CARMINE-EMANUELE CELLA

COMPOSING WITH ORCHIDEA

A PRACTICAL OVERVIEW ON DYNAMIC TARGET-BASED ASSISTED ORCHESTRATION

IRCAM FORUM - MONTREAL, JAN. 2021

PART 0: DISCLAIMERS!

I will not teach you orchestration!

Ceci n'est pas l'orchestration…

INSTRUCTOR

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University of California, Berkeley

Musical composition
Applied mathematics
Computational creativity

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Creative computing

Mathematics

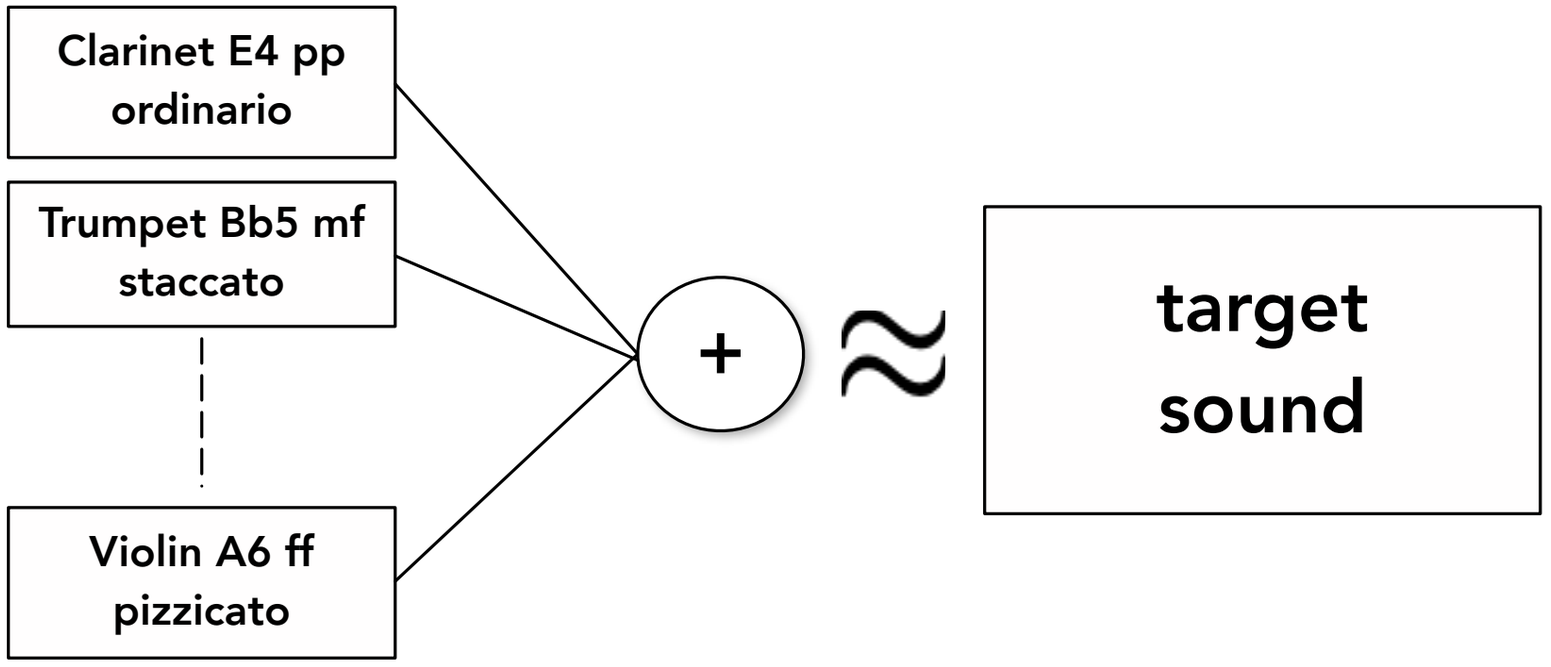
Music

Call me Carmine!

PART 1: TARGET-BASED ORCHESTRATION

A PRELIMINARY DEFINITION

The process of searching for the best combinations of orchestral sounds to match a target sound under specified metric and constraints.



HISTORIC OVERVIEW

Manual analysis

(spectralism)

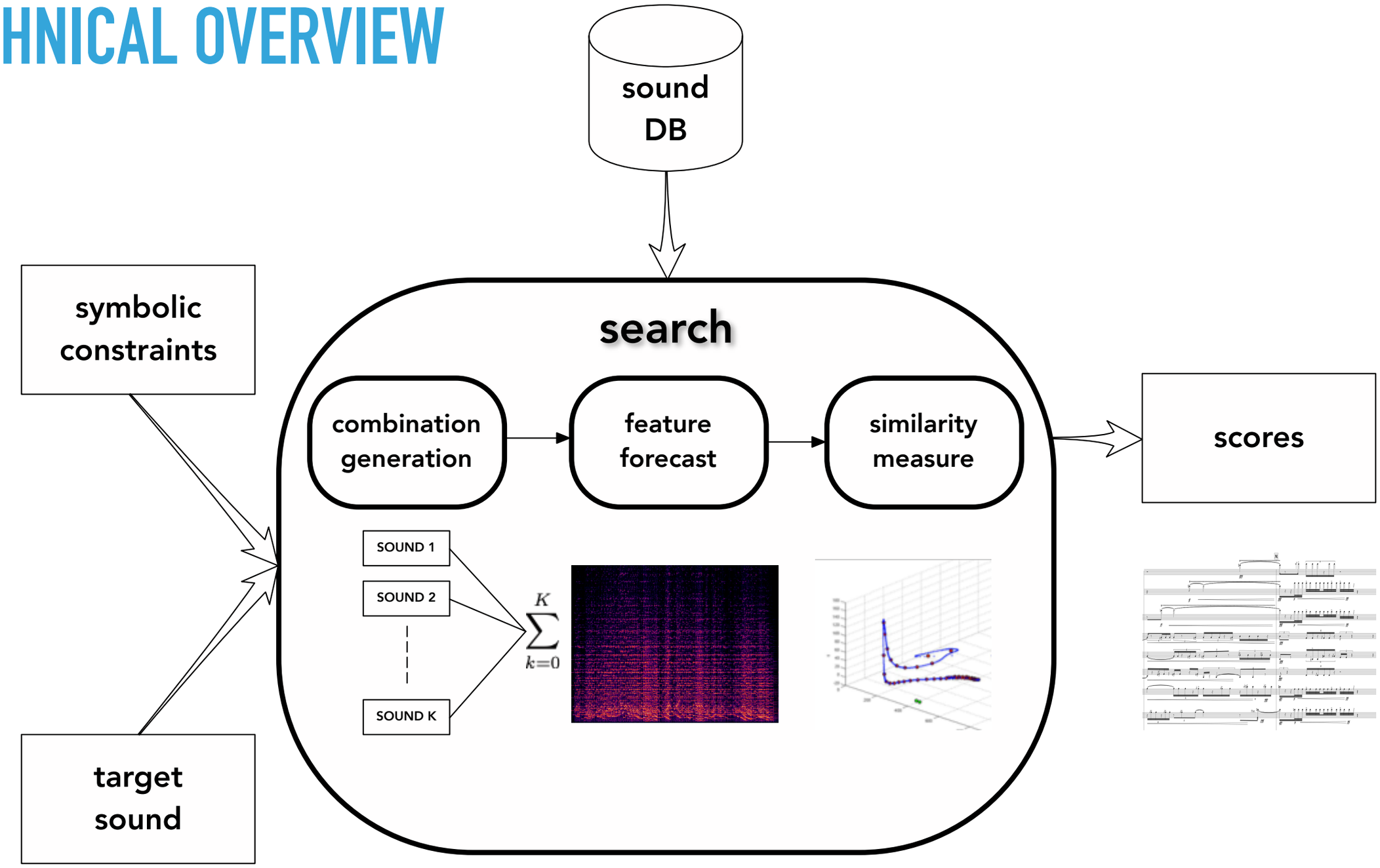
Orchidée

(**static** orchestration)

Orchids - Orchidea

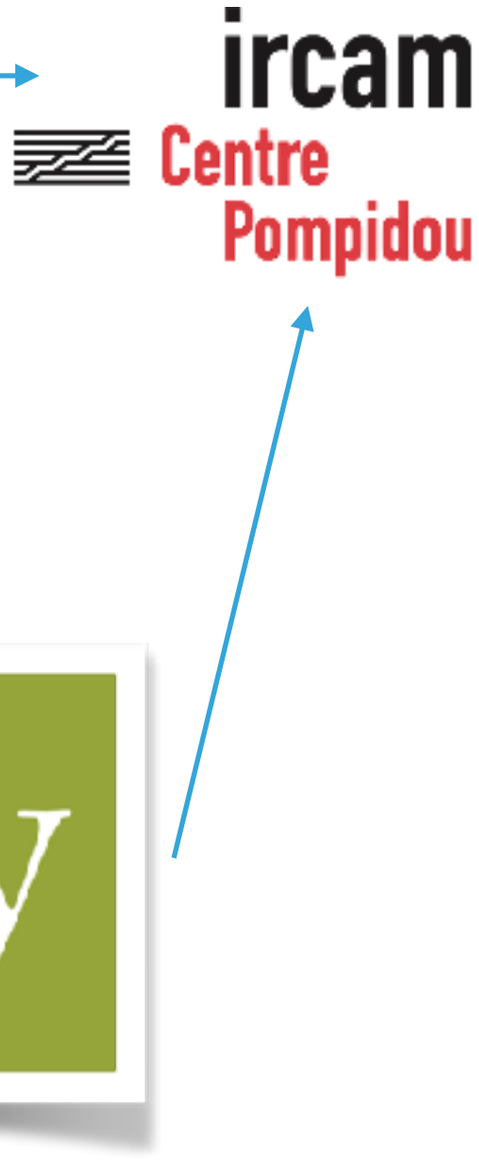
(**dynamic** orchestration)

TECHNICAL OVERVIEW

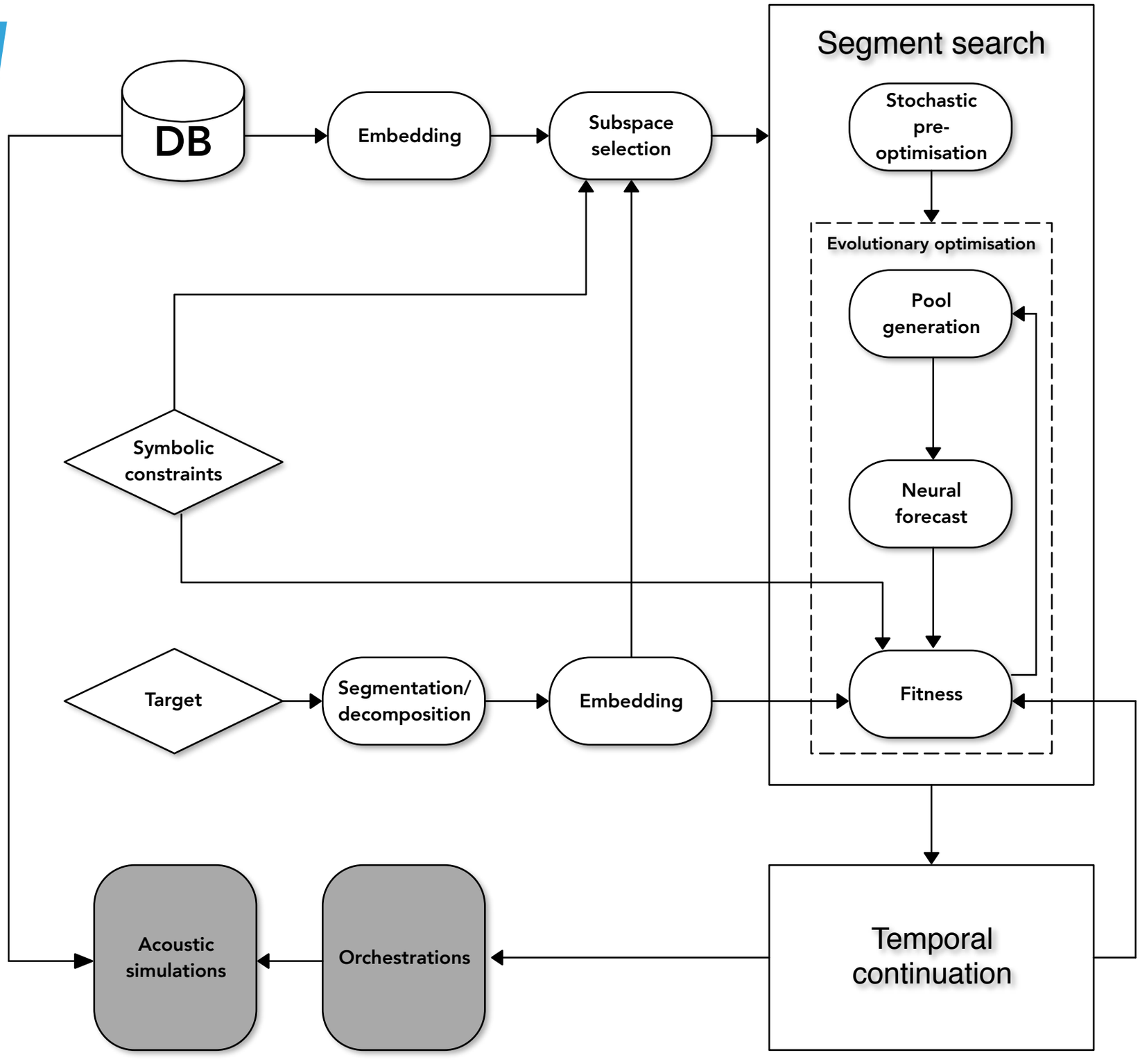


PART 2: ORCHIDEA

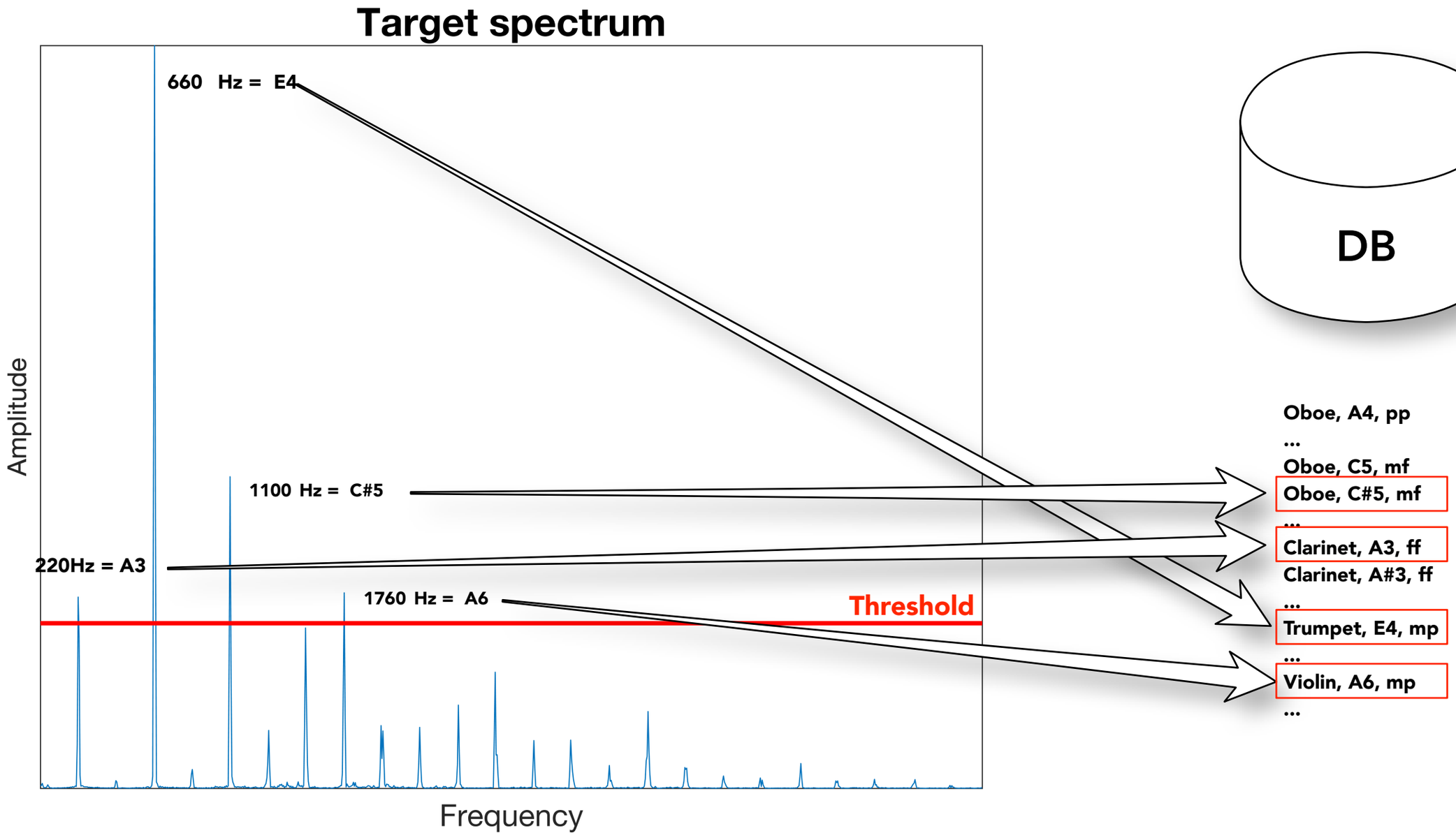
JOINT PROJECT



OVERVIEW


DB
Embedding
Subspace selection
Segment search
Stochastic pre-optimisation
Evolutionary optimisation
Pool generation
Neural forecast
Fitness
Symbolic constraints
Target
Segmentation/ decomposition
Embedding
Acoustic simulations
Orchestrations
Temporal continuation

PARTIALS FILTERING



OPTIMISATION

Crossover

Solution A

- Clarinet E4 pp ordinario
- Trumpet Bb5 mf staccato
- Violin A6 ff pizzicato

Solution B

- Flute F5 mp Flatterzung
- Viola A5 p ordinario
- Basson C3 f ordinario

Offspring A+B

- Clarinet E4 pp ordinario
- Viola A5 p ordinario
- Basson C3 f ordinario

Mutation

Mutated

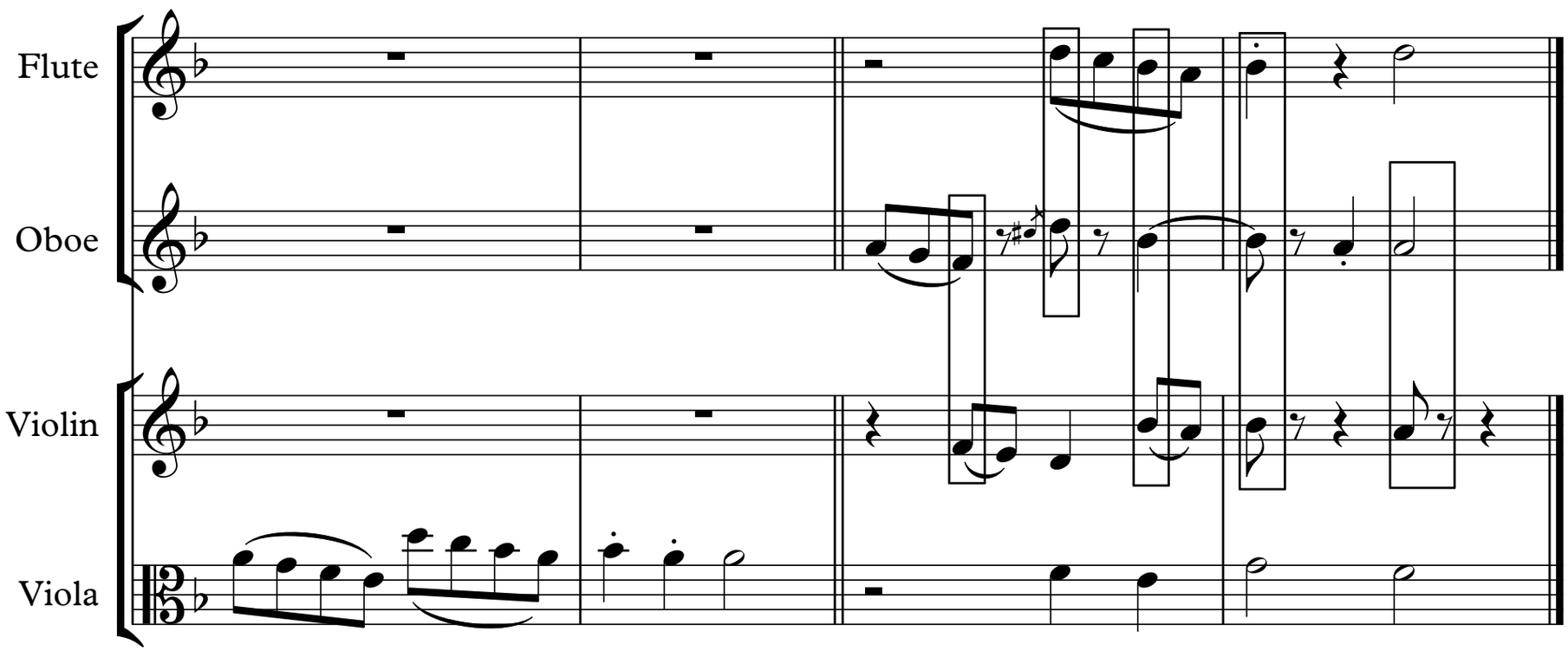
- Clarinet E4 pp ordinario
- Viola A4 mp mute
- Basson C3 f ordinario

Sparsity

Sparse

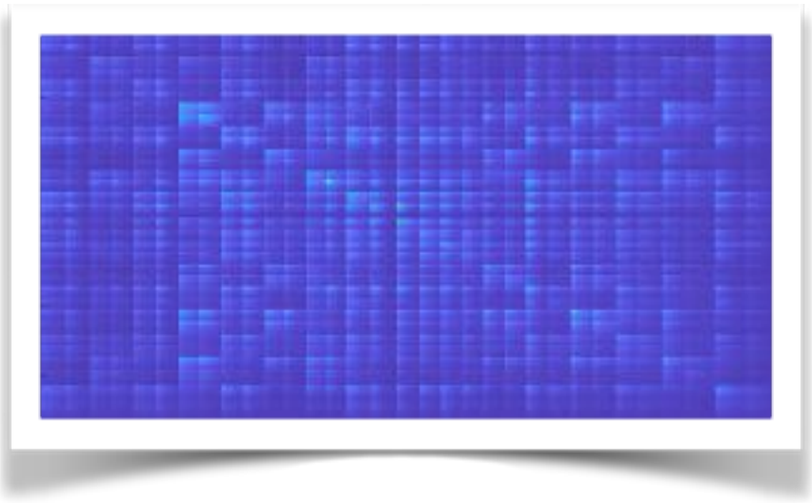
- Clarinet E4 pp ordinario
- Viola A4 mp mute

THE DOVETAIL EFFECT

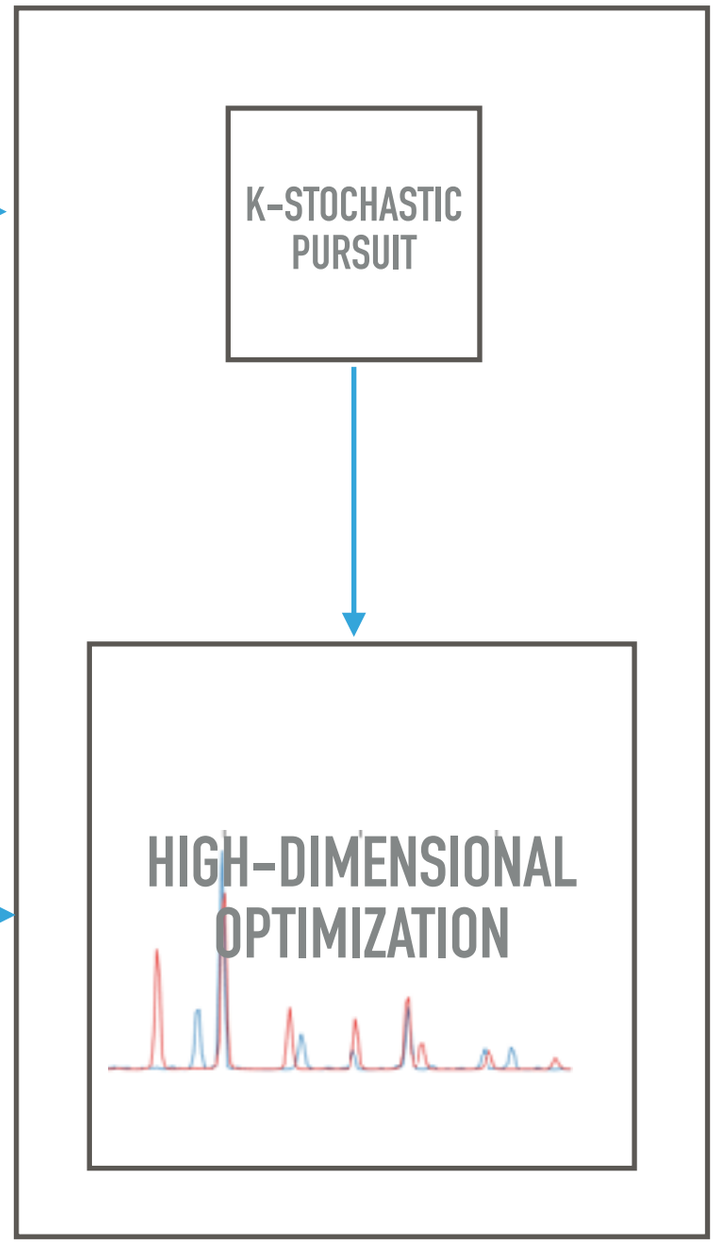


TEMPORAL MODELING

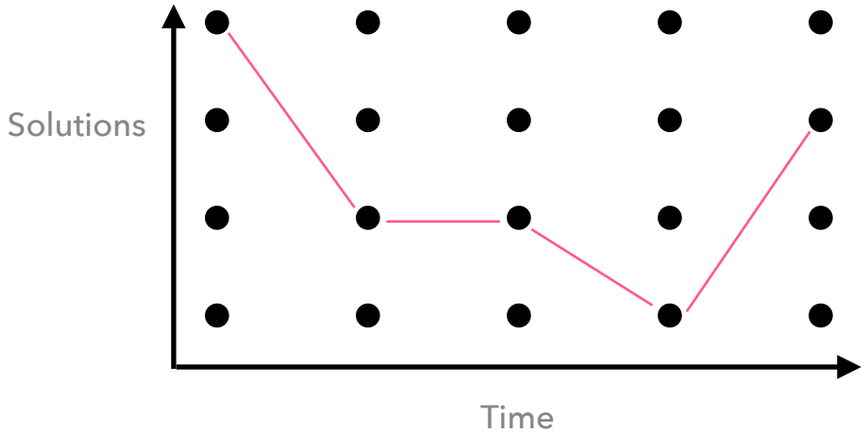
Target segmentation



For each segment....



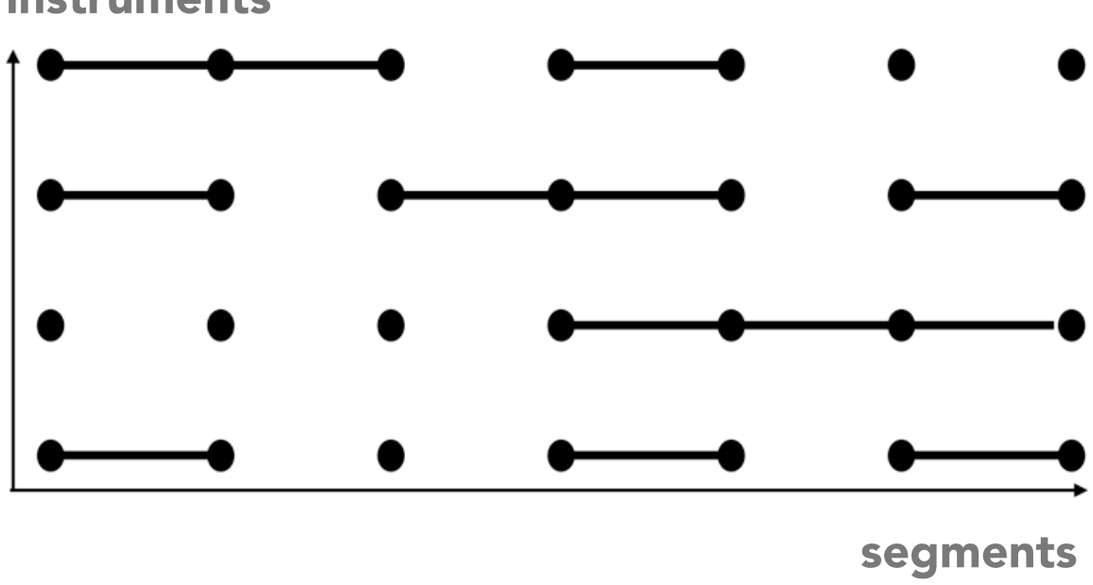
Shortest-path continuation



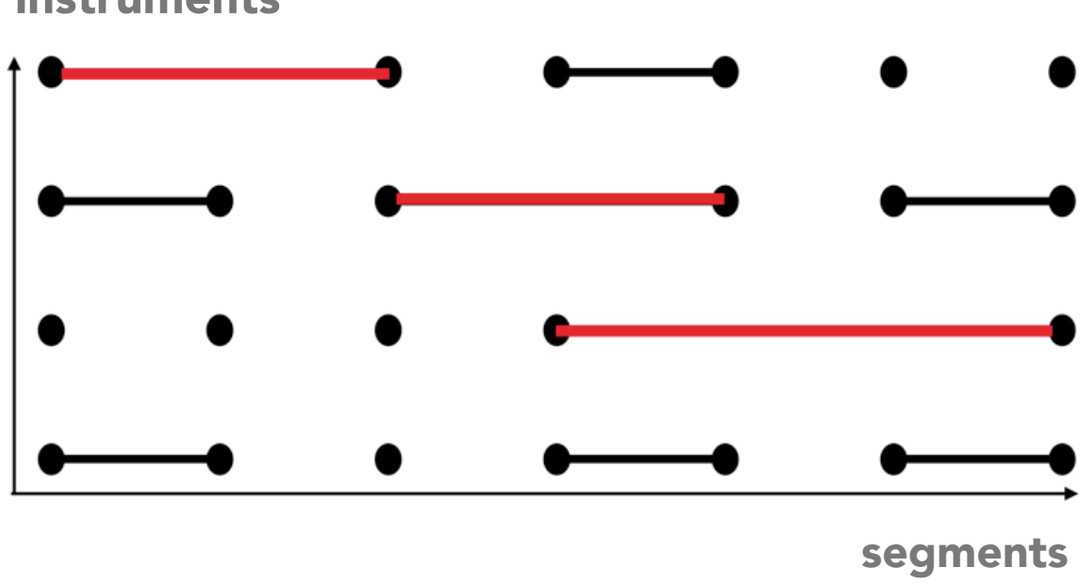
Joint-optimisation

ONSET CONTINUATION

Before onset-continuation



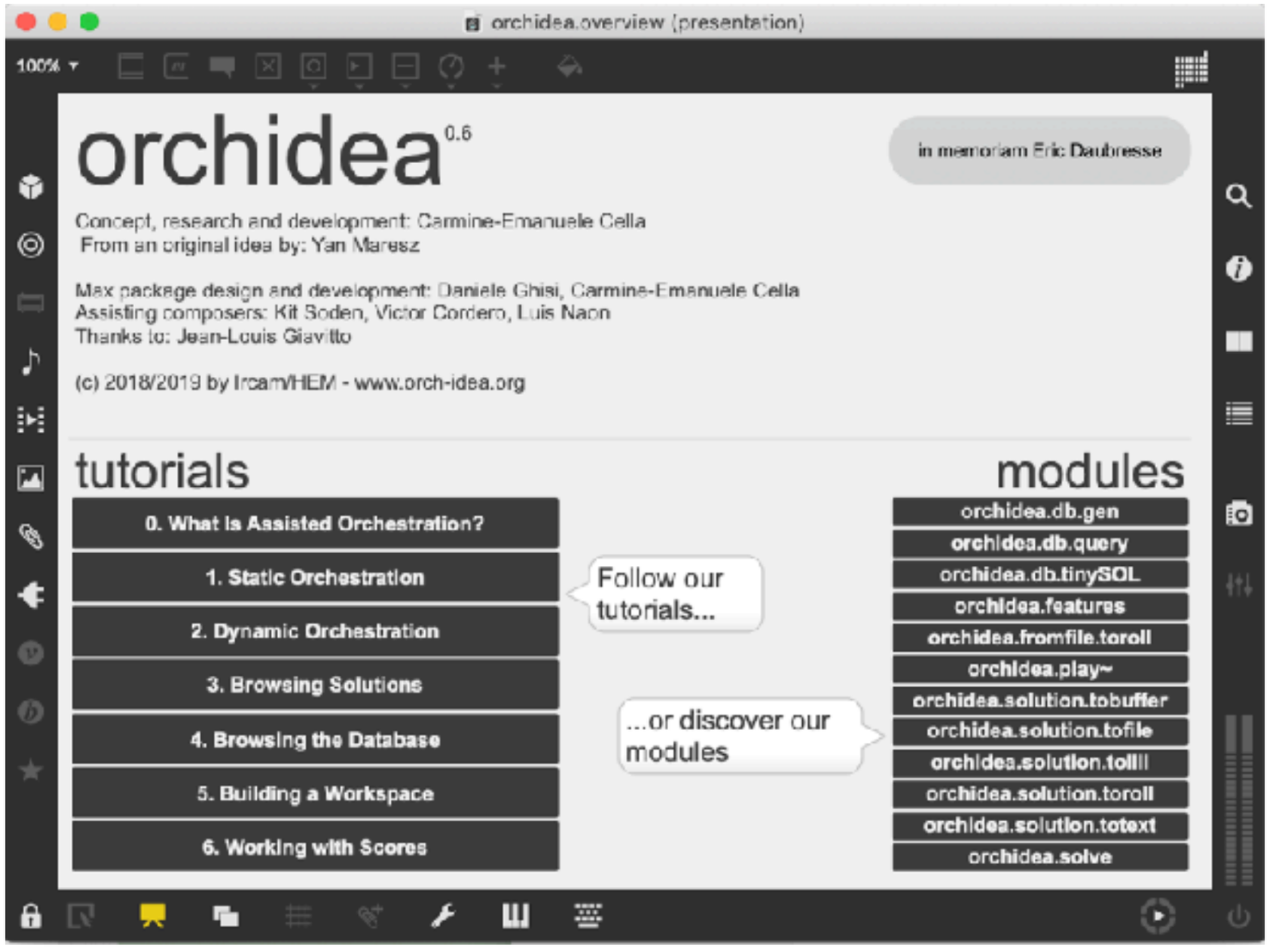
After onset-continuation



PART 3: APPLICATIONS

ORCHIDEA MAX PACKAGE

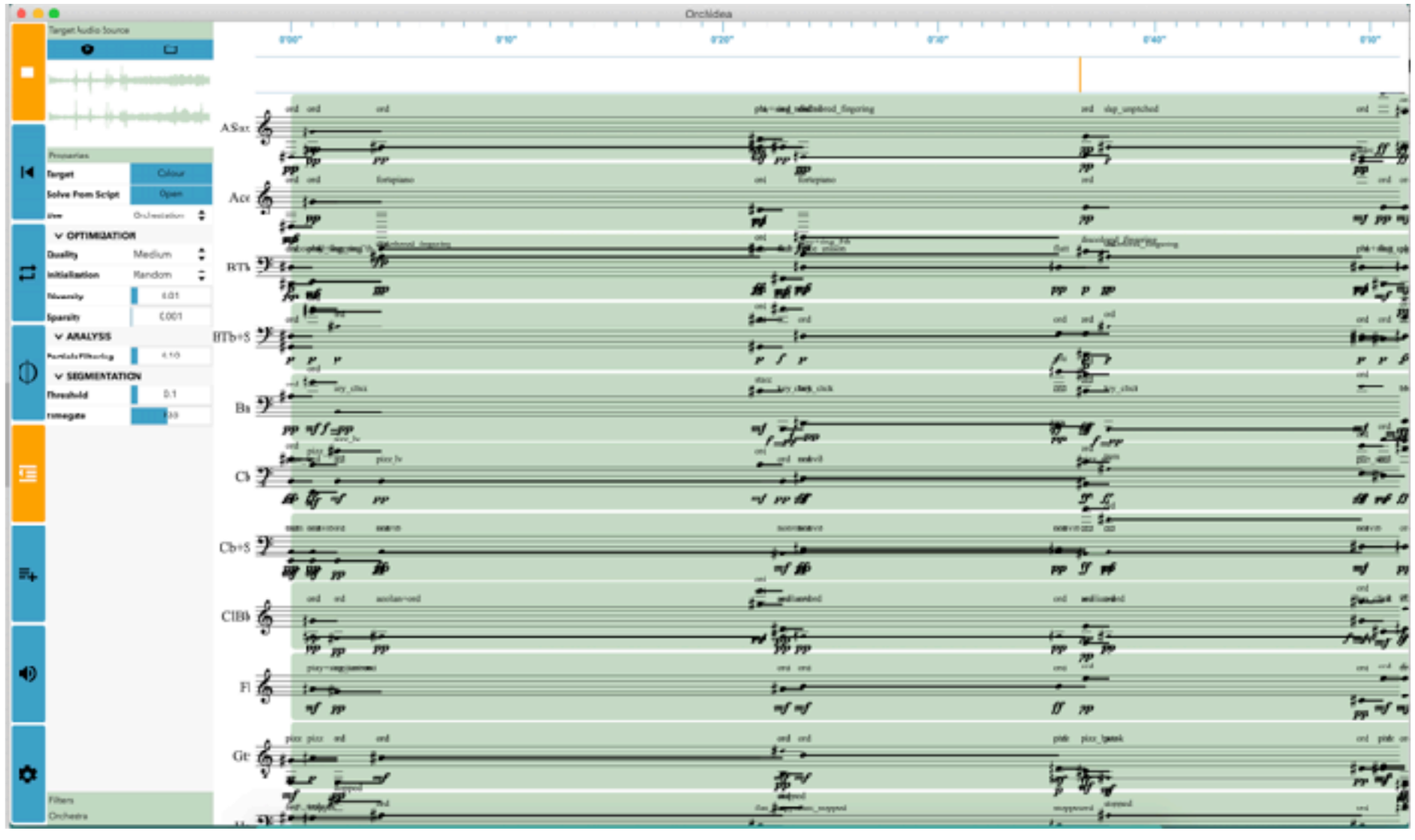
Carmine-Emanuele Cella, Daniele Ghisi



www.orch-idea.org

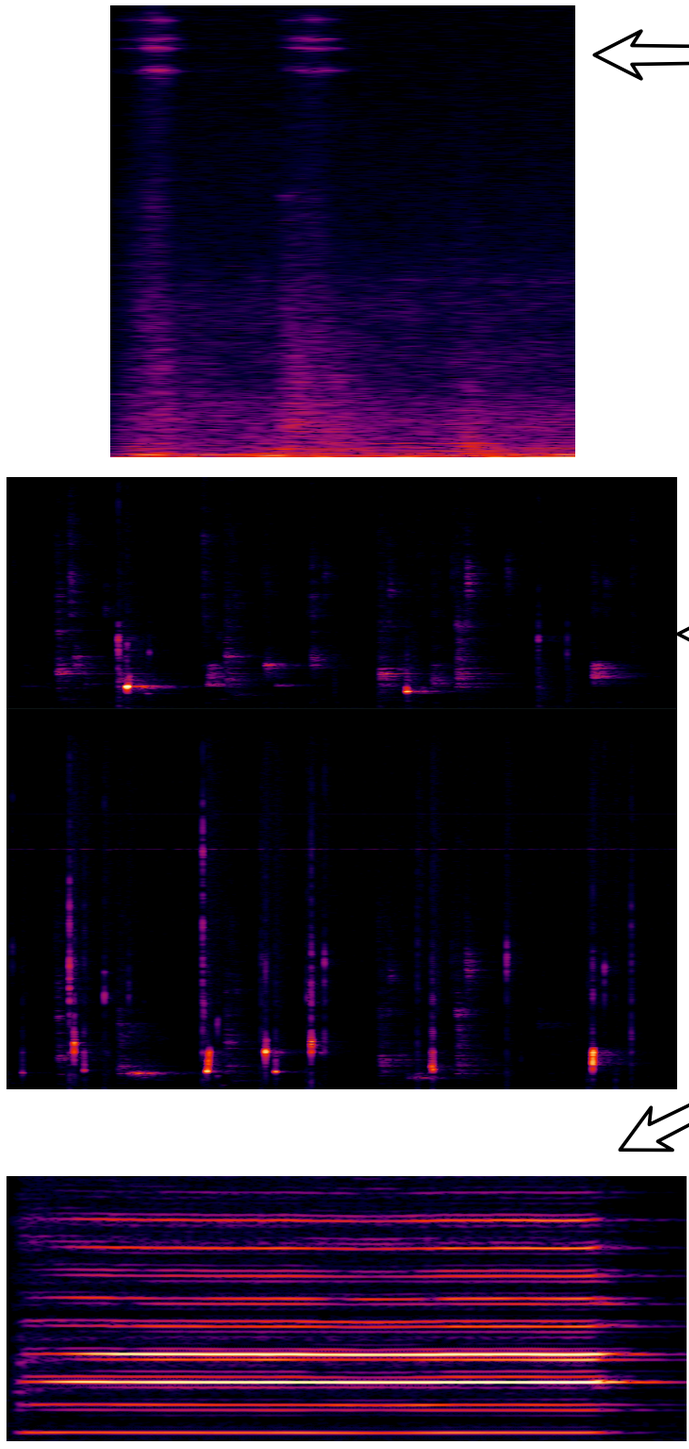
ORCHIDEA STANDALONE

Alessandro Petrolati, Daniele Ghisi, Carmine-Emanuele Cella



www.orch-idea.org

C. E. CELLA, STADES D'OMBRE, STADES DE LUMIÈRE (2018)



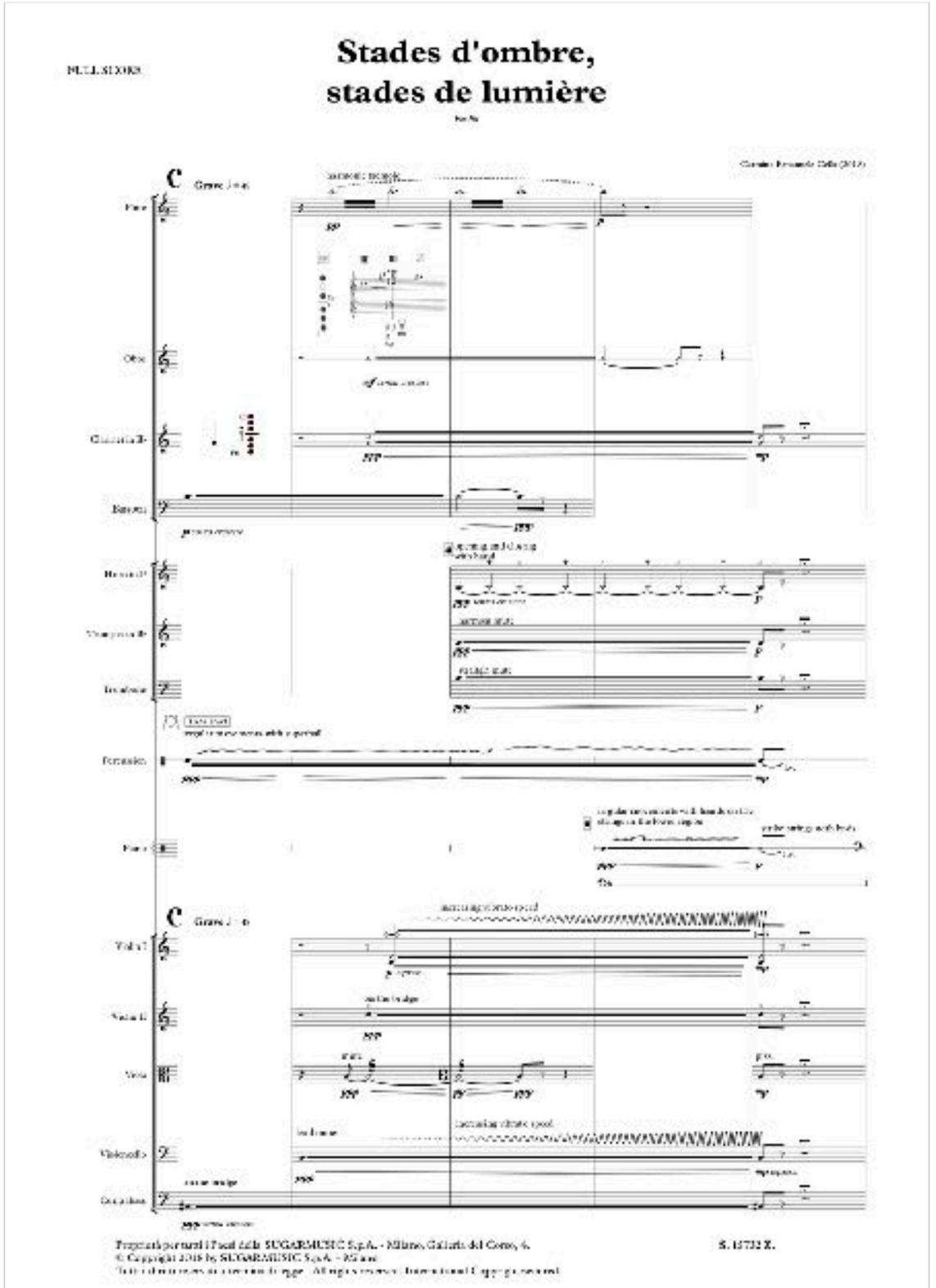
EXAMPLES

Target sound

Orchidea solution

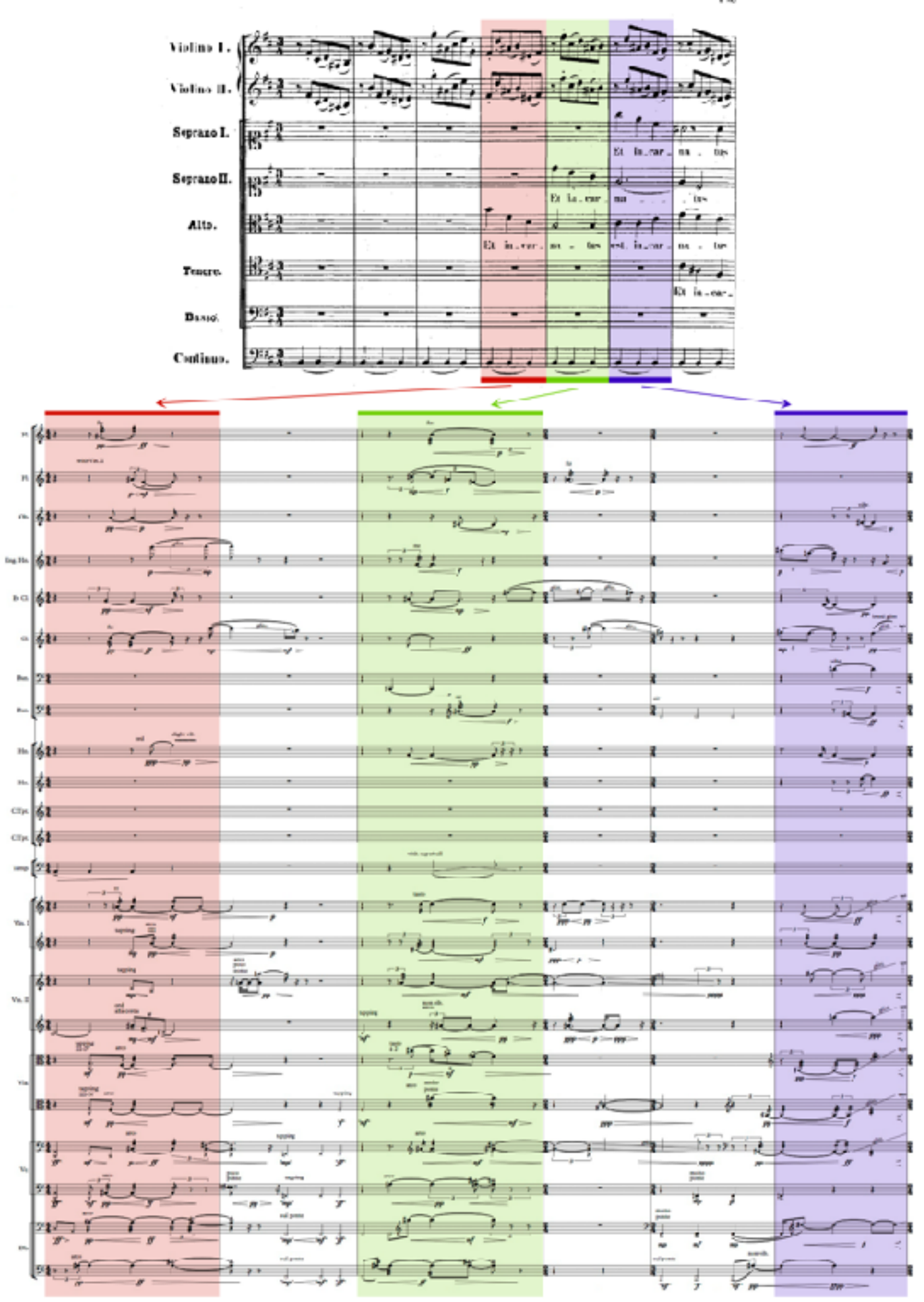
Real orchestration

(longer excerpt)



N. GIMENÉZ, AD LIMAEN CAELI (2018)

Nuria Giménez Comas uses *orchidea* to emulate baroque instruments via a modern orchestra. The starting point is a collection of passages from a recording of J.S. Bach's Mass in B minor, whose timbre was adapted to fit with modern instruments.

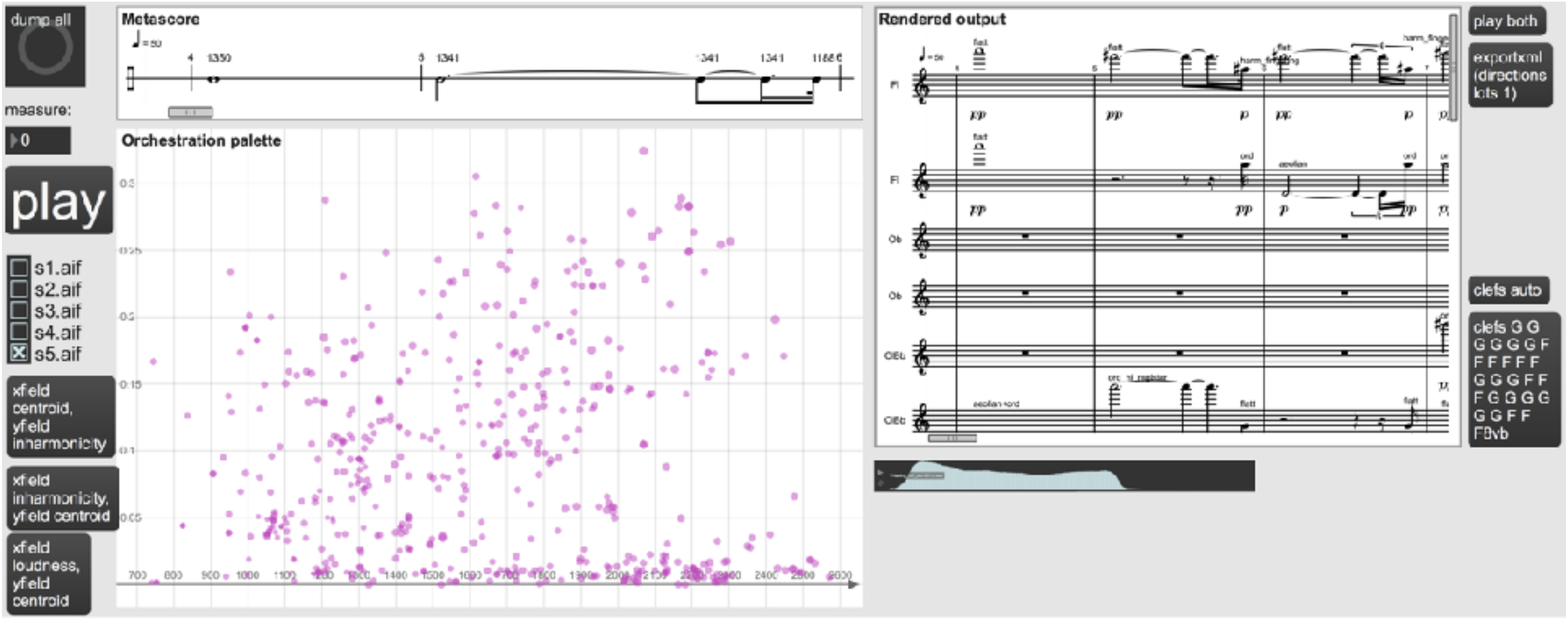


L. GOLDFORD, TELL ME, HOW IS IT THAT I POISONED YOUR SOUP? (2019)

Louis Goldford combines target-based orchestration with computer-aided composition techniques at large (both in OpenMusic and in *bach*). His aesthetic goal is to use segmentation of dynamic targets as a magnifying glass, the perceptual distance between target and orchestration relating to a distance, proposed by Lacan (1978), between subject and object

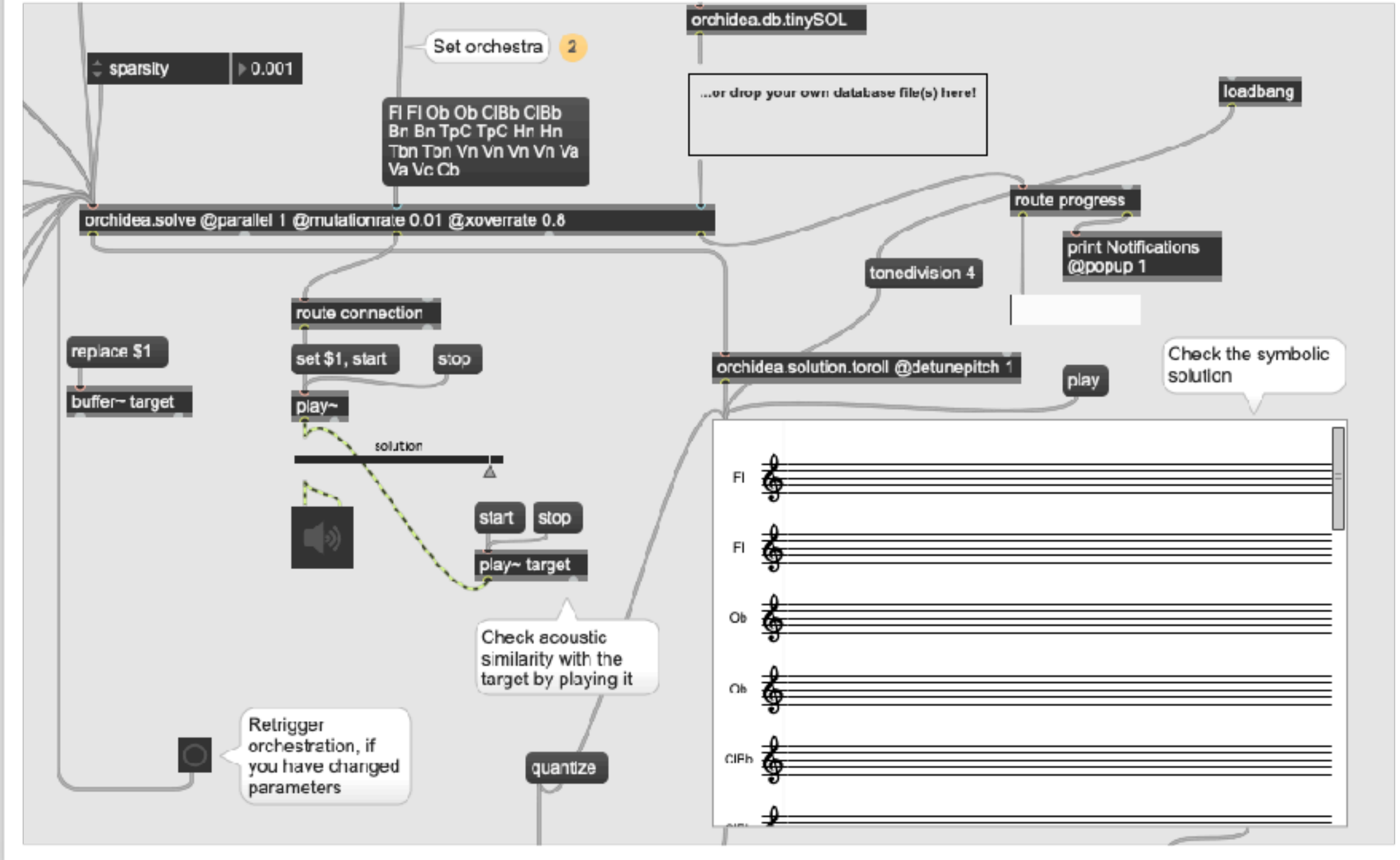
Target sounds are mostly field recordings of sound environments in Taiwan; the finer the segmentation grains, the perceptually closer the orchestration often appears to the sounds—an approach that also somehow relates to electroacoustic practices such the ones of Iannis Xenakis and Curtis Roads

DANIELE GHISI, ORCHESTRAL SUITE



The last episode of the collection is based on a database of several hundreds orchestrations of an audio fragment featuring a distorted voice and an electric guitar. The orchestrations are analysed using standard descriptors (centroid, inharmonicity, spread) and explored via the graphic user interfaces provided by the *dada* library

HANDS ON!


orchidea.db.tinySOL
Set orchestra
2
sparsity
0.001
...or drop your own database file(s) here!
loadbang
Fl Fl Ob Ob ClBb ClBb
Bn Bn TpC TpC Hn Hn
Tbn Tbn Vn Vn Vn Vn Va
Va Vc Cb
orchidea.solve @parallel 1 @mutationrate 0.01 @xoverrate 0.8
route progress
print Notifications
@popup 1
tonedivision 4
route connection
replace $1
set $1, start
stop
buffer~ target
play~
orchidea.solution.toroll @detunepitch 1
play
Check the symbolic solution
solution
start
stop
play~ target
Fl
Fl
Ob
Ob
ClBb
Check acoustic similarity with the target by playing it
Retrigger orchestration, if you have changed parameters
quantize

GENERAL STRATEGY

- Understand your target sound!!! (**How would you orchestrate without *orchidea*?**)
- Build a workspace by using: tutorials, orchidea.solve
- Focus on static orchestration first:
  - Determine the orchestra and the database
  - Determine *partials filtering*
  - Determine *sparsity*
  - Adapt symbolic filters: e.g. playing styles, dynamics, etc.
- Work on segmentation (threshold and timegate)

WEB RESOURCES

- **Main page:** www.orch-idea.org
- **IRCAM forum page:** https://discussion.forum.ircam.fr/c/orchidea/49
- **YouTube channel (Orchestration Idea):** https://www.youtube.com/channel/UCvQqqpZmCWSIy6k4urWKjIw

PAPERS ON ORCHIDEA

- Carmine-Emanuele Cella, Daniele Ghisi, Alexandre Teiller, Yan Maresz, Philippe Eslinge, **Dynamic aided orchestration with Orchidea: a practical overview**, Computer Music Journal, in preparation, 2021

- Carmine-Emanuele Cella, **Orchidea: a comprehensive framework for target-based computer-assisted dynamic orchestration**, Journal of New Music research, under review, 2021

- M. Caetano and C. E. Cella, **Generative Computer-Aided Musical Orchestration with Biologically Inspired Algorithms,** book chapter, in Handbook of Artificial Intelligence for music, Springer, to appear in 2021

- Carmine-Emanuele Cella, Luke Dzwonczyk, Alejandro Saldarriaga-Fuertes, Hongfu Liu and Helene-Camille Crayencour, **A Study on Neural Models for Target-Based Computer-Assisted Musical Orchestration,** Joint conference on AI Music Creativty, 2020, Stockholm, Sweden

- Carmine-Emanuele Cella, Daniele Ghisi, Vincent Lostanlen, Fabien Levy, Joushua Fineberg, Yan Maresz**, OrchideaSOL: a dataset of extended instrumental techniques for computer-aided orchestration,** ICMC 2020, Santiago, Chile

- Jon Gillick, C. E. Cella and David Bamman**, Estimating unobserved audio features for targed-based orchestration,** ISMIR 2019, Delft, The Netherlands

- C. E. Cella and P. Esling, **Open-source modular toolbox for computer-aided orchestration,** Timbre conference, 2018, Montreal, Canada