

Berkeley
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ircam
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Haute école de musique
Genève - Neuchâtel



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

1794

ENS
ÉCOLE NORMALE
SUPÉRIEURE

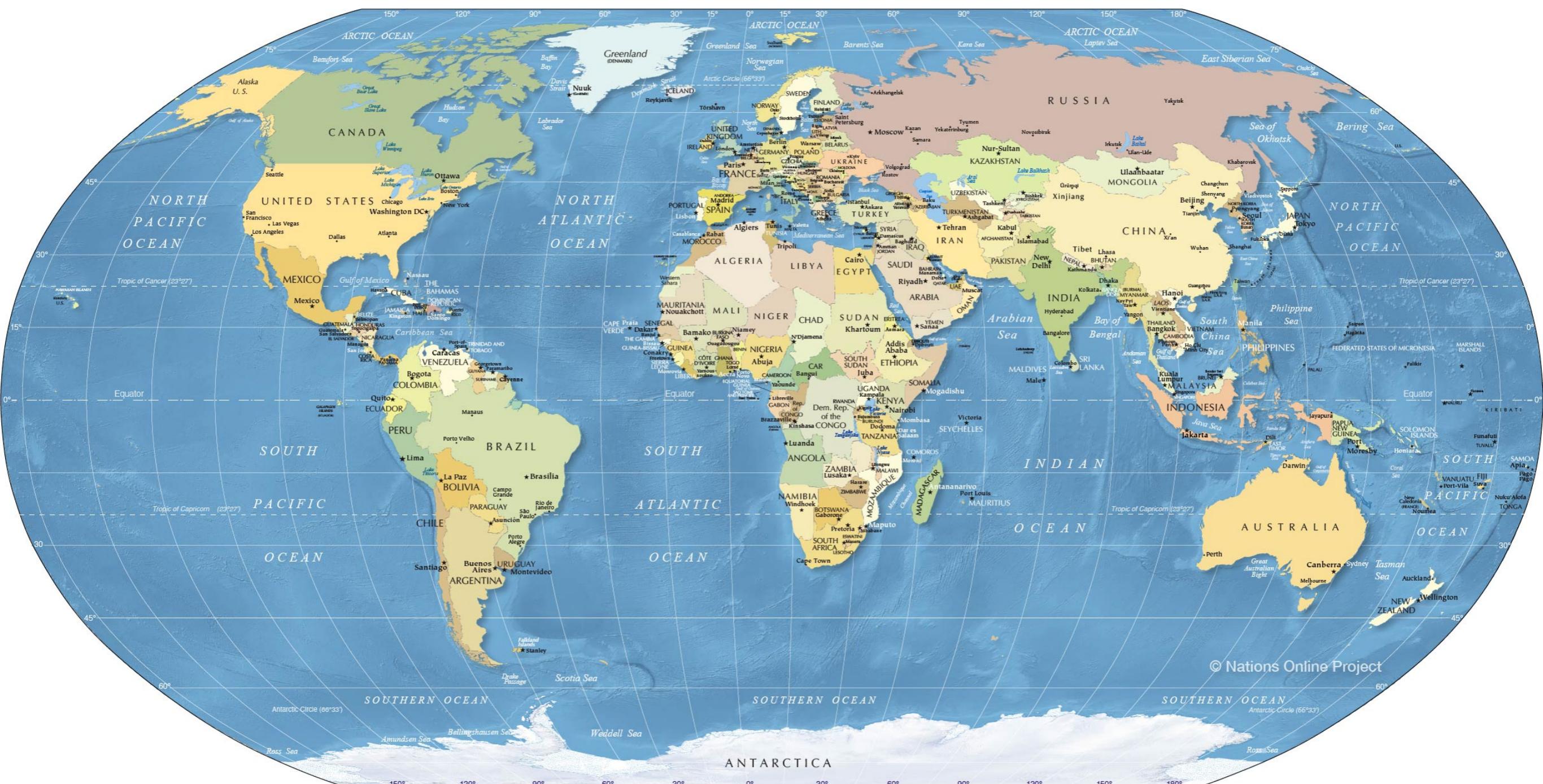


CARMINE-EMANUELE CELLA

OVERVIEW OF MY WORK

CARMINE WHO?

SOME HISTORY...



SOME HISTORY....



- 4 masters: piano, computer music, composition and mathematical logic
- 2 PhDs: composition, applied mathematics (symbolic signal processing)

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SOME HISTORY....



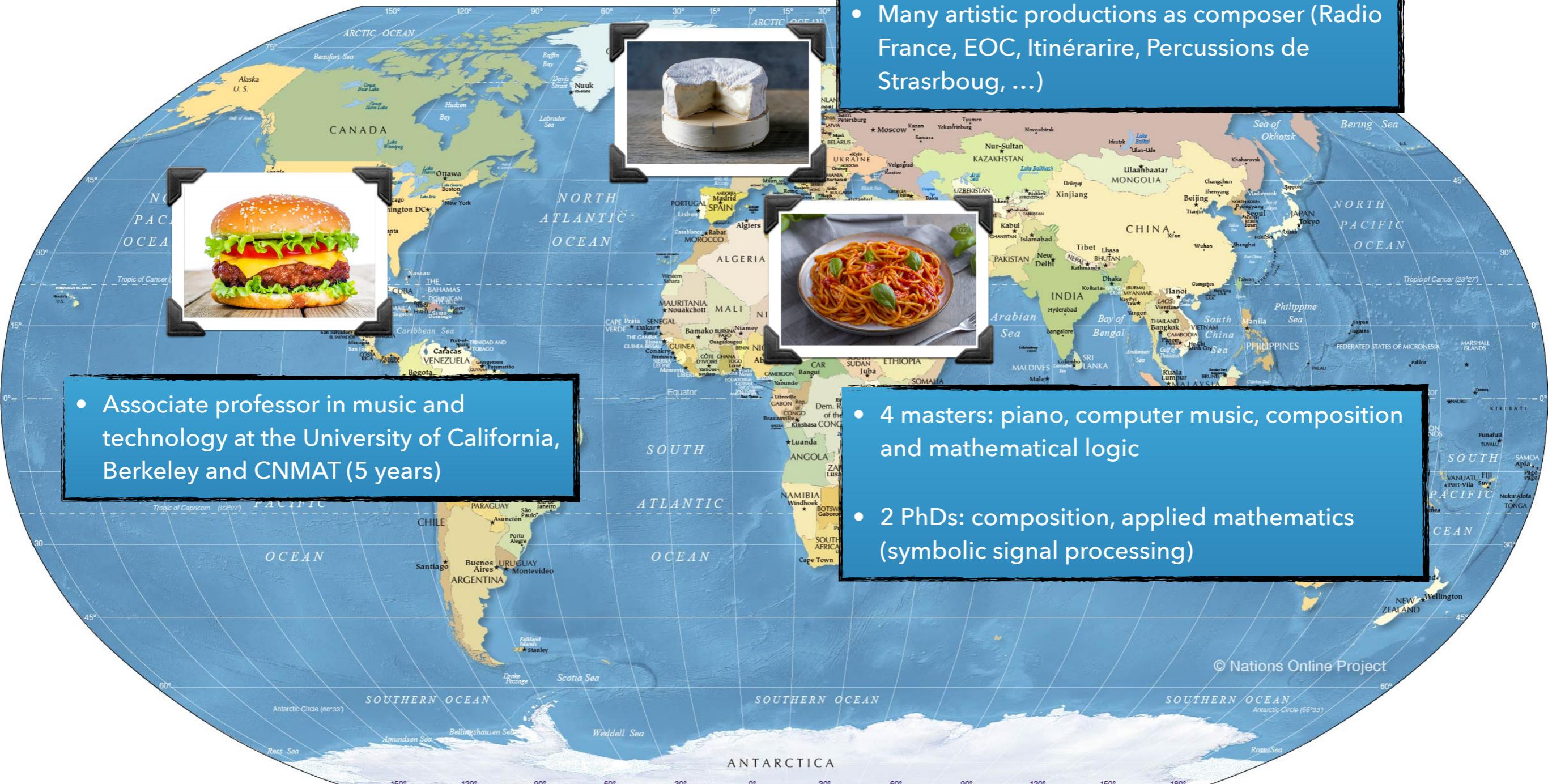
- Several research/post-doc positions (IRCAM, ENS Ulm, HEM Geneva, ...)

- Many artistic productions as composer (Radio France, EOC, Itinérarire, Percussions de Strasbourg, ...)

- 4 masters: piano, computer music, composition and mathematical logic
- 2 PhDs: composition, applied mathematics (symbolic signal processing)

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SOME HISTORY....



- Associate professor in music and technology at the University of California, Berkeley and CNMAT (5 years)

- Several research/post-doc positions (IRCAM, ENS Ulm, HEM Geneva, ...)
- Many artistic productions as composer (Radio France, EOC, Itinérarire, Percussions de Strasbourg, ...)

- 4 masters: piano, computer music, composition and mathematical logic
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ABOUT ME

Carmine-Emanuele Cella

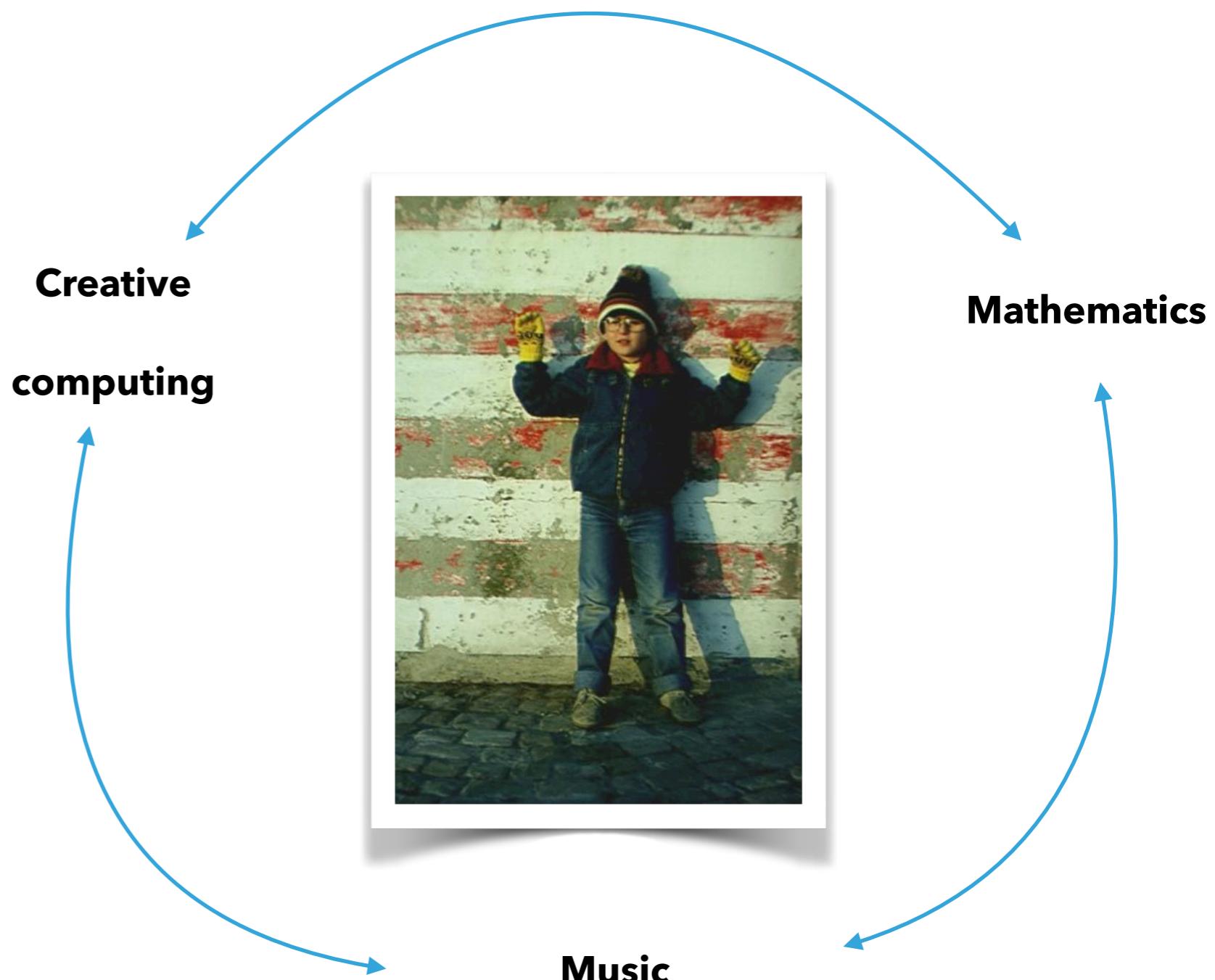
Associate professor in music technology

Center for New Music
and Audio Technology (CNMAT)

University of California, Berkeley

Music composition
Applied mathematics
Computational creativity

carmine.cell@berkeley.edu
www.carminecella.com



ABOUT ME

Carmine-Emanuele Cella

Associate professor in music technology

Center for New Music
and Audio Technology (CNMAT)

University of California, Berkeley

Music composition
Applied mathematics
Computational creativity

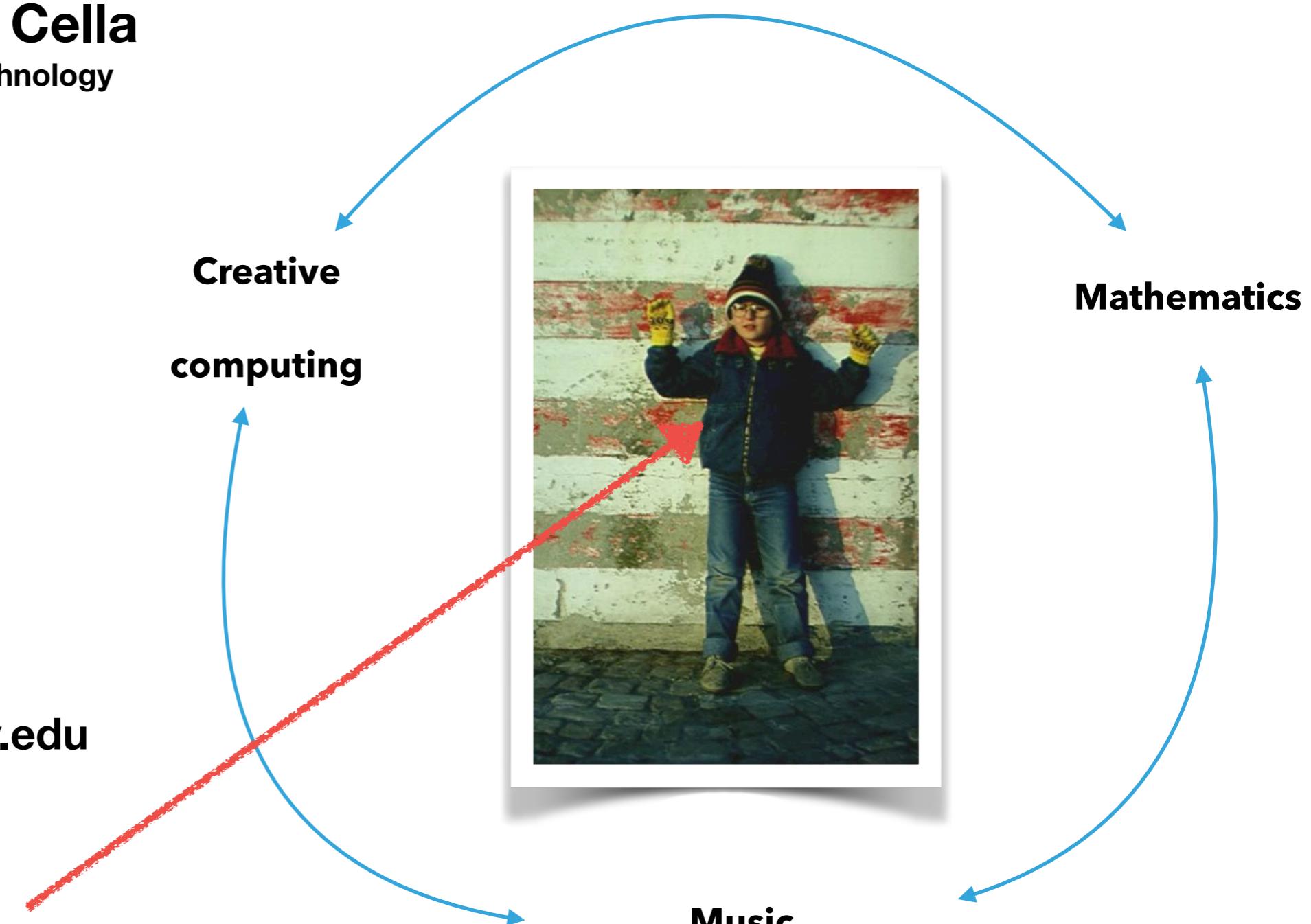
carmine.cell@berkeley.edu
www.carminecella.com

Call me Carmine!

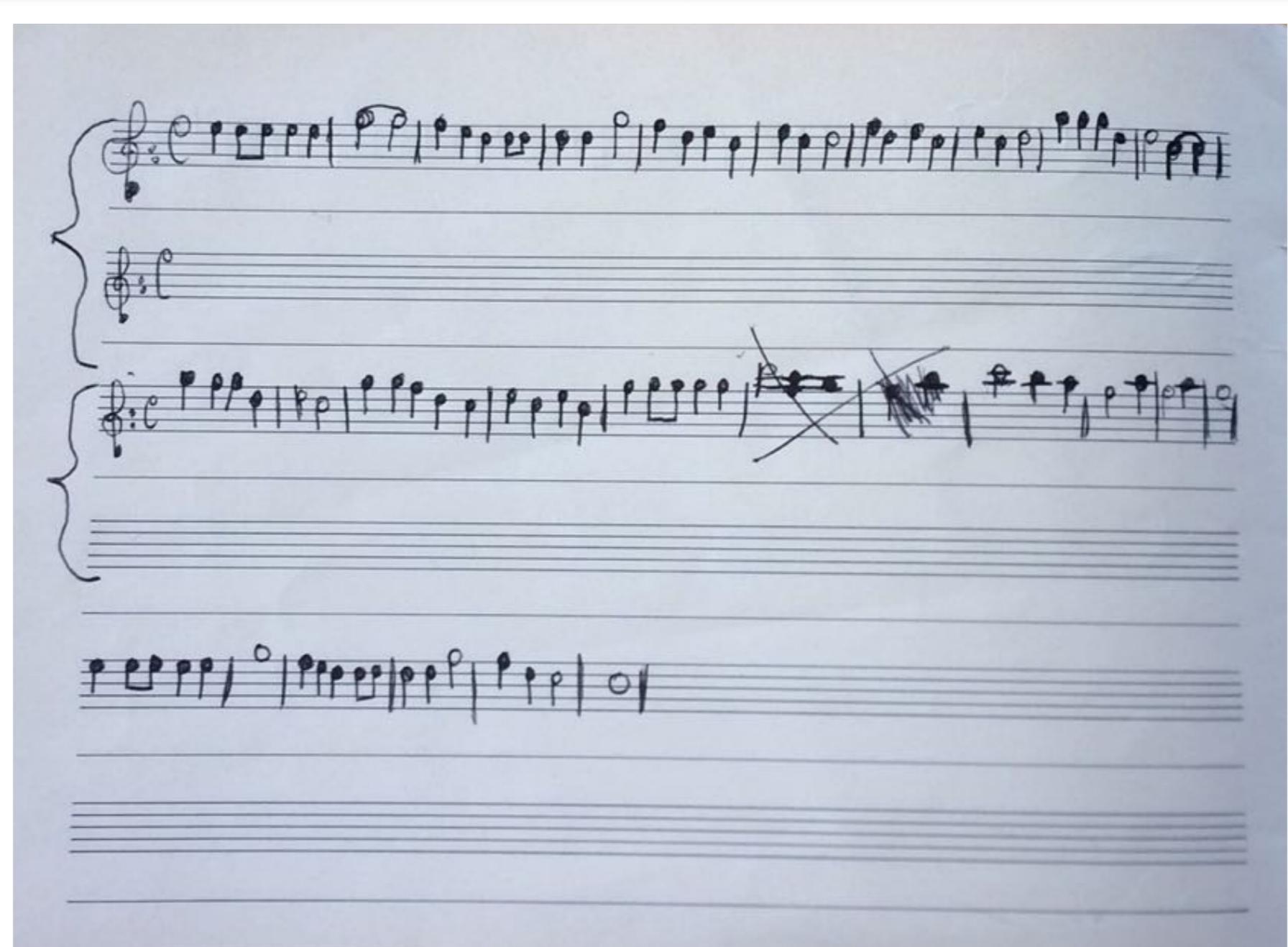
Creative
computing

Music

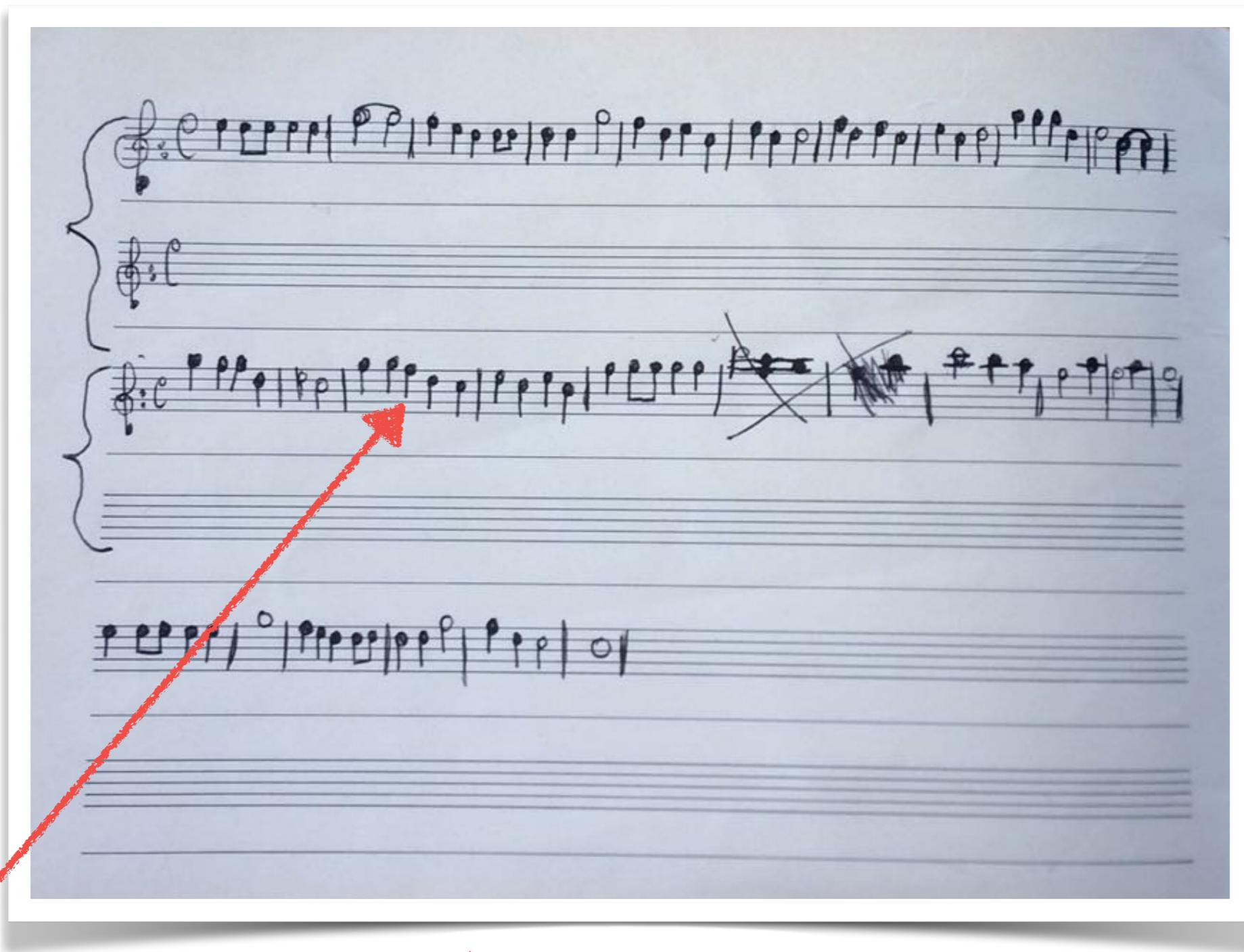
Mathematics



MY FIRST COMPOSITION: TRILLO ALLEGRO (6YO)



MY FIRST COMPOSITION: TRILLO ALLEGRO (6YO)



5/4 on 4/4 measures :)

REFLETS DE L'OMBRE (2013)

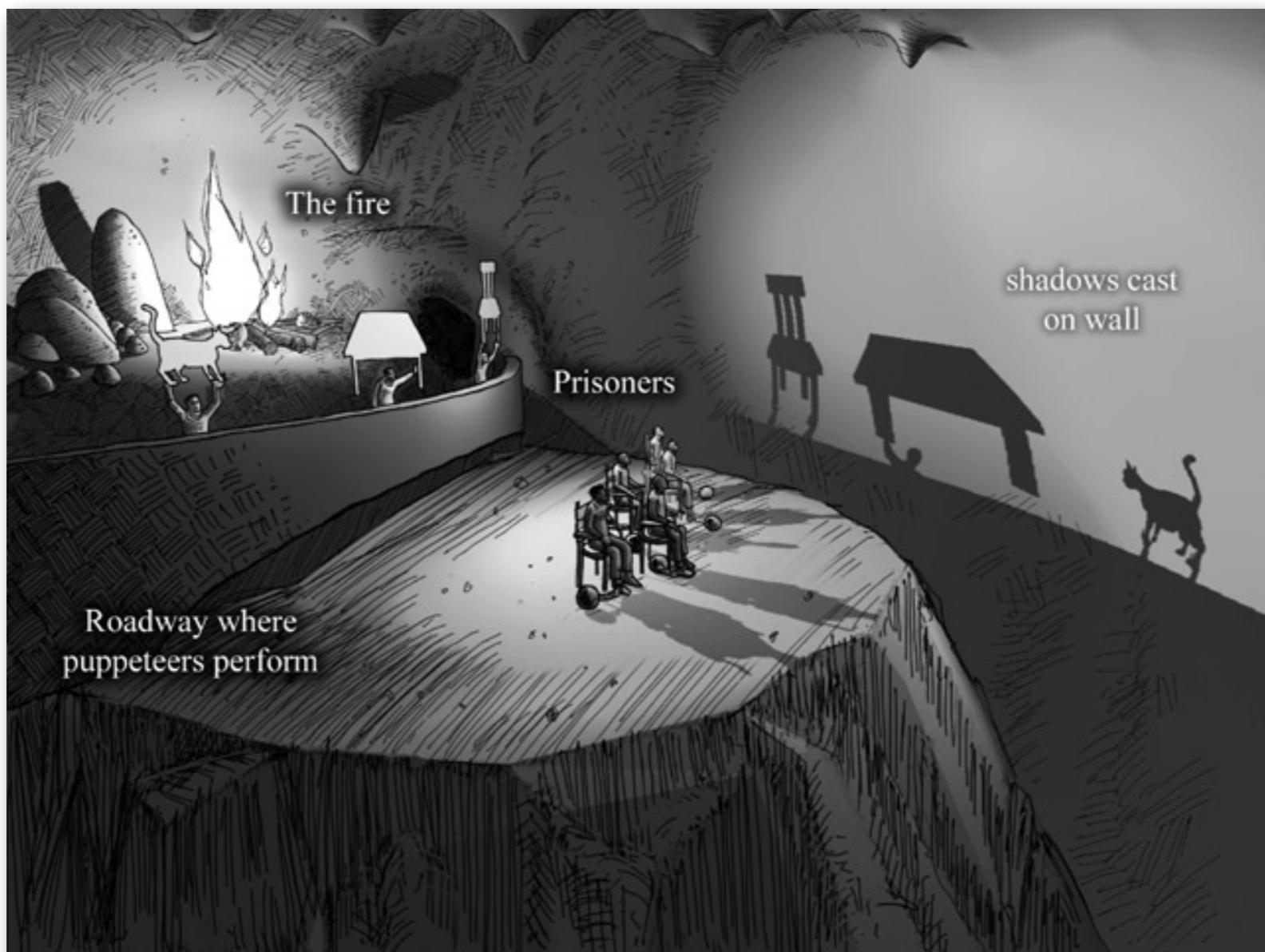
REFLETS DE L'OMBRE (2013)

- **Instrumentation:** large orchestra and live electronics
- **Commission:** IRCAM - Radio France
- **First performance:** 6 june 2013, Salle Pleyel - Paris, OPRF, Jukka-Pekka Saraste
- **Duration:** 18 minutes
- **Production:** jan-june 2012 musical research, oct 2012-june 2013 studio work



PLATO: THE MYTH OF THE CAVE

- In VII book of the “Republic”, with the myth of the cave, Plato tries to describe the way humans discover reality (allegory.)



SOUND-TYPES

- The *theory of sound-types* is a framework for sound representation with multiple abstraction levels

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- Sounds are described by **equivalence classes** and **probabilities**:

Equivalence classes



Timbre

Probabilities



Temporal behavior

SOUND-TYPES

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- Sounds are described by **equivalence classes** and **probabilities**:

Equivalence classes



Timbre

Probabilities



Temporal behavior

- This is realised by the **sound-types transform** (STT) and by joint probabilistic models and machine learning

REFLETS DE L'OMBRE

COMPUTER-ASSISTED COMPOSITION

Dyadic groups generated by: c c# e f# g# a a#
c c# e f# g# a a# - iv: 344532

c# e f a d g# a# f# - iv: 545752

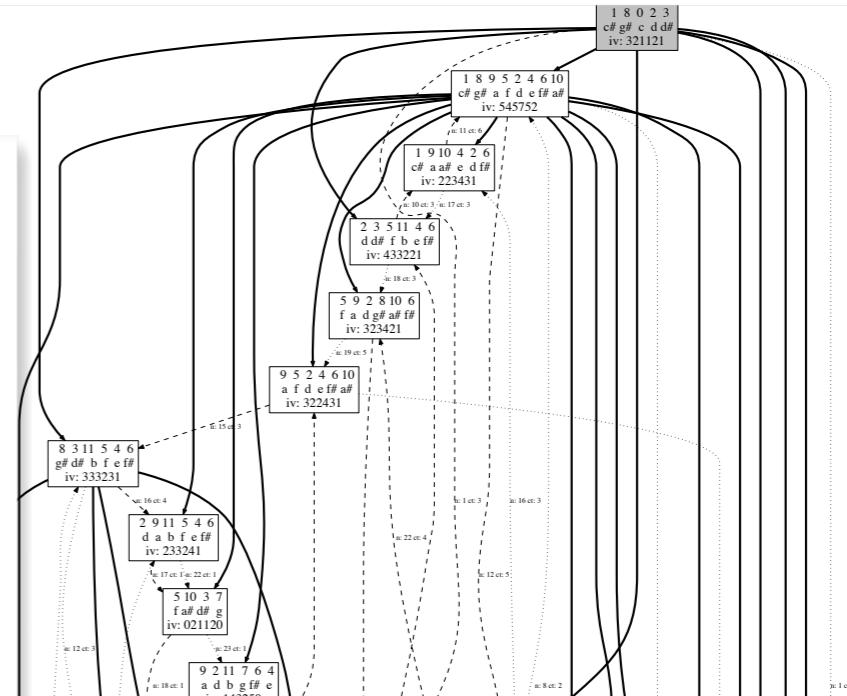
c# a a# e d f# - iv: 223431

c# a# b d# d g# - iv: 333231

e c# f d# g# d a# f# - iv: 565552

e a# d f# - iv: 020301

Dyadic groups generated by: c c# e a a# b



GraphicalEditor – Line

Help OpenImg file Export 2 Midi Select/Move Line Group Clone Delete Delete All

LES REFLETS DE L'OMBRE

for large orchestra and live electronics
commissioned by IRCAM-Radio France
(2013)

A sketch of a musical score for orchestra and live electronics, featuring handwritten markings like 'A214', 'P01', 'Lento + 10', and 'Cantabile'. The score includes parts for Bassoon, Oboe, English Horn, and Clarinet in Bb.

LES ESPACES PHYSIQUES (2017-2022)

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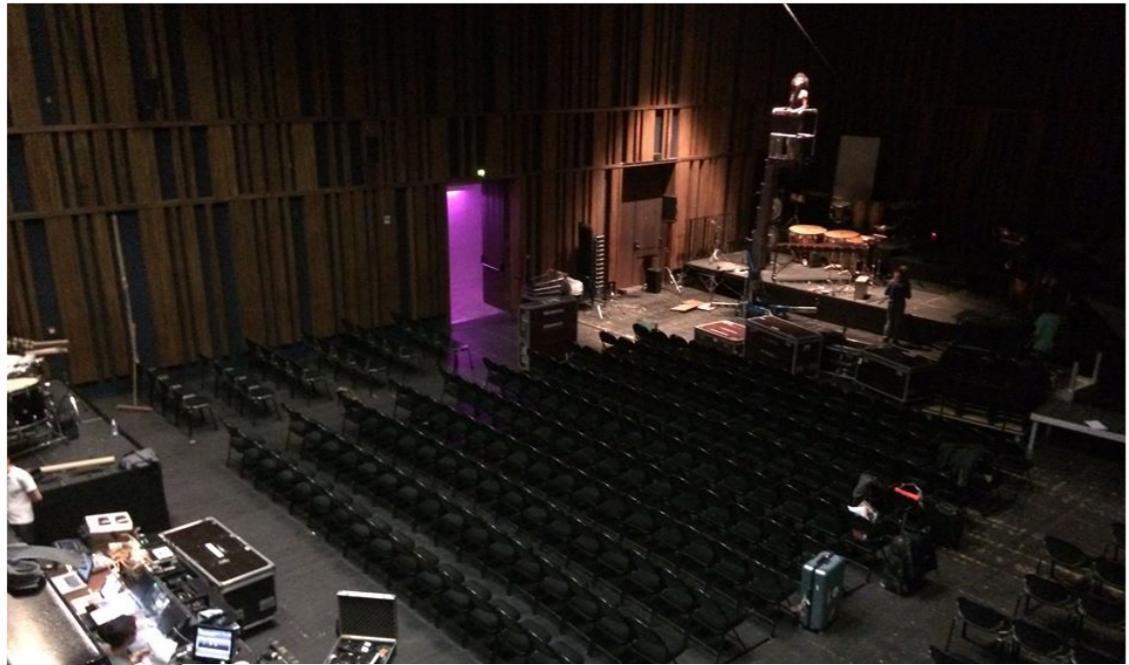
- Cycle of pieces for *augmented* percussions based on the idea of **instrumental inversion**
- Physical instruments have a *locality* property of perception (produced sound is close to the source)
- The electronic medium is perceptually immersive/global via surround projections
- Instrumental inversion: merge of the locality of physical instrument with the immersive properties of electronics using augmented instruments

INSIDE-OUT (2017)

for smart percussions

commissioned by Ircam and Percussions de Strasbourg

first performance: June 2017, Paris



KOALAS AND COALAS



KORE (2019)

for six percussionists with smart instruments - *commande d'état*

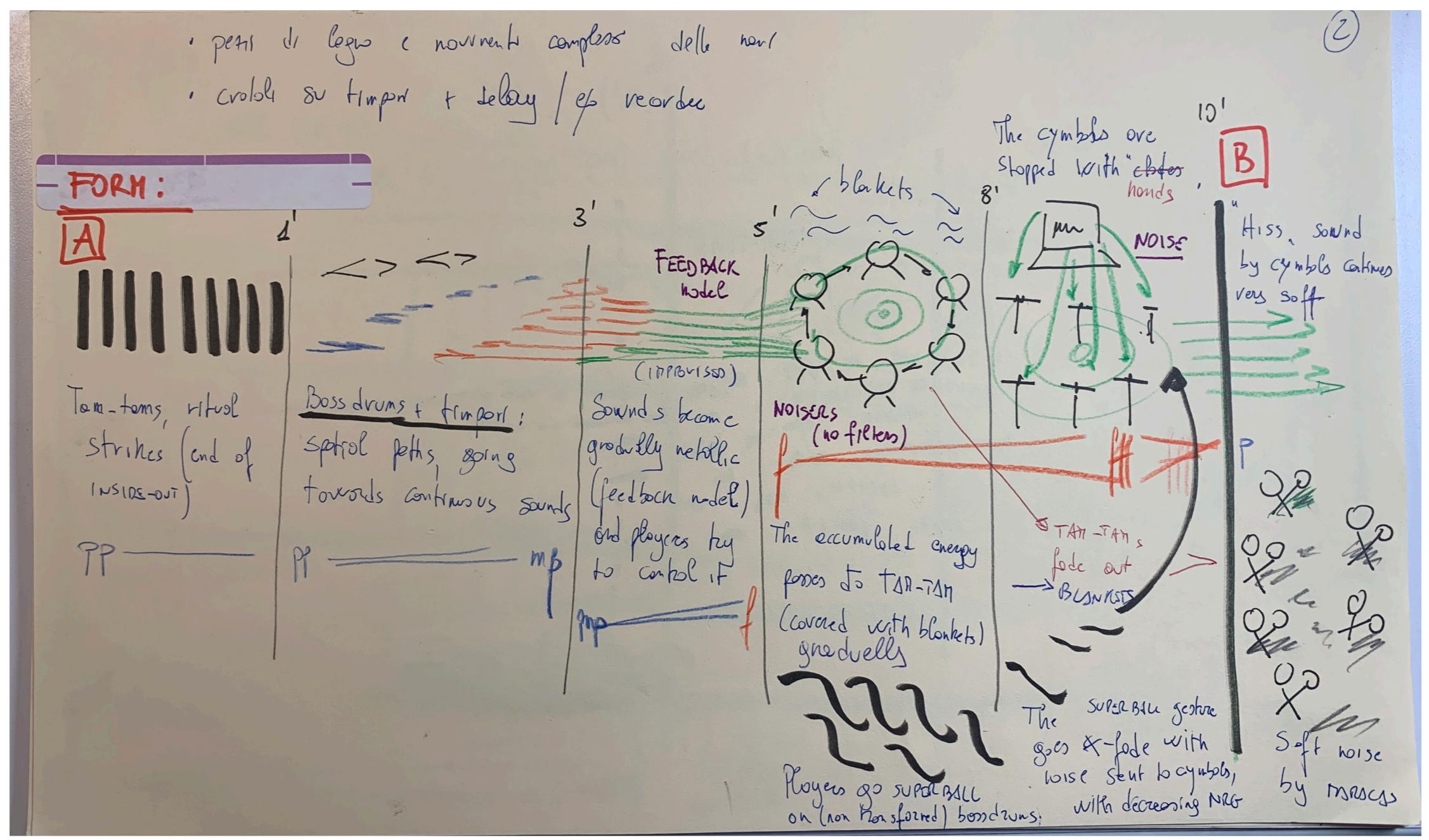
commissioned by Percussions de Strasbourg

first performance: October 2019, Hangar Bicocca, Milano musica

RIMs: **C. E. Cella/E. Demoulin**



KORE - MATERIALS



KORE - MATERIALS



DENDRUM (2021)

for two percussionists with smart instruments

commissioned by Sixtrum

first performance: October 2021, CIRRMT

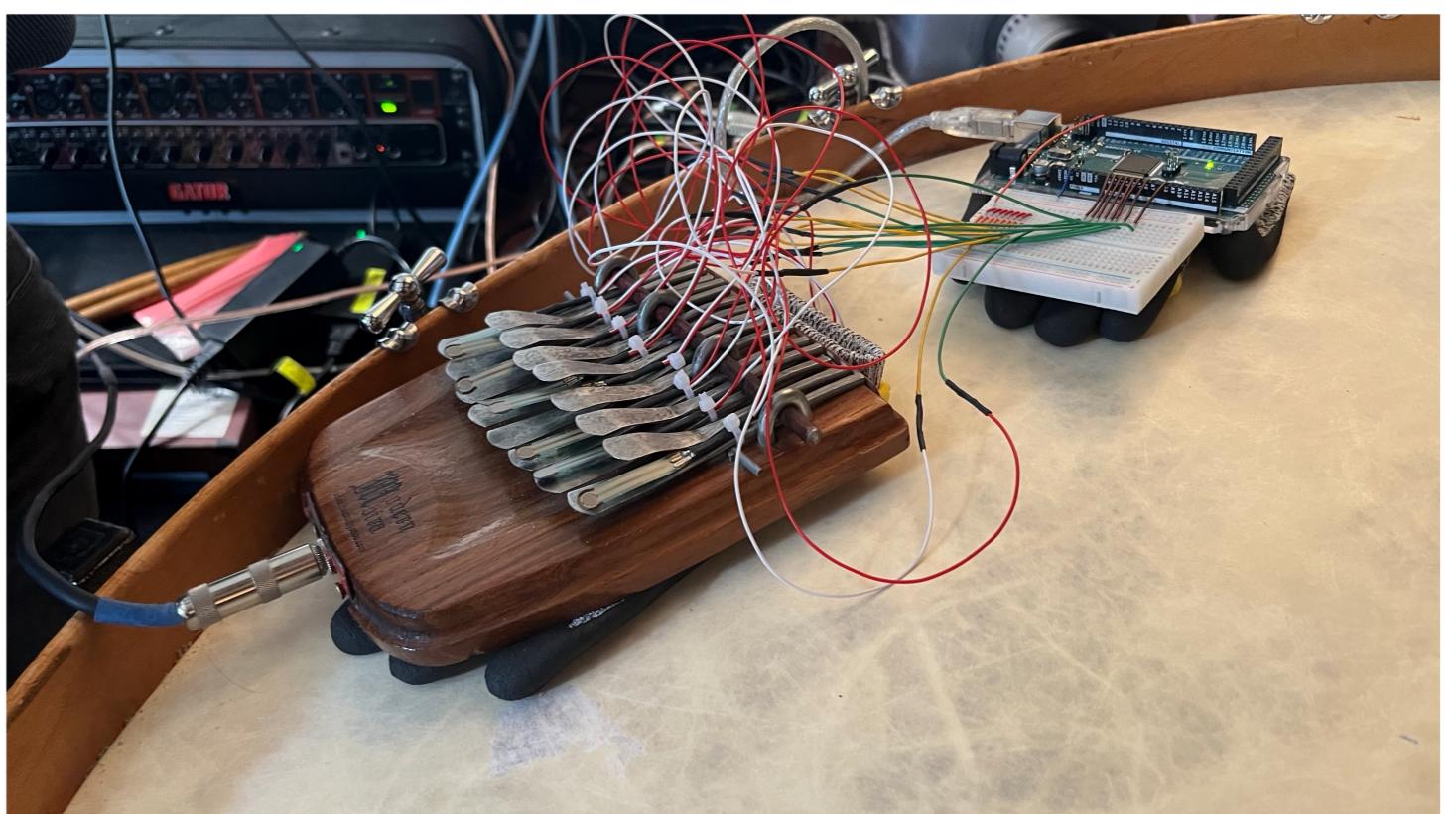


KOBI (2022)

for augmented mbira and augmented metal sheet

commissioned by Milano Musica

first performance: May 2022, Santeria Toscana, Milano



I AM IN BLOOD (2023)

I AM IN BLOOD (2023)

**for large ensemble and electronics
2023**

Co-commision: Ircam and Itineraire

Duration : 35 minutes

Ensemble: L'Itineraire (<http://itineraire.fr/wp/>)

Live electronics: Ircam (www.ircam.fr)

Dedication: Ornella Pianosi and Bernardino Cella

RIM: Etienne Demoulin

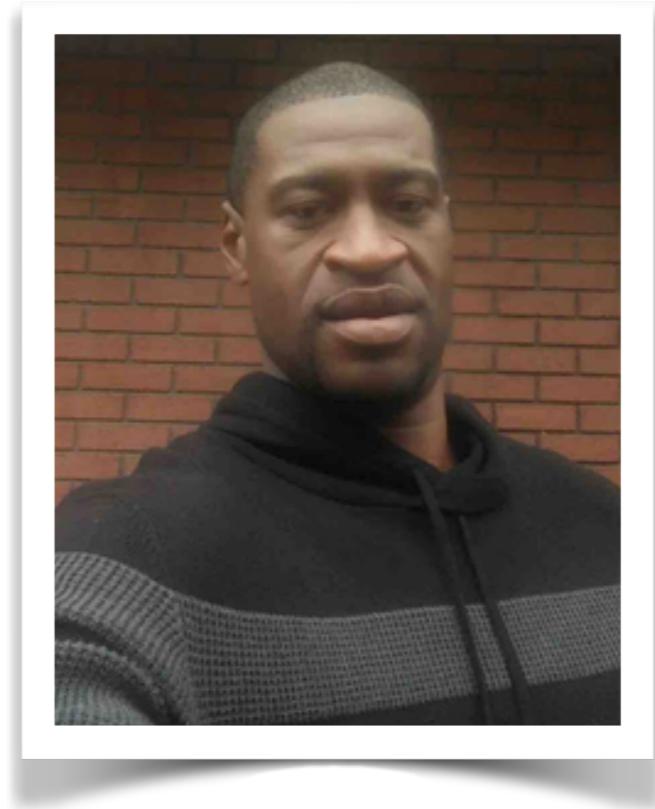
Additional sound design: Nicola Casetta

Scientific support: Benjamin Matuszewski, Benoît Alary

Premiere: Ircam, Espace de projection (reopening), Feb 16 2023

Publisher: Suvini-Zerboni, Milano (<http://www.esz.it/en/>)

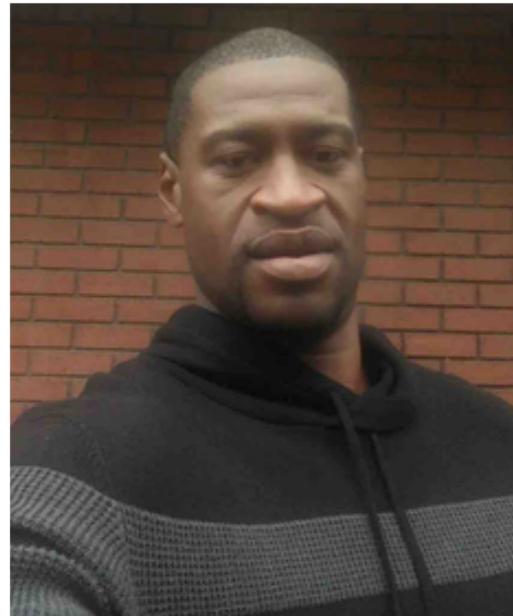
*I am in blood
Stepped in so far that, should I wade no more,
Returning were as tedious as go o'er.
(W. Shakespeare, Macbeth, III.4.136–8)*



George Perry Floyd Jr.

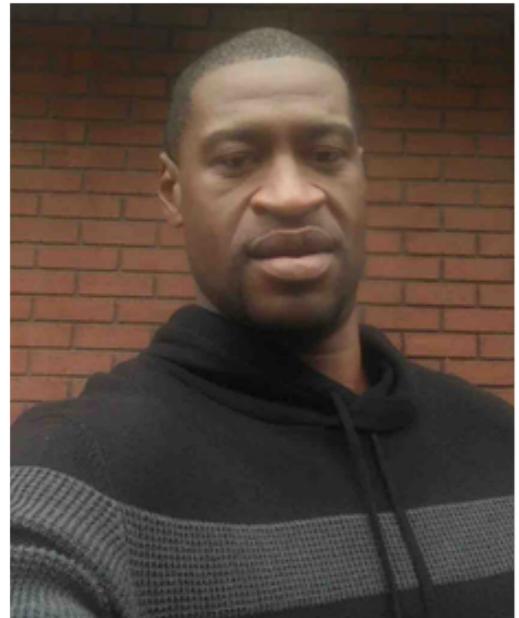
(October 14, 1973 – May 25, 2020)

COMPUTER-ASSISTED ORCHESTRATION OF GEORGE'S VOICE

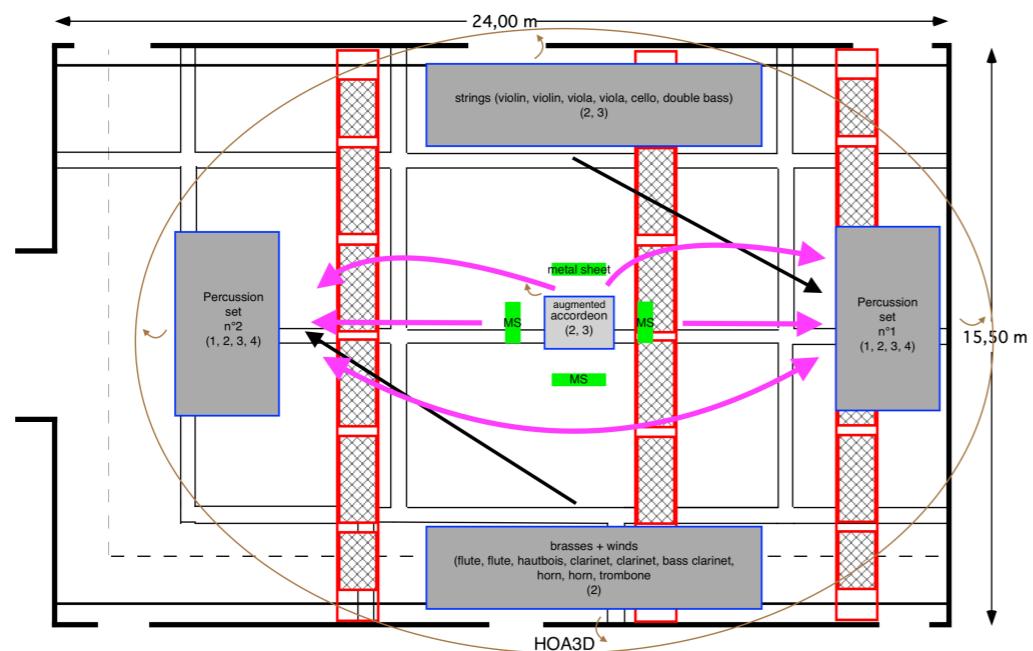


A page of a musical score titled "Muovendo" with tempo "♩ = 78". The score is numbered 7 and 8. It includes parts for Picc. (Piccolo), Fl. (Flute), and Ob. (Oboe). The score features various dynamics such as ff, sff, and ff, along with performance instructions like "tr.", "simile", and "dim.". The music consists of six measures of musical notation.

COMPUTER-ASSISTED ORCHESTRATION OF GEORGE'S VOICE



OPEN QUESTIONS

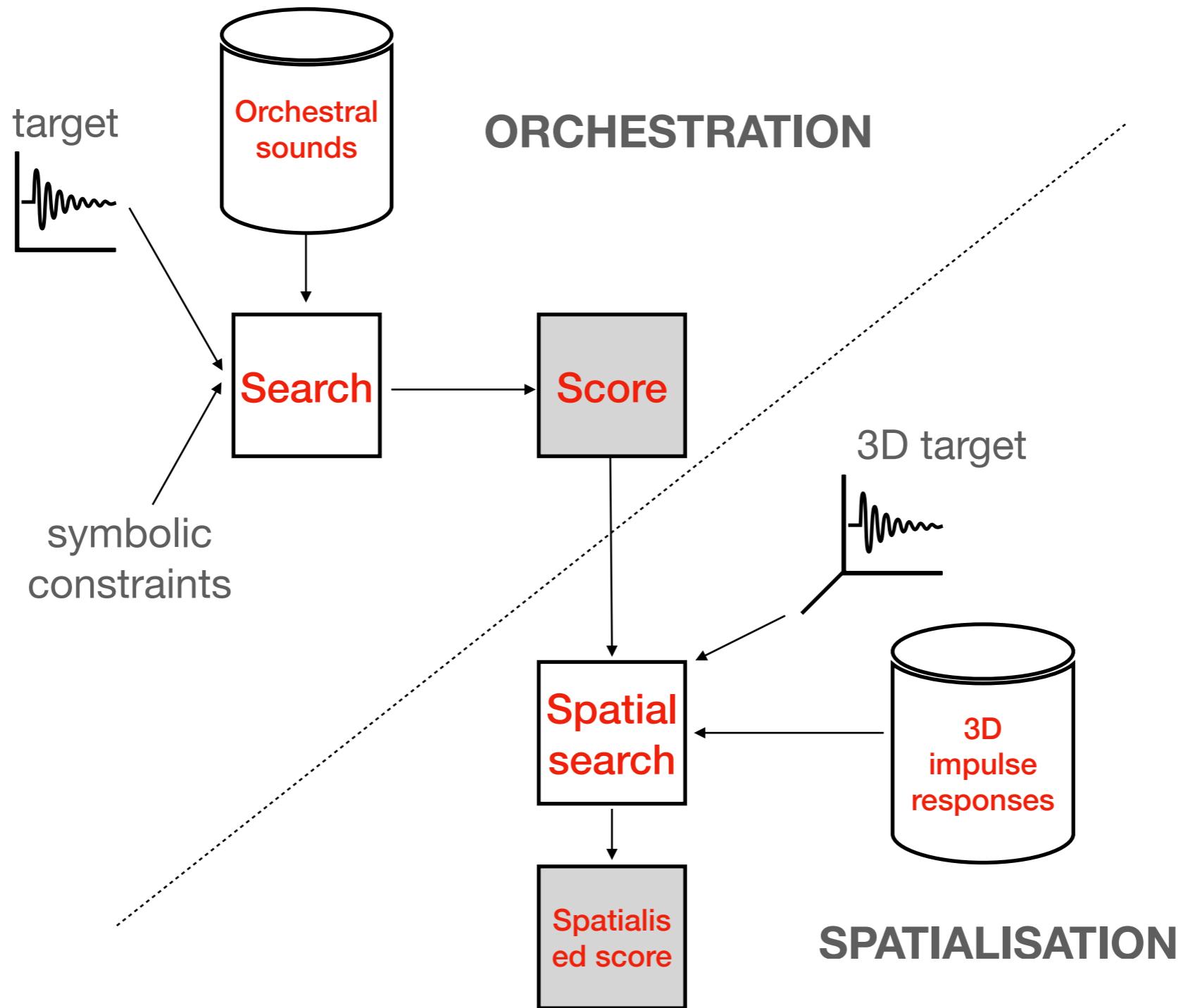


Physical space vs virtual space

Can we think about spatialisation in a poetical sense?

Spatial sense of suffocation

COMPUTER-ASSISTED SPATIALISATION







OUTCOMES

OUTCOMES: PEER-REVIEWED PUBLICATIONS (40+)

- 2022 **Journal** Carmine-Emanuele Cella, *Orchidea: a comprehensive framework for taraet-based computer-assisted dynamic orchestration*, *JNMR*, Fall 2022, to appear.
- 2022 **Journal** Daniele Ghisi and Carmine-Emanuele Cella, *A generative model via Peano curves*, *Journal of Mathematics and Music*, 2022.
- 2022 **Conference** Elliott Waissbluth, Jon G. Gómez, *Layering: Learning a Variational Space*, *Music Creativity*, 2022.
- 2022 **Conference** Jeremy J. Lee, Carmine Cella, *AI-Powered Web Application for Real-Time feedback on AI Music Creativity*, 2022.
- 2022 **Conference** Luke Dzwonczyk, Léo Chédier, Hélène-Camille Crayencour and Carmine-Emanuele Cella, *Neural Orchestration Methods for Computer-assisted Orchestration*, *Music Creativity*, 2022.
- 2021 **Journal** Jon Gillick, Joshua Yang, Carmine-Emanuele Cella and David Bamman, *Drumroll Please: Modeling Music Performances without Quantizing*, *Transactions of ISMIR*, Spring 2021.
- 2021 **Book chapter** Marcelo Caetano and Carmine-Emanuele Cella, *Imitative Computer-Aided Musical Orchestration with Biologically Inspired Algorithms*, in *Handbook of Artificial Intelligence in Music*, Springer, Spring 2021.
- 2021 **Book preface** Carmine-Emanuele Cella, preface for *Musica elettronica e sound design*, Vol. 3, by A. Cipriani and M. Giri, ConTempoNet, Roma, Spring 2021.
- 2020 **Journal** Carmine-Emanuele Cella, *Music Information Retrieval and Contemporary Classical Music: A Successful Failure*, *Transactions of ISMIR*, Volume 3 - issue 1, 2020.
- 2020 **Journal** Mathieu Andreux, Tomás Angles, Georgios Exarchakis, Roberto Leonardiuzzi, Gaspar Rochette, Louis Thiry, John Zarka, Stéphane Mallat, Joakim Andén, Eugene Belilovsky, Joan Bruna, Vincent Lostanlen, Muawiz Chaudhary, Matthew J. Hirn, Edouard Oyallon, Sixin Zhang, Carmine-Emanuele Cella and Michael Eickenberg, *Kymatio: Scattering Transforms in Python*, *Journal of Machine Learning Research*, 21(60):1-6, 2020.
- 2020 **Conference** Carmine-Emanuele Cella, Luke Dzwonczyk, Alejandro Saldarriaga-Fuertes, Hongfu Liu and Hélène-Camille Crayencour, *A Study on Neural Models for Target-Based Computer-Assisted Musical Orchestration*, Joint conference on AI Music Creativity, 2020, Stockholm, Sweden.
- 2020 **Conference** Carmine-Emanuele Cella, Daniele Ghisi, Vincent Lostanlen, Fabien Levy, Joshua Fineberg and Yan Maresz, *OrchideaSOL: a dataset of extended instrumental techniques for computer-aided orchestration*, ICMC 2020, Santiago, Chile.
- 2020 **Conference** Jon Kulpa, Carmine-Emanuele Cella and Edmund Campion, *QuBits, a System for Interactive Sonic Virtual Reality*, ICMC 2020, Santiago, Chile.
- 2019 **Journal** Hélène-Camille Crayencour and Carmine-Emanuele Cella, *Learning, probability and logic: towards a unified approach for content-based Music Information Retrieval*. *Frontiers in Digital Humanities*. April 2019.

OUTCOMES: MUSIC PRODUCTIONS (30+)

Musical theater

Pane, sale, sabbia Opera in one act for 4 voices, actors and chamber orchestra (2017)

[Scene I, excerpt - rehearsals](#)

First performance: Kyiv national opera, June 15 2017
Uhko ensemble; conductor: Luigi Gaggero
Published by: Edizioni Suvini Zerboni - Milan

Symphonic music

All of a sudden for orchestra (2015)

[Score \(excerpt - pages 1/6\)](#) - [Recording](#)

First performance: Florence - Teatro Verdi, 26 September 2015

Orchestra regionale della Toscana; conductor: Marco Tam Nguyen, Les percussions de Strasbourg
Published by: Edizioni Suvini Zerboni - Milan

Reflets de l'ombre for large orchestra and live electronics (2010)

[Score \(excerpt - pages 1/6\)](#) - [Recording](#)

First performance: Paris - Salle Pleyel, 7 June 2013

Orchestre Philharmonique de Radio France; conductor: Leo Hussain
Published by: Edizioni Suvini Zerboni - Milan

Gia' s'ottenebra il giorno for orchestra (2012)

[Score \(excerpt - pages 1/6\)](#) - [Recording](#)

Video trailer: [ManiFeste 2012](#)

First performance: Paris - Centre Pompidou (Grande Salle)

France; conductor: Leo Hussain
Published by: Edizioni Suvini Zerboni - Milan

The Manhattan distance for orchestra (2010, suite from [A short introduction to the work](#))

[Score \(excerpt - pages 1/6\)](#) - [Recording](#)

First performance: Seoul Art Center, 14 September 2011

Published by: Edizioni Suvini Zerboni - Milan

Chamber music

Improvviso statico III for sax quartett and live electronics (2022)

First performance: Sansepolcro, ilSuono music week, July 2022;

Sidera sax quartett

Published by: Edizioni Suvini Zerboni - Milan

Kobi for augmented Mbira and metal plates (2022) - from *Les espaces physiques*

First performance: Milano Musica, Santeria Toscana, May 2022;

Marco Tam Nguyen, Les percussions de Strasbourg

Published by: Edizioni Suvini Zerboni - Milan

Dendrum for two percussionists with augmented percussions (2021) - from *Les espaces physiques*

First performance: McGill-CIRMMT, Montreal, October 2021;

Sixtrum ensemble

Published by: Edizioni Suvini Zerboni - Milan

Kore for six percussionists with augmented percussions (2019) - from *Les espaces physiques*

First performance: Milano Musica, Hangar Bicocca, October 2019;

Les percussions de Strasbourg

Published by: Edizioni Suvini Zerboni - Milan

Stades d'ombre, stade de lumière for large ensemble (2018)

[Recording](#)

First performance: Milan, Teatro Elfo Puccini, October 2018;

Ensemble Orchestral de Lyon (EOC), conductor: Daniel Kawka

Published by: Edizioni Suvini Zerboni - Milan

Inide-out for four percussionists with augmented percussions (2017) - from *Les espaces Physiques*

[Recording](#)

[A dedicated web page](#)

First performance: Paris, 104, June 27 2017;

Les percussions de Strasbourg

Published by: Edizioni Suvini Zerboni - Milan

OUTCOMES: SOFTWARE PRODUCTIONS



Orchidea

Orchidea is a framework for static and dynamic computer-assisted orchestration. It is the new generation of the Orchid* softwares for assisted orchestration (originally created in the Ircam Music Representation team). It is a joint project between Ircam, HEM Geneve and UC Berkeley and is made of several tools, including a standalone application, a Max package and a set of command line tools.

[Official web page](#) - [YouTube channel](#) - [Discussion forum](#)

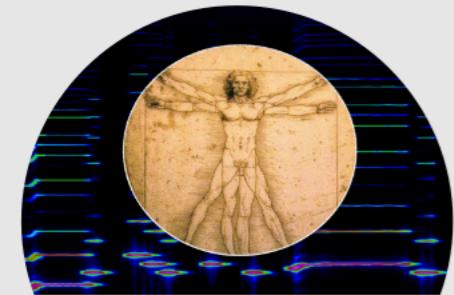


Kymatio

Kymatio is an implementation of the wavelet scattering transform in the Python programming language, suitable for large-scale numerical experiments in signal processing and machine learning. Scattering transforms are translation-invariant signal representations implemented as convolutional networks whose filters are not learned, but fixed (as wavelet filters).

[Official web page](#)

OUTCOMES: TEACHING & SUPERVISION



Computational creativity for music and the arts MUSIC 30

Overview

The advancements in machine learning, especially neural networks, promoted novel art performances and fostered research in the fine arts. In other arts, music has also benefited from artificial intelligence.

Music 30 (*Computational creativity for music*) explores the potential that computers have to support, enable, and expand our creative potential. The course is divided into two modules. The first module shows how computers can analyze sound and presents the creative relations between sound and music. The second module shows real problems and opportunities that arise when computers are used to create music. Classes are supported by labs based on software developed at the Center for New Music and Audio Signal Processing (CNA) and feature guest artists and researchers.

Students Learn To

- Explore synergies between human and machine creativity
- Use and manipulate digital tools for musical composition and performance



Jon Gillick

Neural models for music generation (*Drumify*)



Luke Dzwonczyk

Source separation models for assisted orchestration



Alois Cerbu

Low-dimensional topological models for music improvisation

10+ undergraduate/graduate courses

Introduction to machine learning

C++ meta programming, Python,

Signal processing, Linear algebra

...

OUTCOMES: DIRECTORSHIP AND SERVICE

- **Scientific leadership at CNMAT**

- ✓ direction of the research agenda
- ✓ co-coordination of staff, researchers and students
- ✓ funding: UC sources (Hellman fund, France-Berkeley fund, Chambers chair, ...) and national sources (experience with NSF and NSH)
- ✓ organisation of events: CNMAT OpenLabs, invited researchers (D. Ghisi, JJ Burred, ...), invited artists and ensembles (L'Itinéraire, ...)
- ✓ co-coordination of the concert season

- **University-level service**

- ✓ university committees for searches and coordination (faculty, dean, university)
- ✓ specialised in diversity, equity and inclusion

- **International service**

- ✓ member of EURASIP SAT for Acoustic, Speech and Music Signal processing
- ✓ reviewer and meta-reviewer of many journals and conferences (CMJ, EURASIP, CIM, MCM, ICMC, SMC, IMSIR, ...)

THANK YOU!!!



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