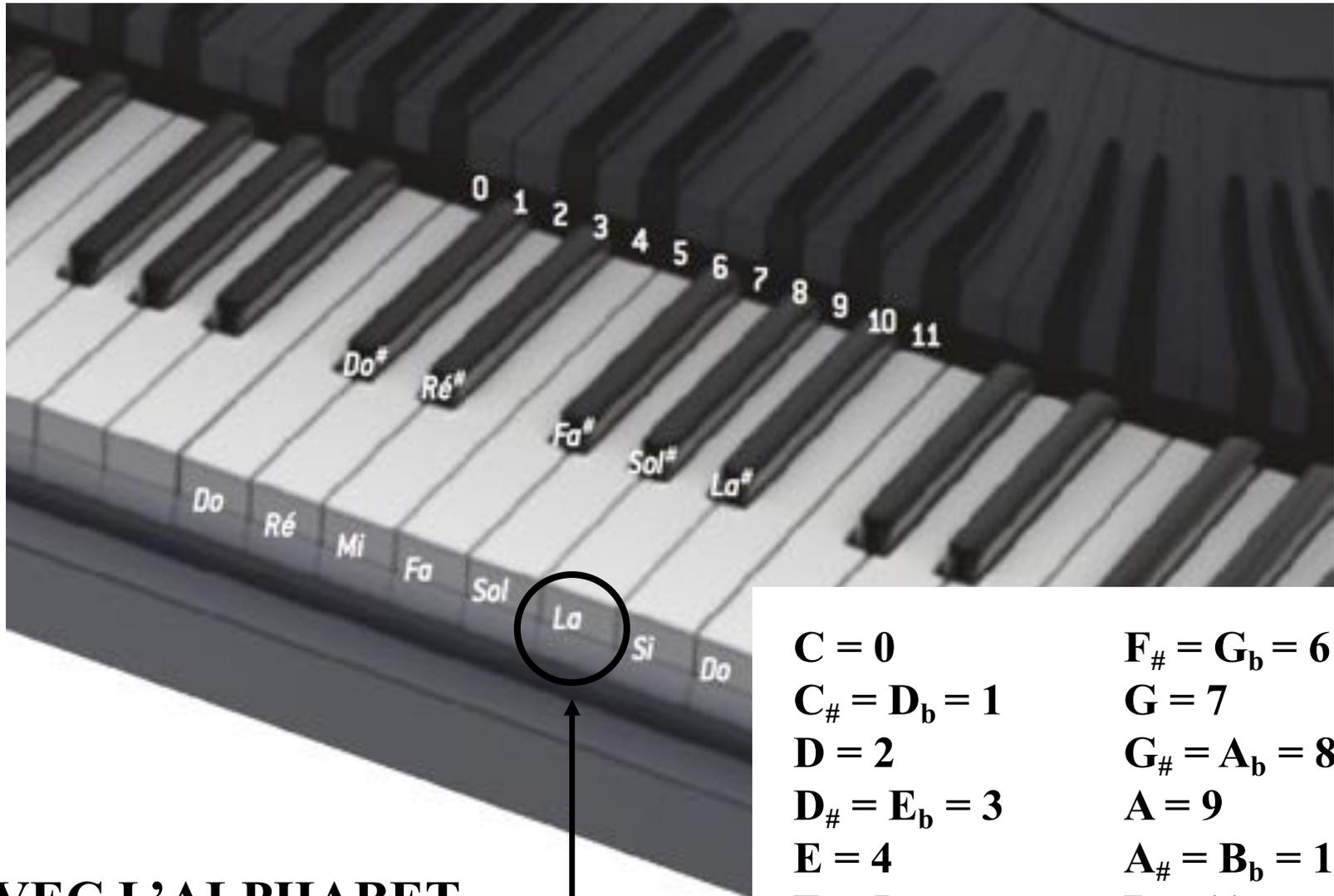
Sol# = La_b = 8

La = 9

La# = Si_b = 10

Si = 11

Le piano : douze notes = douze nombres



AVEC L'ALPHABET
A partir du *la* = A

C = 0

C_# = D_b = 1

D = 2

D_# = E_b = 3

E = 4

F = 5

F_# = G_b = 6

G = 7

G_# = A_b = 8

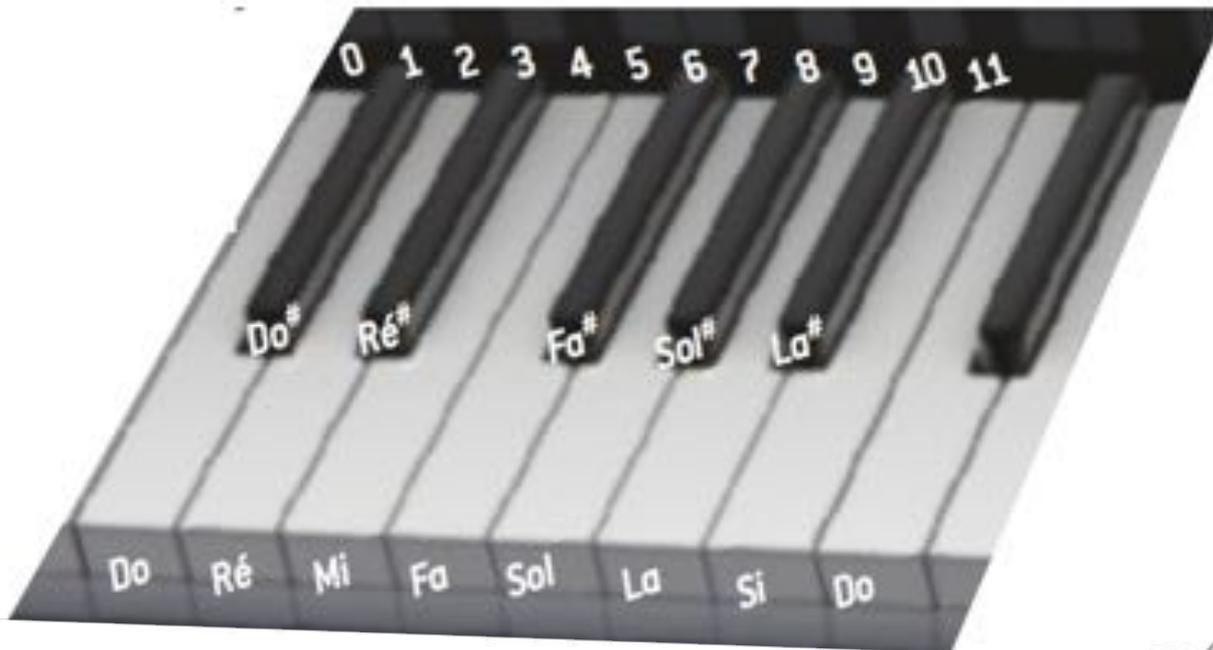
A = 9

A_# = B_b = 10

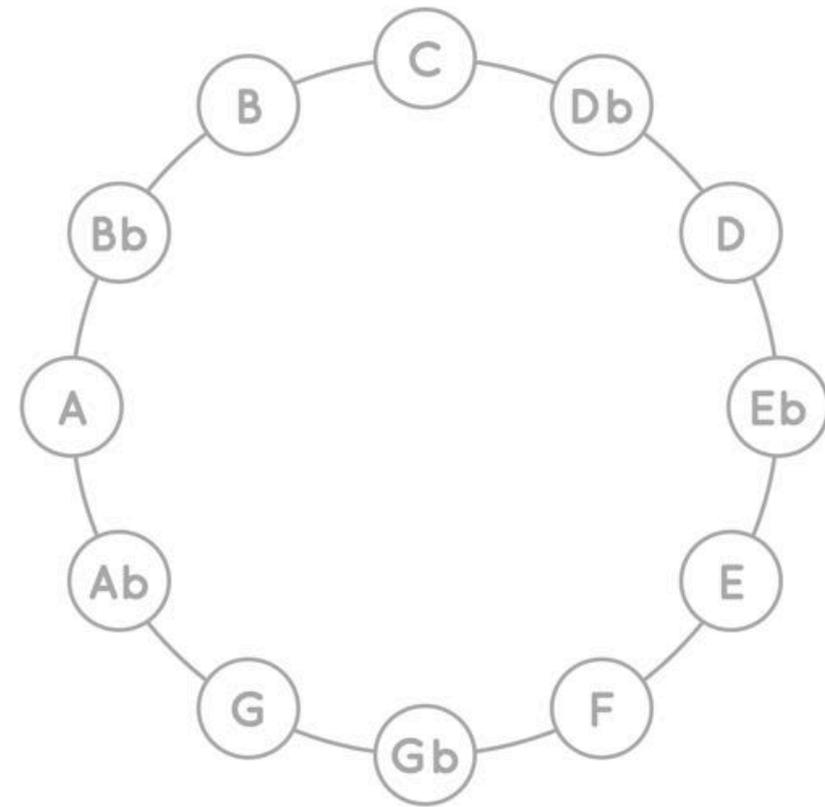
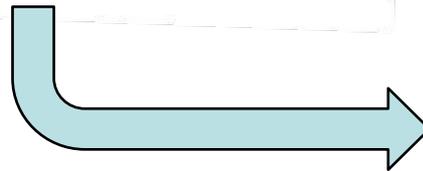
B = 11

Du piano à l'horloge musicale (notation anglo-saxonne)

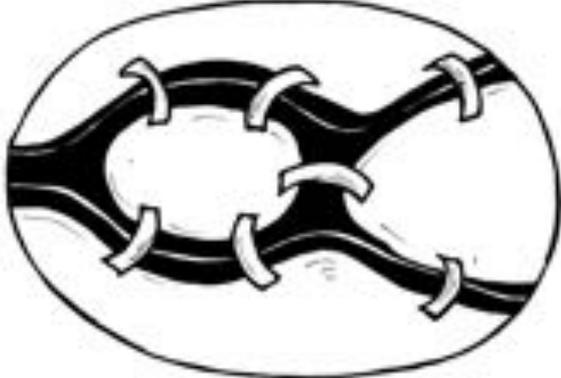
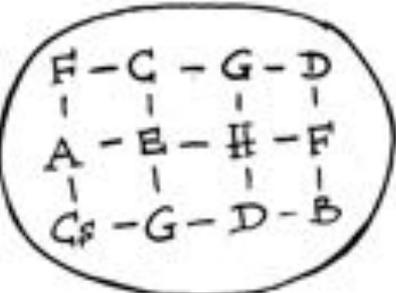
➔ DEMO



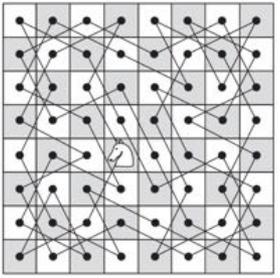
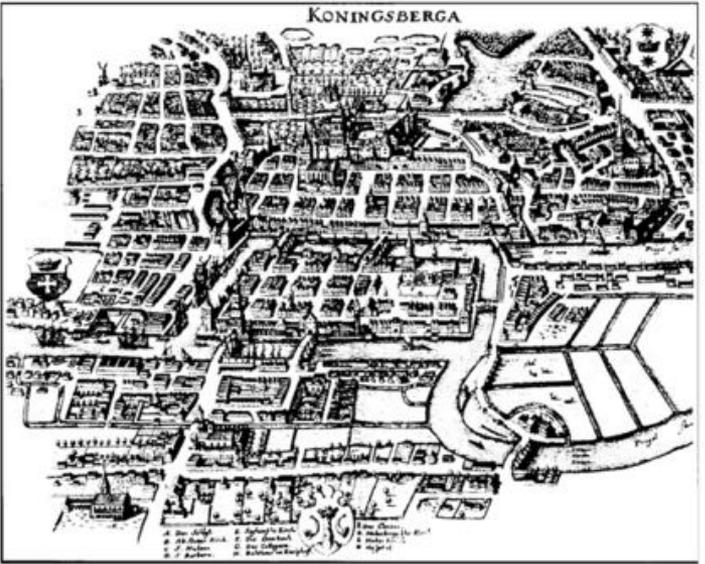
C = 0
C# = D_b = 1
D = 2
D# = E_b = 3
E = 4
F = 5
F# = G_b = 6
G = 7
G# = A_b = 8
A = 9
A# = B_b = 10
B = 11



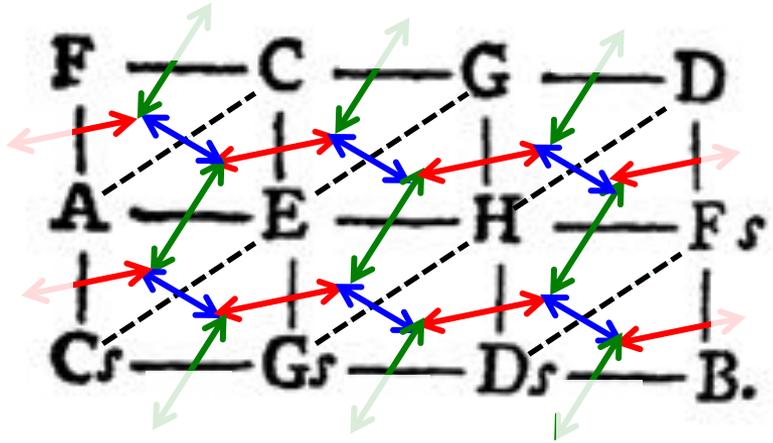
Euler et la naissance de la théorie des graphes



Le Tonnetz (ou nid musical d'abeilles)

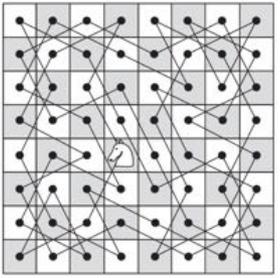
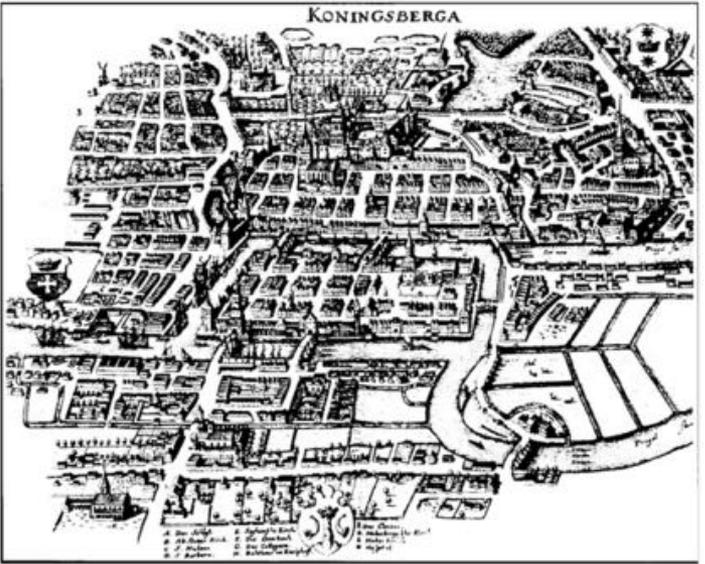
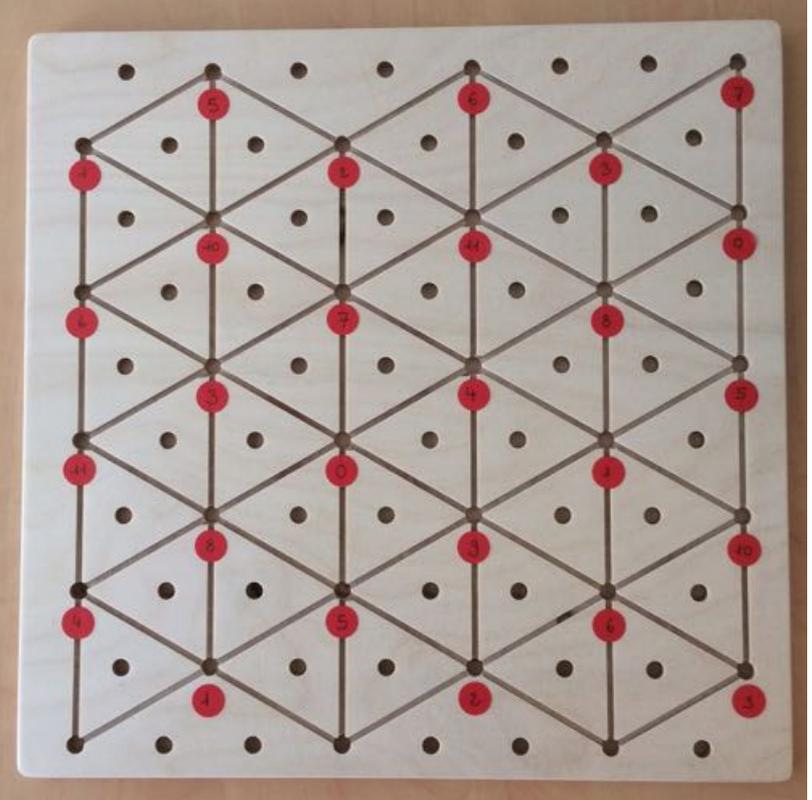


Leonhard Euler

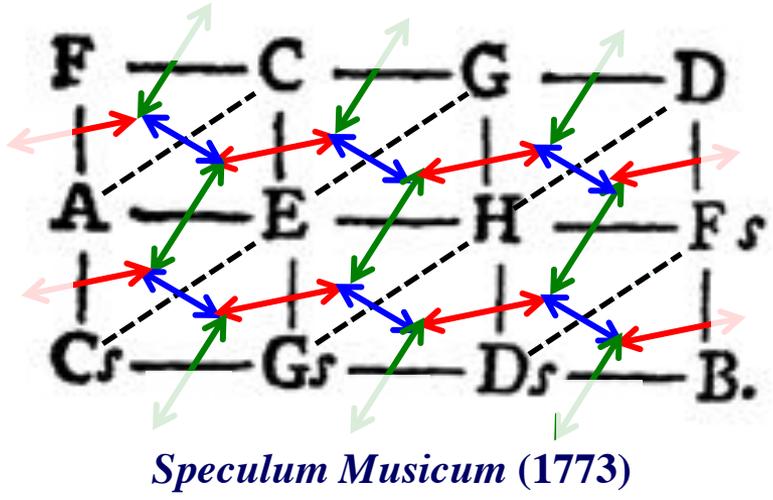


Speculum Musicum (1773)

Le Tonnetz (ou nid musical d'abeilles)



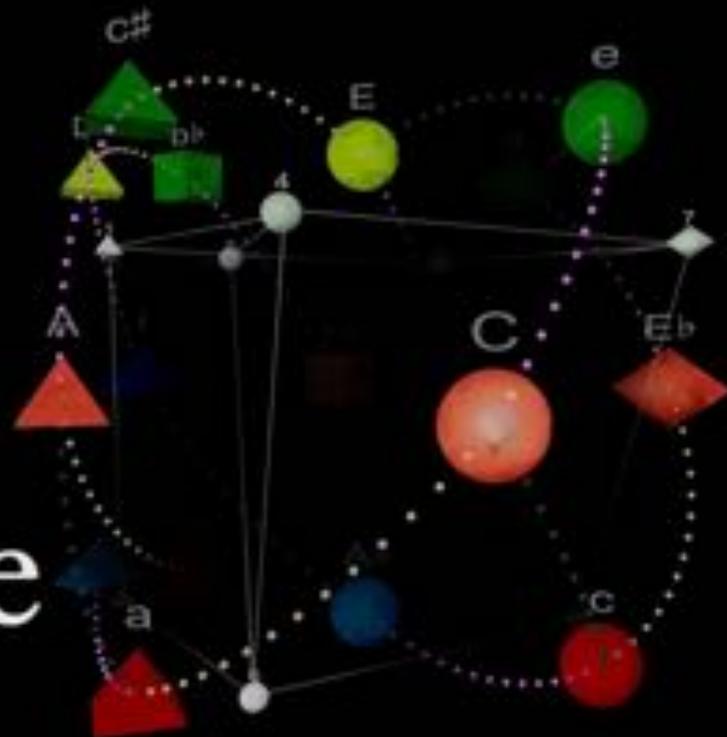
Leonhard Euler



Speculum Musicum (1773)

Beethoven and the Hypersphere

(and the Tonnetz)



Gilles Baroin 2016
www.MatheMusic.net

→ www.mathemusic.net

Zig-zag et cycles hamiltoniens dans le Tonnetz

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

Pêcher 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

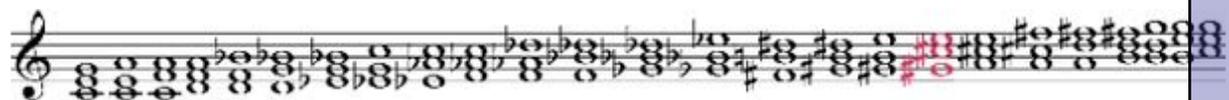
Vers l'îlot d'un petit village

Vers un château d'eau sur la plage

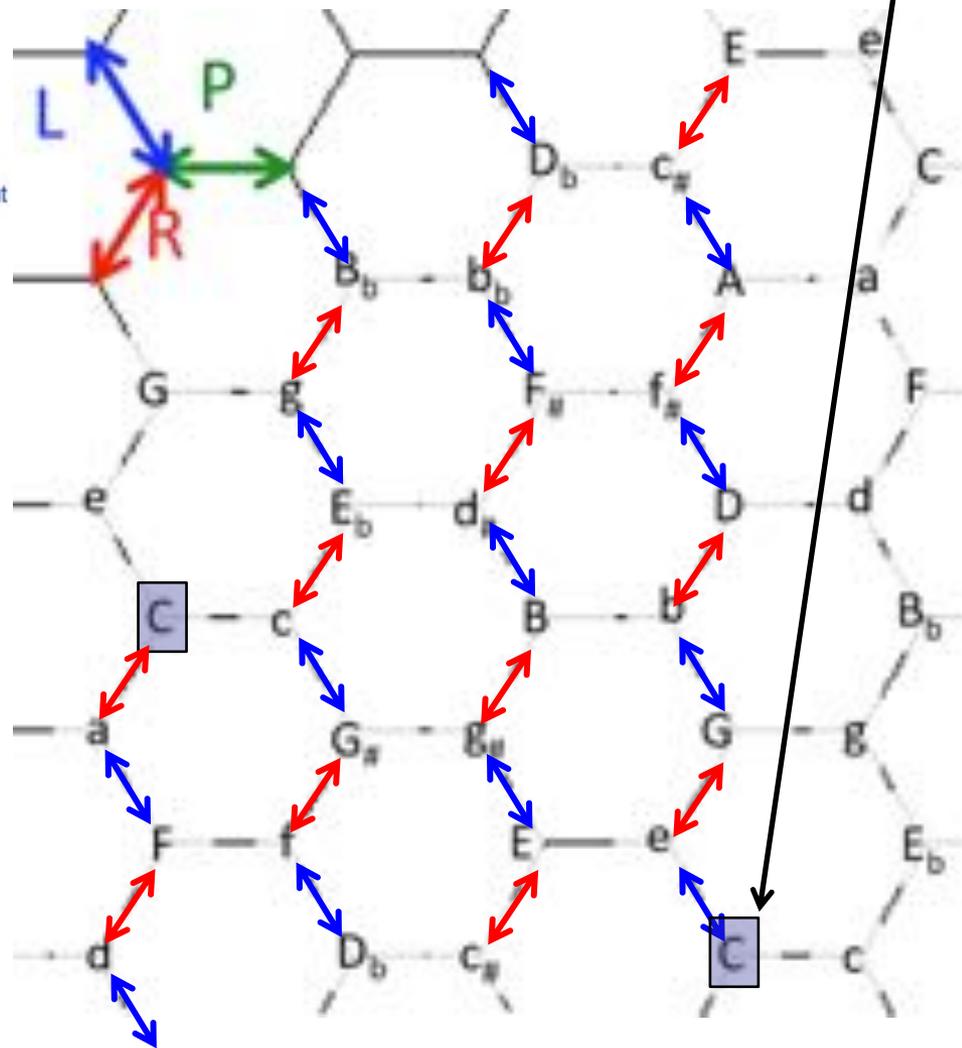
Quand tout s'éteint avant l'orage

Quand se lève le vent du large

Sur le blé vert



← time



CABARET HAMILTONIEN

FABRICE QUÉDY
Formalises dans la musique savante

MORENO ANDREATTI
Mentoratrices appliquées à la musique

POLO PIERRE LAMY
Écriture appliquée aux formes musicales

Alexis - Voix, guitare, écriture
Augustin - Voix, claviers, écriture
Clara - Voix, guitare, écriture
Emilie - Voix, mandoline, écriture
Séverine - Voix, alto, écriture
Thomas - Voix, claviers, écriture

Écrire sous la contrainte...
TACHER DU PAPIER SOUS
L'OBLIGATION DE FAIRE
QUELQUE CHOSE...

SALIR DU BOIS CONDITIONNÉ
AVEC LE DEVOIR MORAL DE
TRANSFORMER UN OBJET
INDEFINI...

SAMEDI 27 FEVRIER 2016 A 11H
AMPHI PARIS SCIENCE ET LETTRES
22 rue de St-Louis
75005 Paris

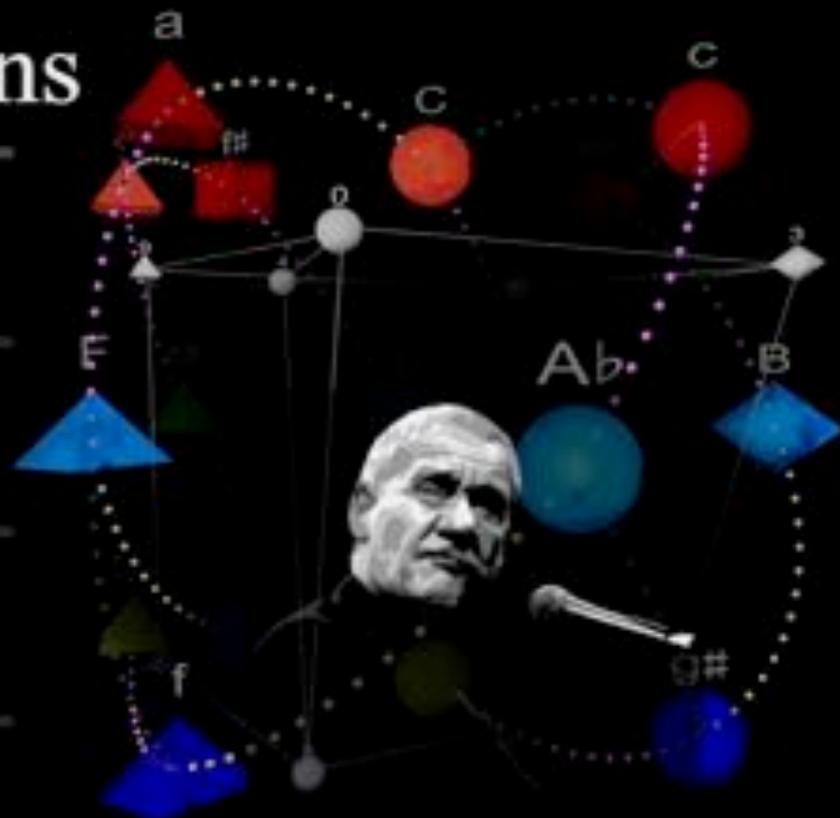
ENTREE LIBRE

PSL*
PARIS SCIENCE ET LETTRES

Harmonic Progressions

In Paolo Conte

Madeleine



Supervision Moreno Andreatta
Modelisation Gilles Baroin 2016

La sera non è più la tua canzone : chanson hamiltonienne 'redondante'

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.

*Le soir n'est plus ta chanson,
c'est ce rochet d'ombre transpercé
par les lumières et les voix sans fin,
la paix d'une chose déjà pensée.*

*Ah, cette lumière vive et claire vient
uniquement de toi, tu es si proche
du vrai d'une chose connue,
tu as pour nom une parole qui est passée
dans l'intimité du cœur où elle s'est
perdue .*

*Tombé est plus qu'un signe de la vie,
tu te reposes, du voyage tu es revenue
à l'intérieur de toi même, tu es
descendue dans cette
pure substance qui est si tienne,
si éloignée
dans le silence de l'être, achevée.*

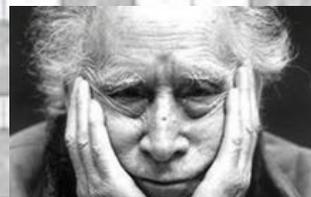
*L'air se tait et le temps derrière toi
se lève tel une montagne aride
où plane ton esprit et se perd,
un vent rare glisse et stagne.*

(tr. Antonia Soulez, philosophe et poète)

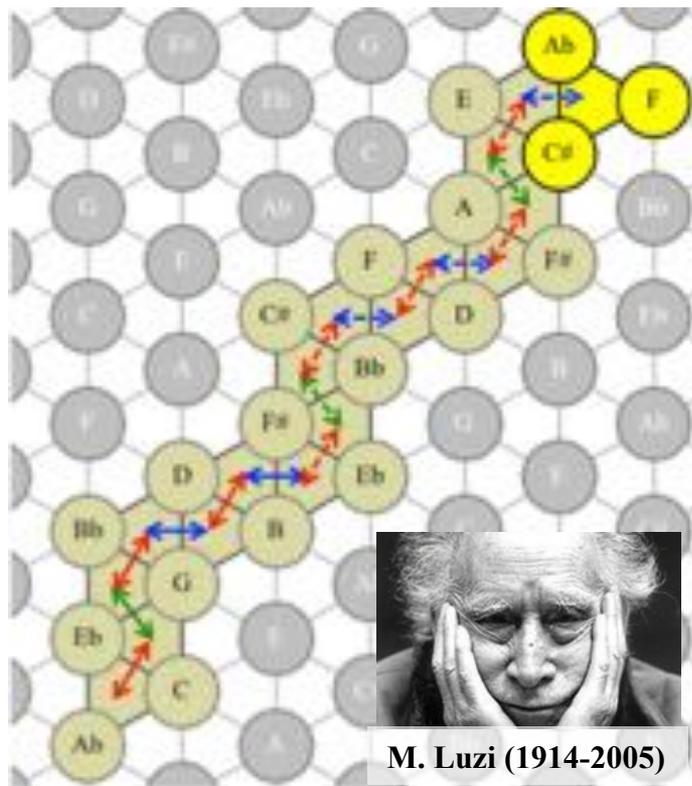
Musique : M. Andreatta
Arrangements et mixage : M. Bergomi &
S. Geravini
(Perfect Music Production)
Mastering : A. Cutolo (Massive Arts
Studio, Milan)



Gilles Baroin



M. Luzi (1914-2005)

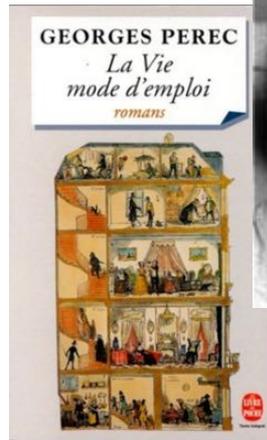


Luzi
Hamiltonian Song
on
Spinnennetz
2014
Lyrics by Mario Luzi
Music and Vocals by Moreno Andreatta
Graphics and Animation by Gilles Baroin
Spinnennetz by Gilles Baroin, Hugò Seress
Original "Chicken Wire" graph by J.Douthett, P.Steinbach

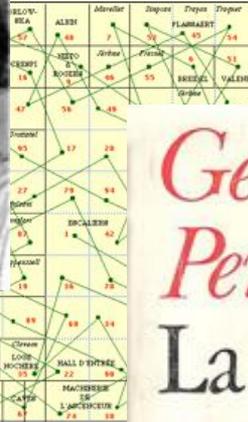
Les contraintes dans l'art : l'OuLiPo (Ouvroir de Littérature Potentielle)



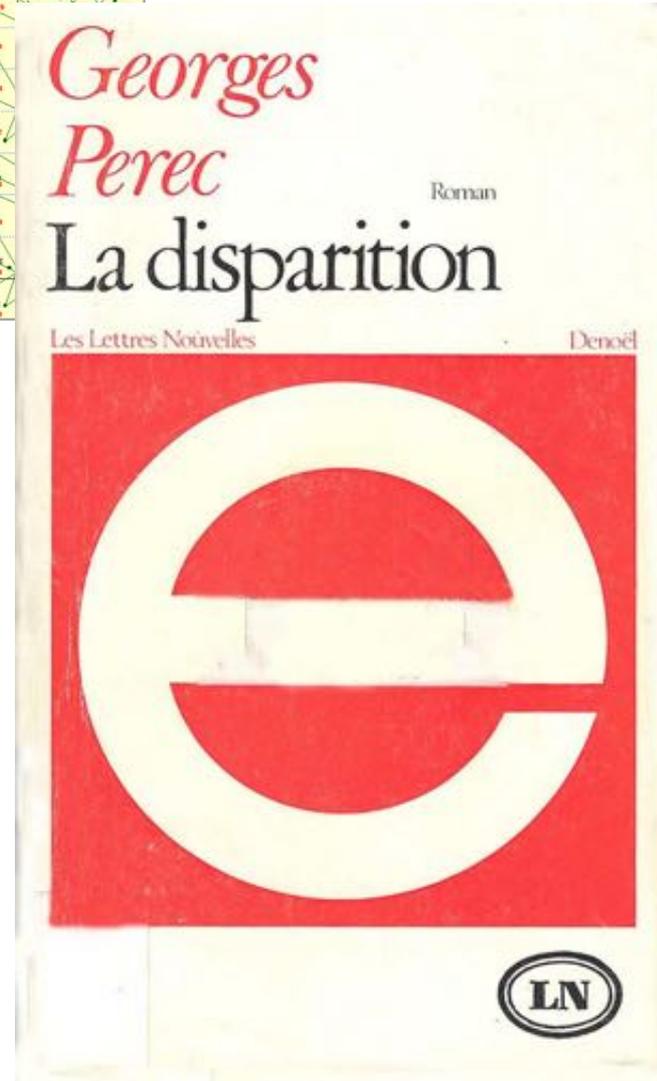
Cent mille milliards de poèmes, 1961



Georges Perec



La vie mode d'emploi,



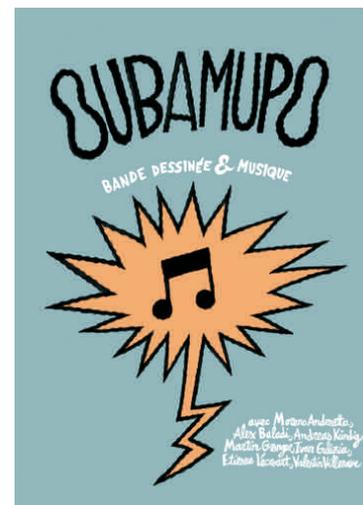
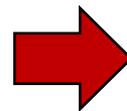
Raymond Queneau



Italo Calvino

Le Château des destins croisés, 1969

De l'OuLiPo à l'OuMuPo (ouvroir de musique potentielle)



La BnF présente
Oubapo/Oumupo
 Avec Élise Haddad, Valentin Villenave, Etienne Lécroart,
 Martin Granger et Moreno Andreatta
 jeudi 9 novembre 2017
 (BnF) Les jeudis de l'Oulipo



Valentin Villenave



Mike Solomon



Jean-François
 Piette



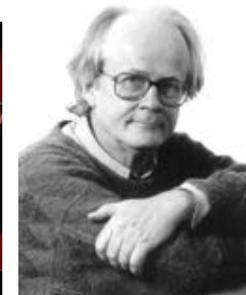
Martin
 Granger



Joseph Boisseau



Moreno Andreatta



Tom Johnson



2019
année des mathématiques
2020



<https://www.mathnpop.com/>

Merci
et...



...à
bientôt
avec
Math'n
Pop !

