

New Notations Symposium @Ircam

Old notation, new interface:
embodied navigation of
complex piano notation
with the GestCom



Pavlos Antoniadis,
LabEx GREAM, Université de
Strasbourg-IRCAM





symposium themes

evolution

affordances

technology

complex notation

dominant paradigm of evolution

historical moment

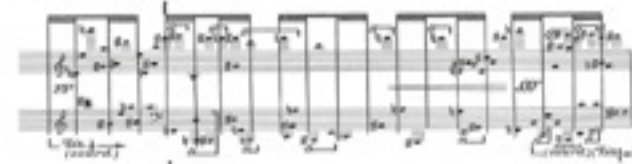
dynamic system

interactive multimodal system

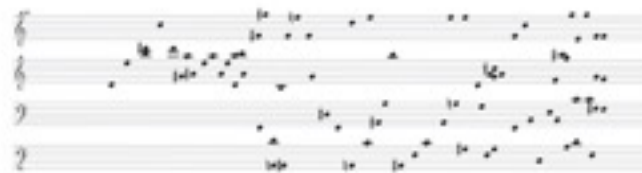
model: embodied navigation

Emergence of a tablature A: Pitch / Texture

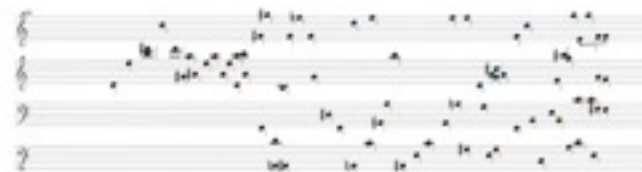
Example 1: Iannis Xenakis *Mixis*, bars 46-47



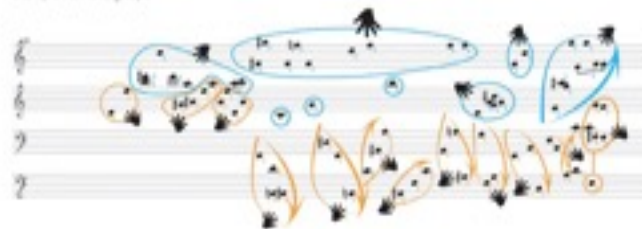
Example 1a: Pitch in space



Example 1b: Fingers

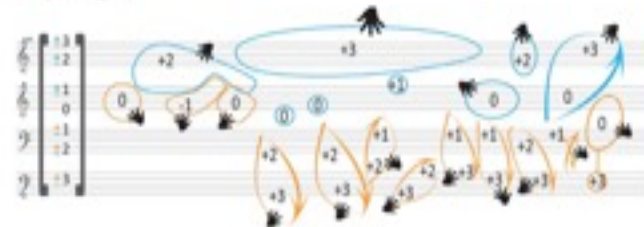


Example 1c: Hand groups

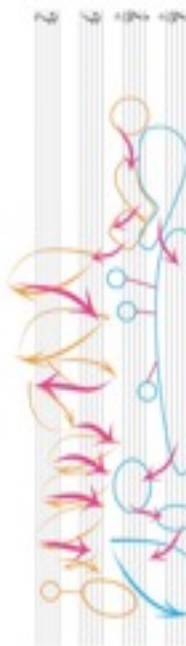


Emergence of a tablature A: Pitch / Texture

Example 1d: Registers



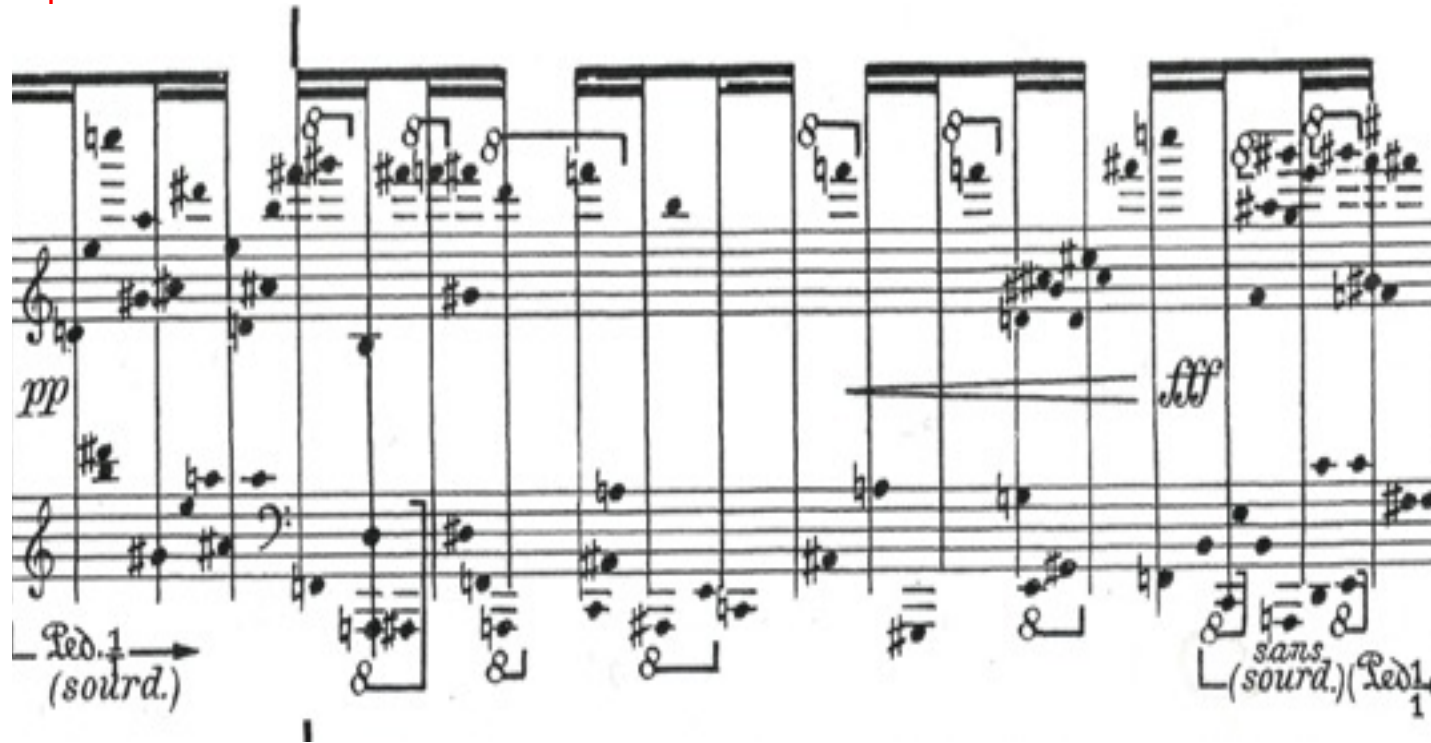
Example 1e: Arms



Example 1f: Arm trajectories



Example 1: Iannis Xenakis *Mists*, bars 46-47



UTI (understanding-technique-interpretation) FAILS

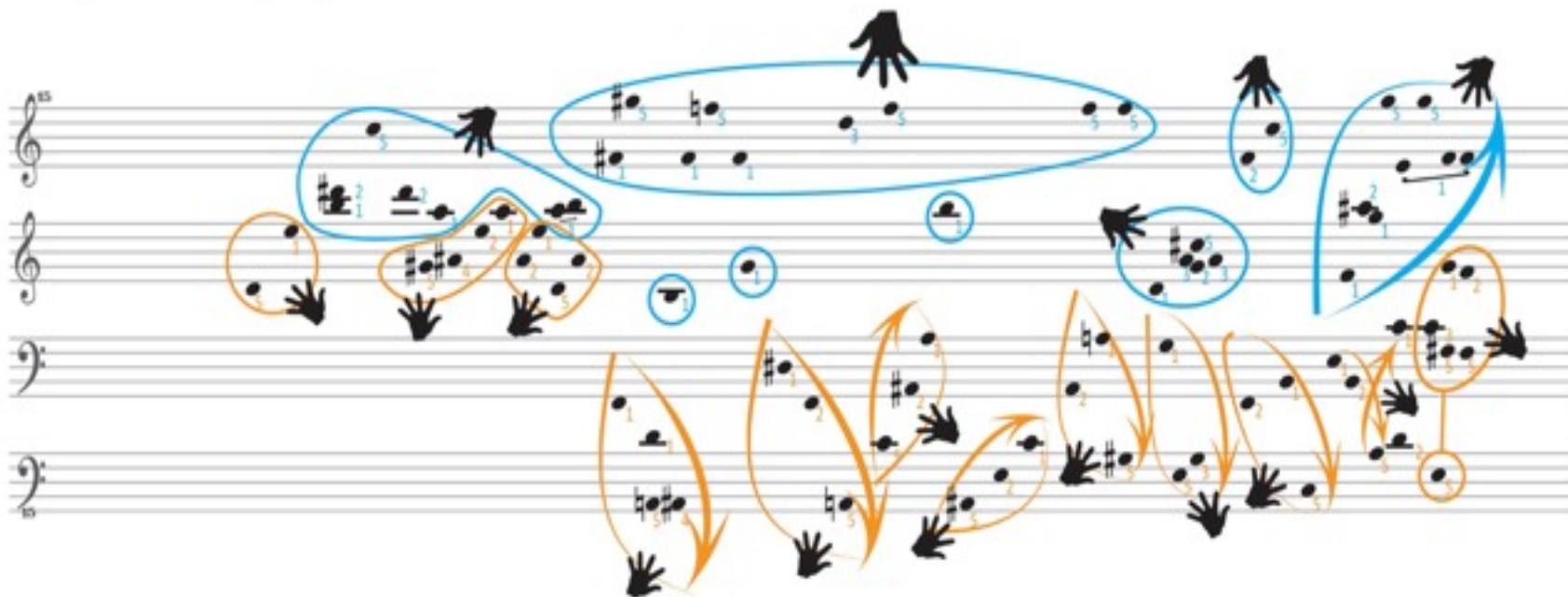
Example 1a: Pitch in space



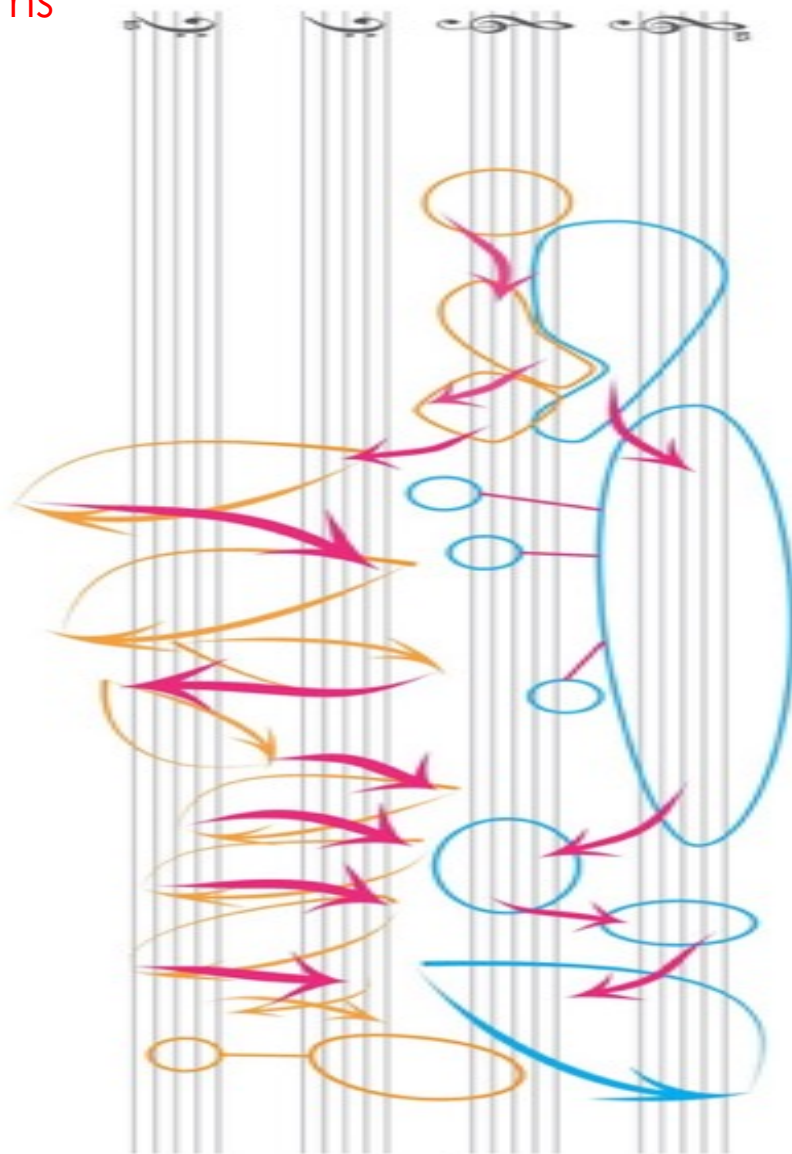
Example 1b: Fingers



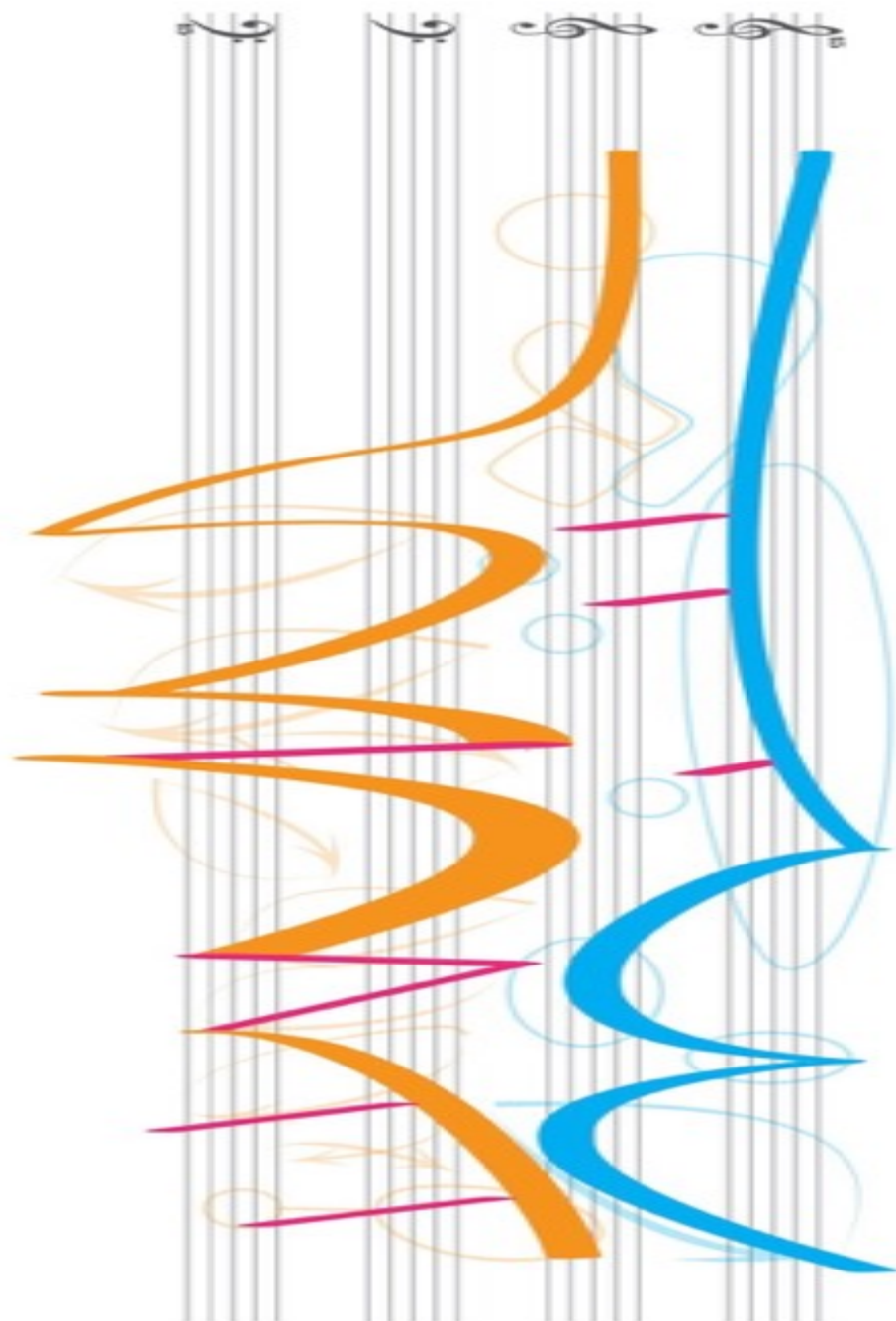
Example 1c: Hand grasps



Example 1e: Arms



Example 1f: Arm trajectories



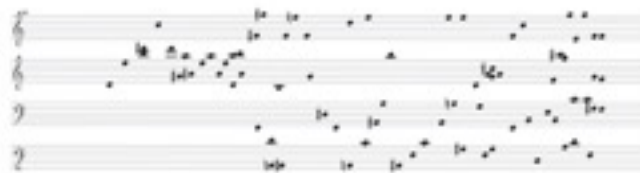
model: embodied navigation

Emergence of a tablature A: Pitch / Texture

Example 1: Iannis Xenakis *Mios*, bars 46-47



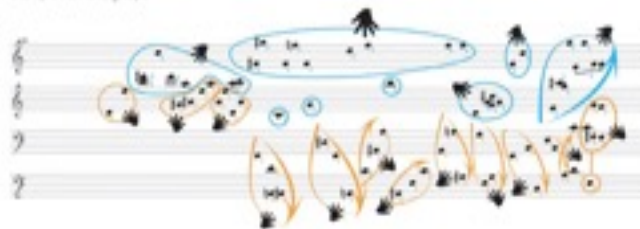
Example 1a: Pitch in space



Example 1b: Fingers

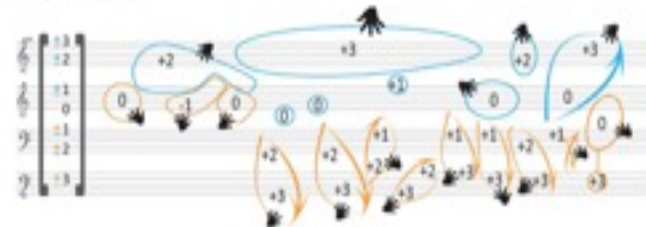


Example 1c: Hand groups



Emergence of a tablature A: Pitch / Texture

Example 1d: Registers



Example 1e: Arms



Example 1f: Arm trajectories



UTI

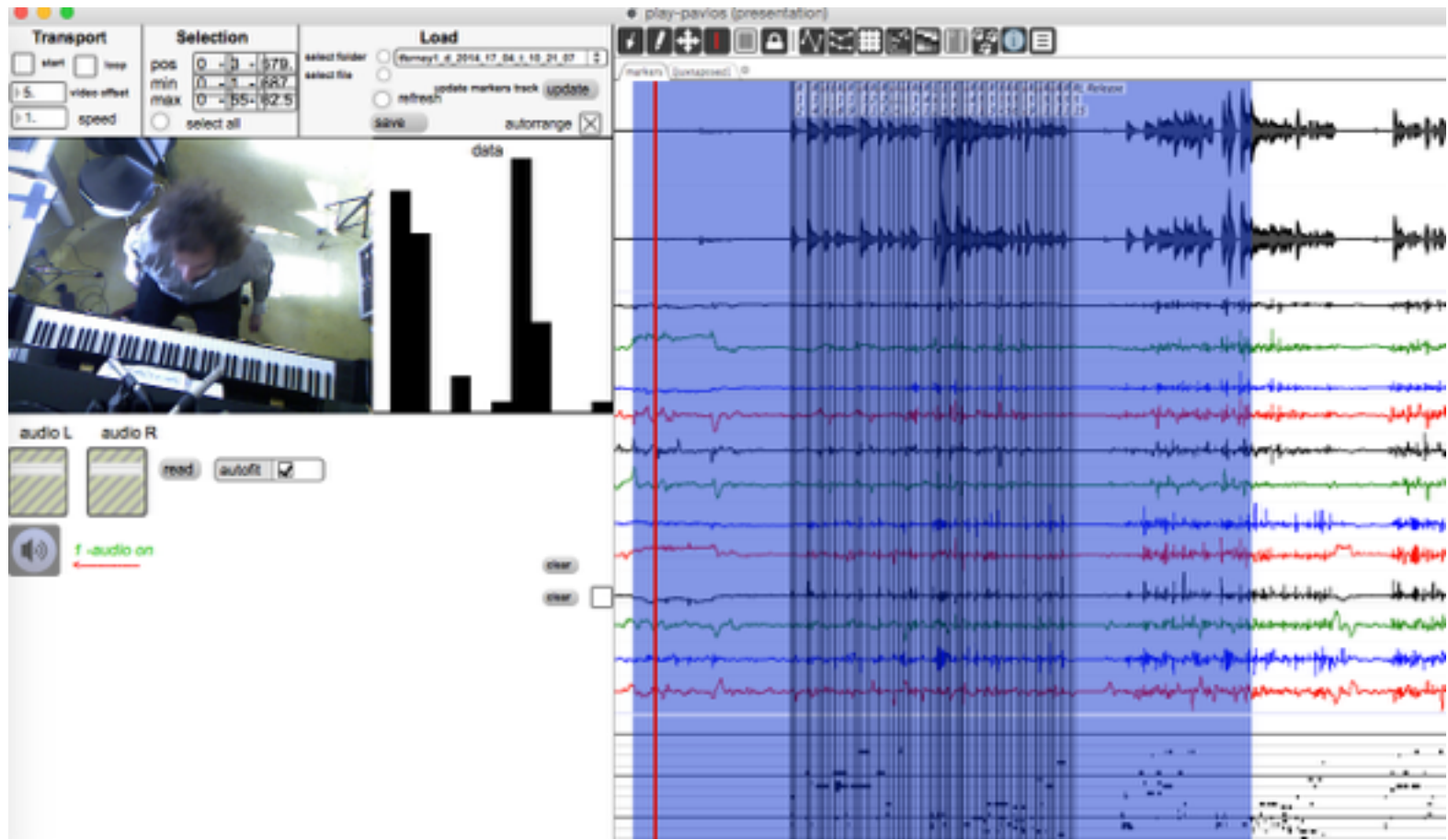
Understanding
Technique
Interpretation

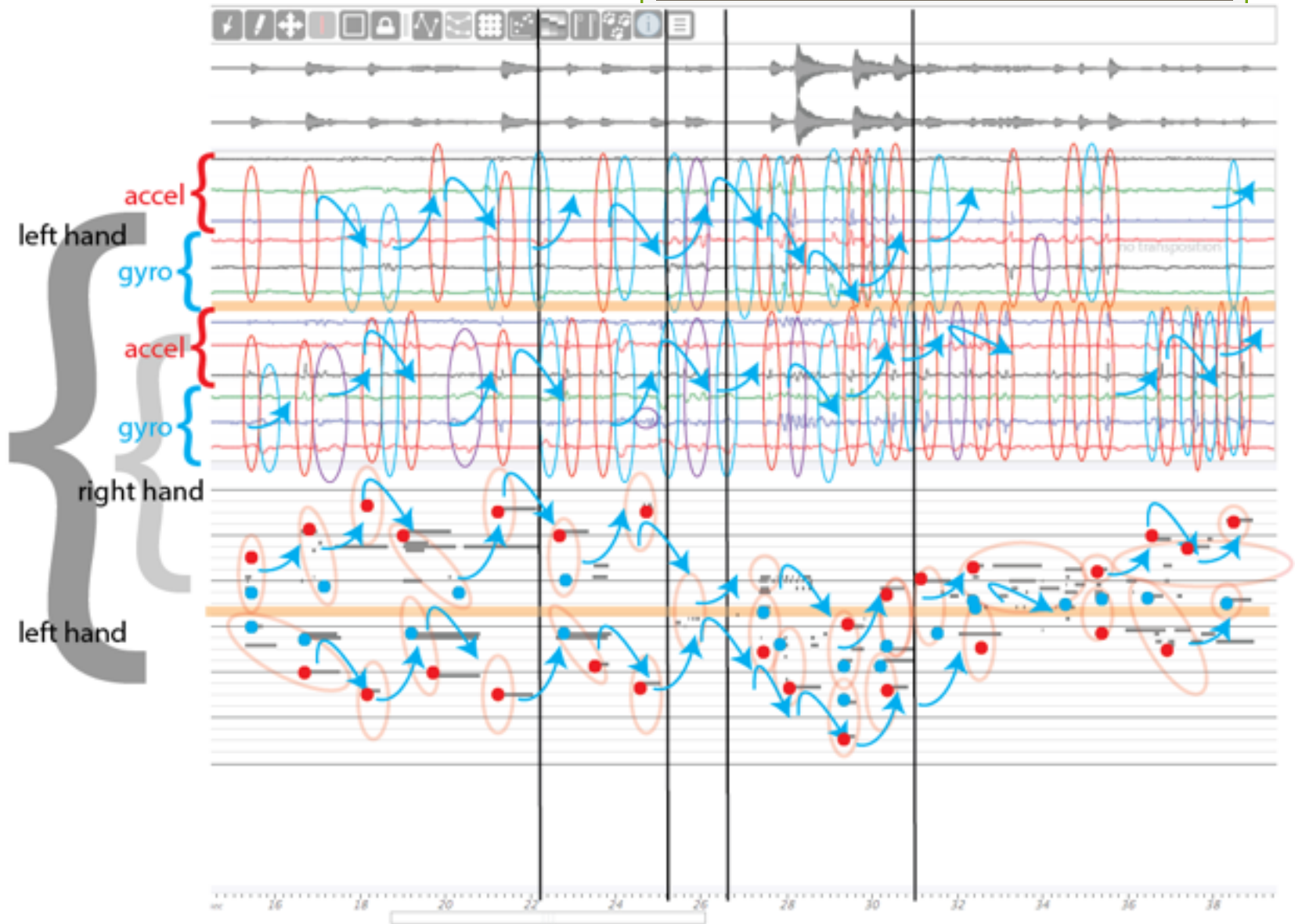
TUI

Tangible
User
Interface

notation as extension of the instrument as extension of the body

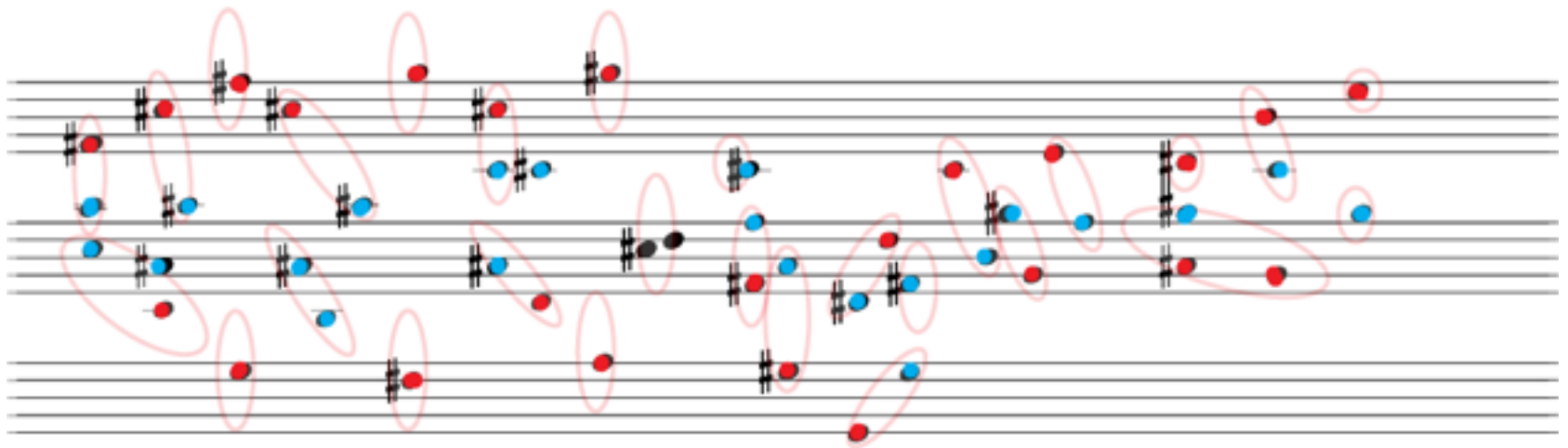
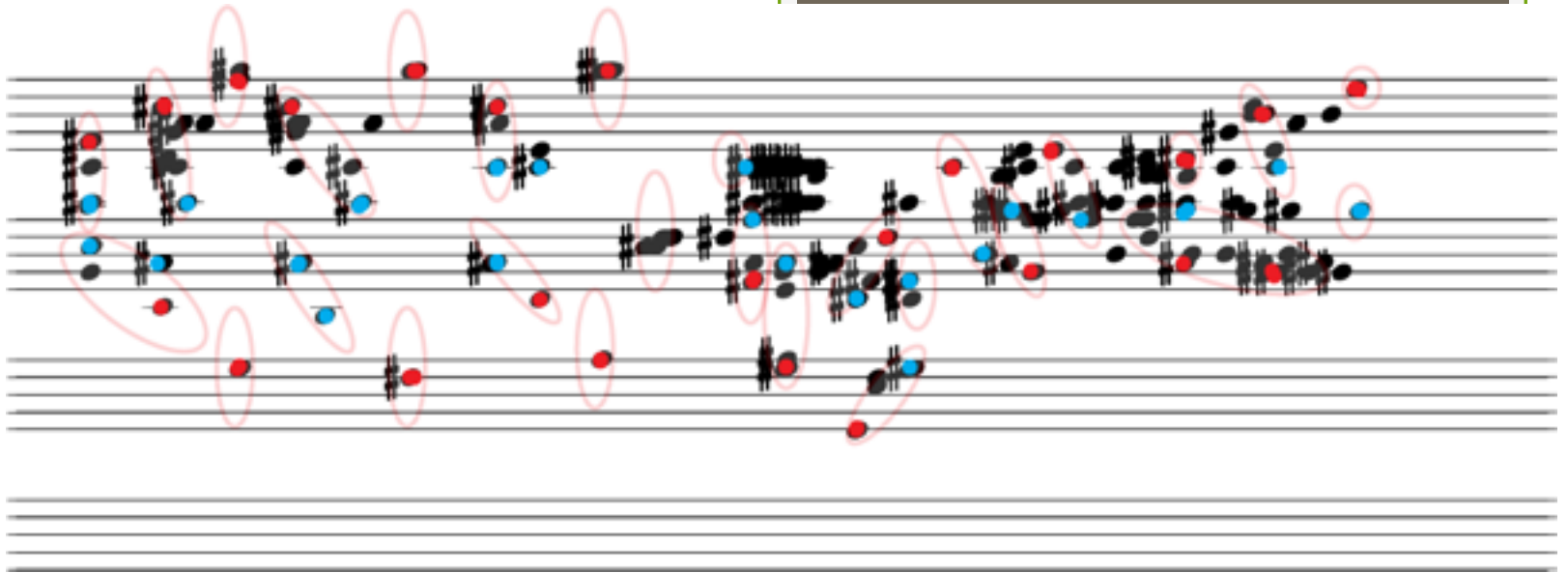
multimodal data

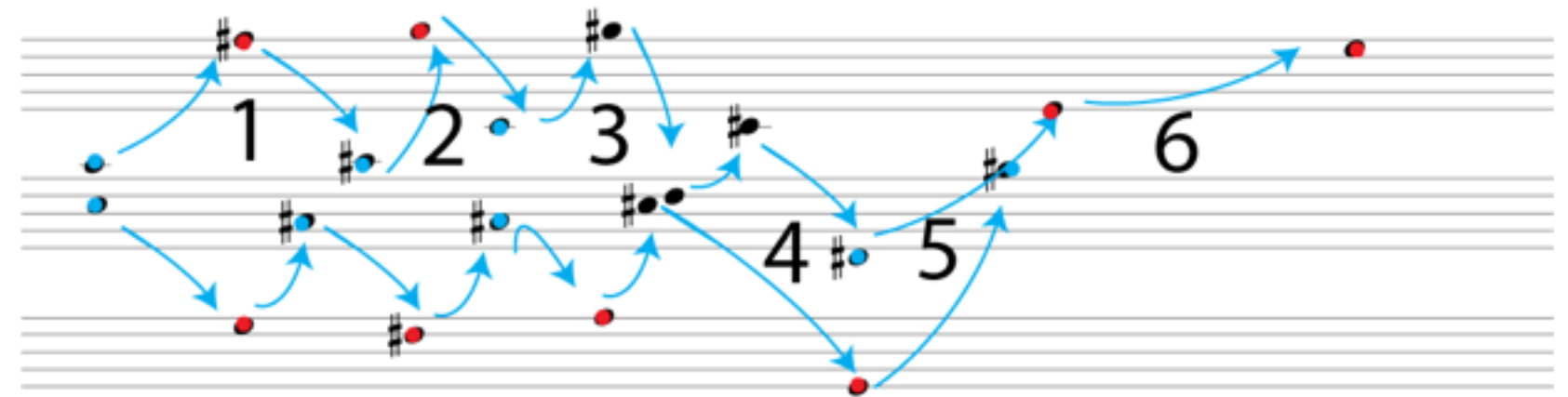
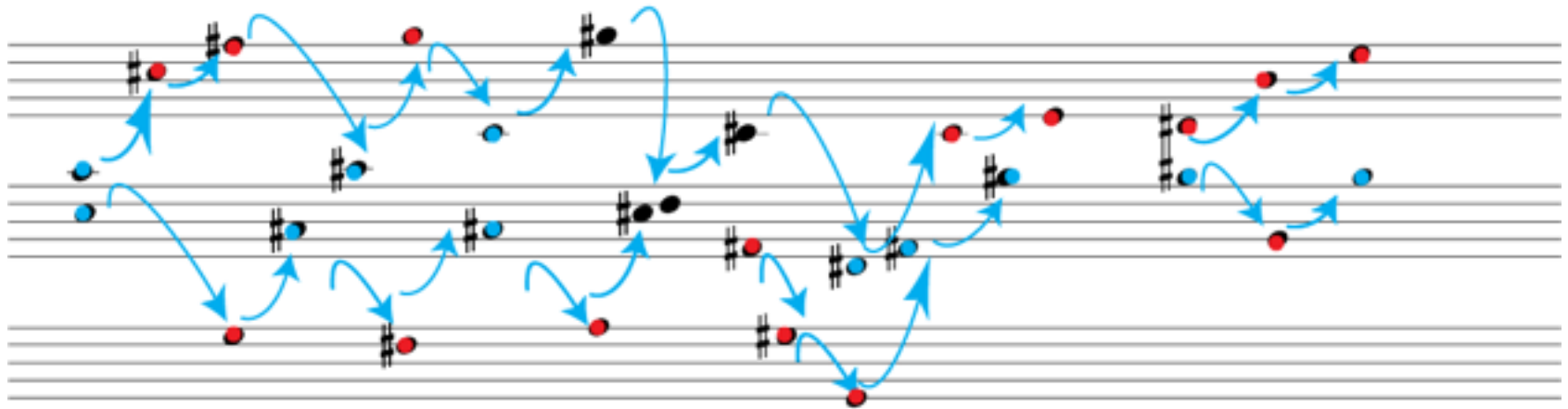




notation processing



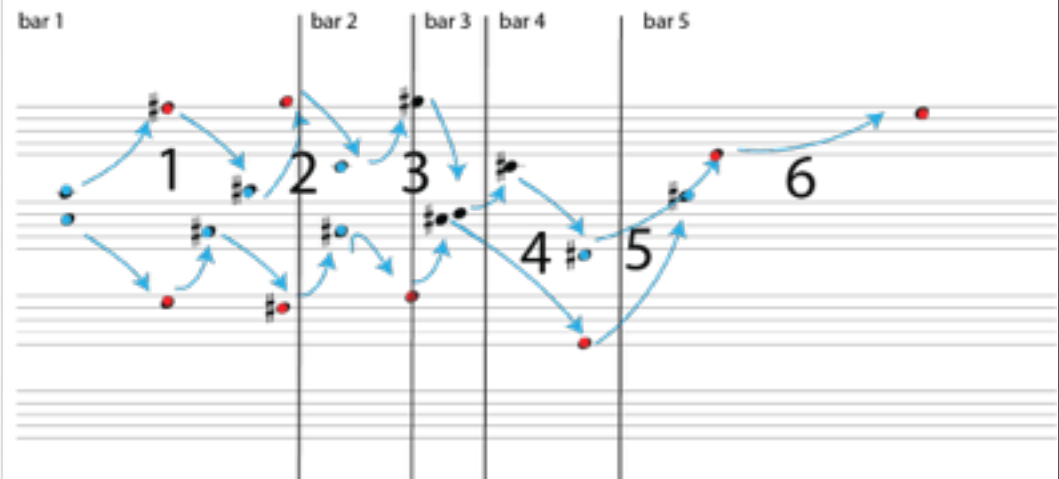




"Tout en hiéroglyphique" (Budelarc)

Lemma-kon-Epigram
for Maximilian Dorerini

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"Tout est hiéroglyphique" (Baudelaire)

Lemma-Icon-Epigram

For Massimiliano Damerini

♩.ca.50

7 16

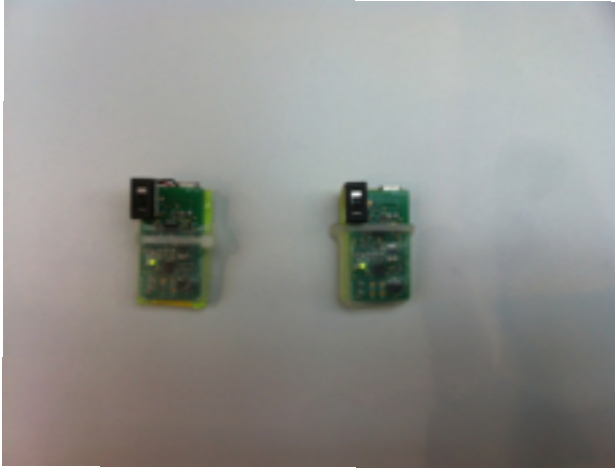
5 16

9 16

Edition Peters No. 7233

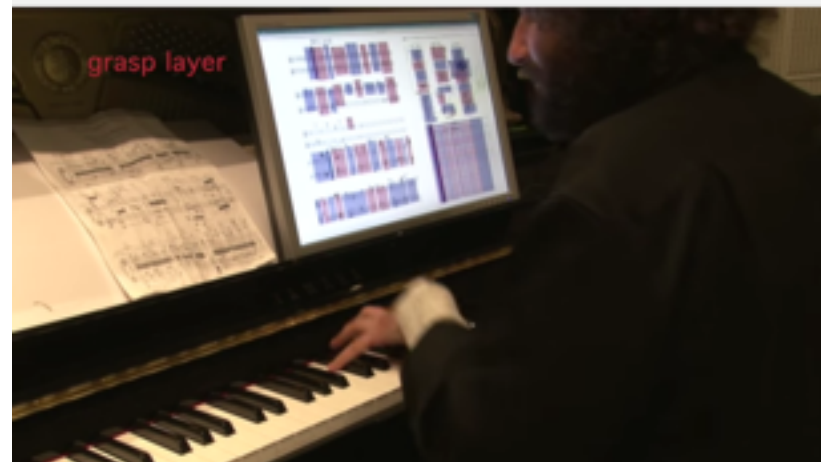
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tool: GestCom



inertial sensors
motionfollower

inscore



conclusion

action-oriented view of notation

new interfaces

human-machine interaction

gesture modeling

interactive multimodal tablature

gesture-to-notation mappings

real-time gestural processing of notation

The evolution of traditional notation towards increased specificity and complexity has been expanding its role from the composer's "brain in a vat" into an elastic interface dynamically amalgamated with instruments and performing bodies. In that sense, a Xenakis or Ferneyhough score is inviting interaction more than interpretation, navigation more than understanding. At the same time, new technologies such as the ones for gesture capture and interactive notation are allowing for the materialisation of metaphors into actual multimodal notations. Along these lines, I will present a model of embodied interaction with complex piano notation (embodied navigation) and a prototype system for the gestural processing of musical scores (GesTCom -Gesture Cutting through Textual Complexity). The first approaches notation through concepts in the field of embodied cognition, the latter integrates views from NIME and CHI into a gesturally controlled interface for notation processing.

the great perversion

symbol → praxis

praxis → symbol → praxis

background

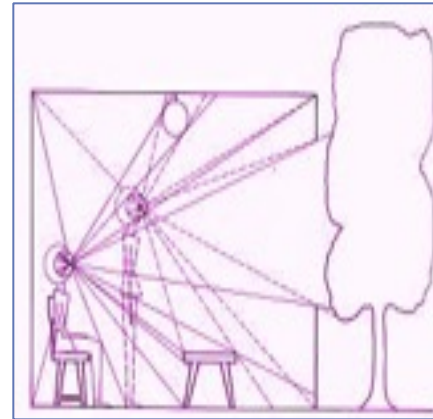
performance



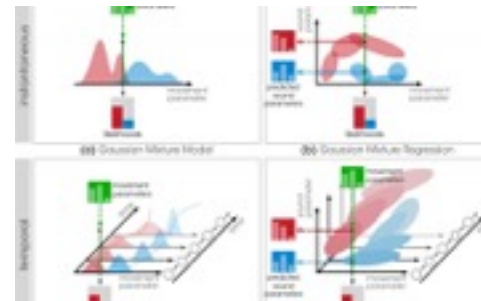
NIME / CHI



embodied cognition



gesture modeling



instrument

self-contained and autonomous
sound-producing object
performable live



turntablism

dependence on pre-recorded materials
dependence on configuration
dependence on context

extension

NIME

Atau Tanaka

open-ended systems

- input device
- mapping algorithm
- sound synthesis engine
- compositional structure**
- output system

controllers

hyperinstruments

studios

sensor interfaces

virtual reality

tabletops

biosignals

network music

GPS-based instruments

....

CHI

James McDermott

tool vs instrument

autotelic

engagement, flow
expressivity

difficulty

virtuosity

EC

Marc Leman

extension of the body

transparency

embodiment

guiding metaphors

haptic feedback

mediation theory

physical energy

symbolic representations

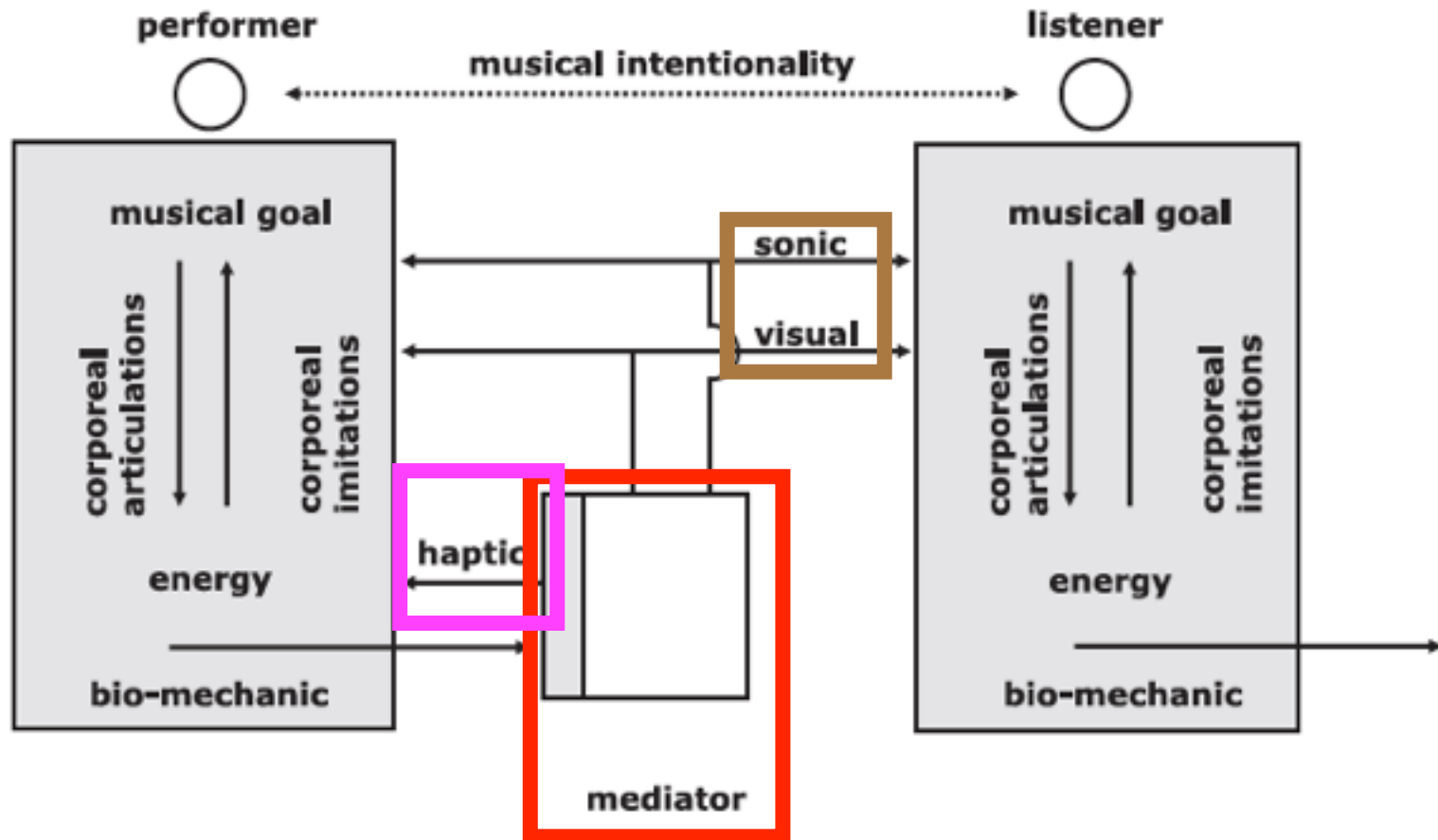
action-oriented

model of communication

multimodal

multimedia

Leman's mediation model



UTI

Understanding
Technique
Interpretation

TUI

Tangible
User
Interface

notation as extension of the instrument as extension of the body

Embodied and Extended Cognition

- A hybrid approach to cognition opposing the Standard computational model, based on symbols, rules and representations. A third wave in the history of cognitive science, after the early computational model (first wave-SCS) and after *connectionism* as a second wave inspired from neuroscience
- Cognition proper is not reducible to its neural implementation, but it is rather distributed among the brain, the body and the environment
- The mental processes are partly enactive, embedded, embodied and extended (what Rowlands refers to as 4E Cognition, after Shaun Gallagher)
- "Very roughly, to build a mind it is not sufficient that one builds a computer; one must build a robot"

4 EC concepts for embodied navigation

- **environmental offloading**: action on external information-bearing structures constitutes cognition (Rowlands, Clark)
- **dynamicity and state-space**: self-organised feedback circles between the senses and the motoric aspects describe better systems that change in time (Brooks, Beer, Van Gelder)
state- space: the map of all possible states of the system
- **conceptualisation**: qualities of our embodiment define the conceptualisation of our world through language (Lakoff, Johnson, Nunez)
- **navigation and affordances**: cognition can be defined as navigation with real-time perception and action and as exploration of environmental affordances (Gibson)

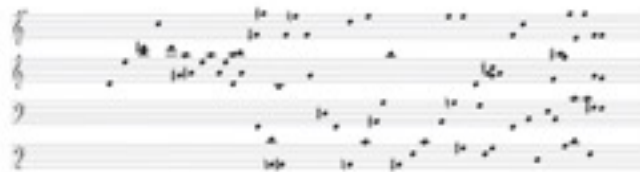
model: embodied navigation

Emergence of a tablature A: Pitch / Texture

Example 1: Iannis Xenakis *Mios*, bars 46-47



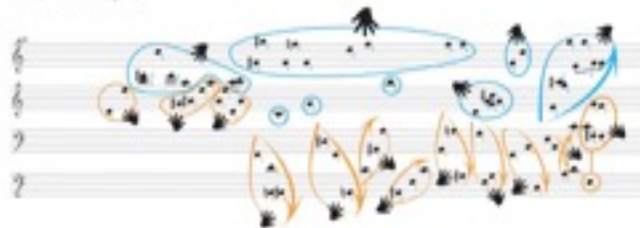
Example 1a: Pitch in space



Example 1b: Fingers

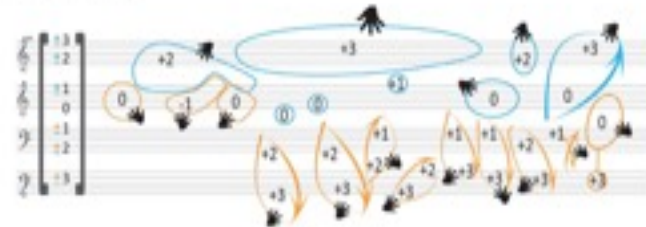


Example 1c: Hand groups

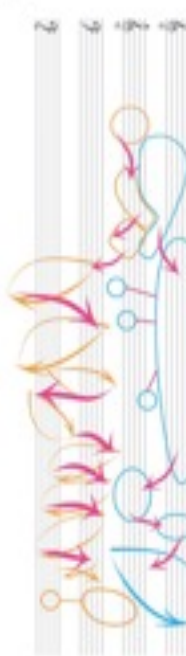


Emergence of a tablature A: Pitch / Texture

Example 1d: Registers



Example 1e: Arms



Example 1f: Arm trajectories



model: embodied navigation

performance as embodied navigation in a non-linear state space of notational (gestural, sonic, stylistic, conceptual...) affordances

affordances are representable as annotations of the score in the form of a multilayered tablature

the performer navigates embodied layers and manipulates notation as if it had tangible properties

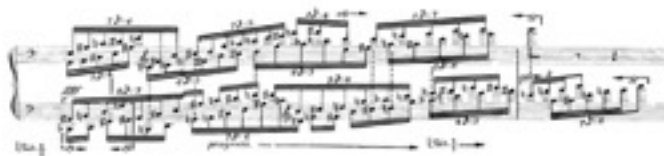
example of mediation between symbolic signification, action-oriented descriptors and physical energy

gesture acts as an interface for notation processing
notation forms part of the dynamic system “body-instrument-notation”

Complex Rhythm: Not-understanding as a chance to re-embody

Emergence of a tablature B: Pitch / Texture / Rhythm

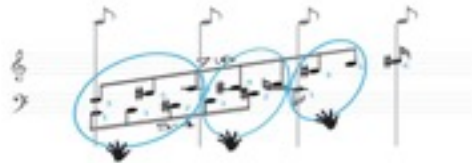
Example 2: Janini Kanakio Misa, bars 9-11



Example 2a: Hand grasps and arms



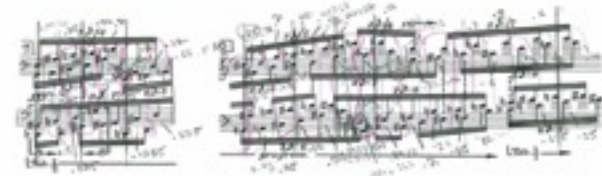
Example 2b: Coupling of pulse-based rhythm and hand-grasps (single-handed rhythmic structure)



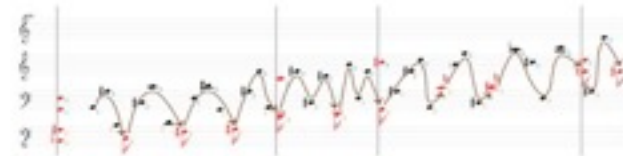
3/4

Emergence of a tablature B: Pitch / Texture / Rhythm

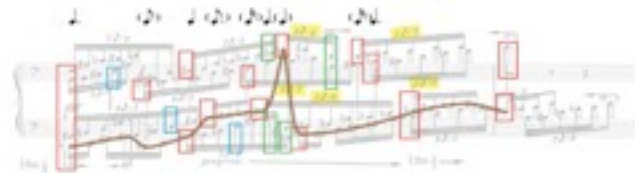
Example 2c: Decimal-based approach to rhythm



Example 2c: Coupling of decimal-based rhythm and fingers (two-handed rhythmic structure)

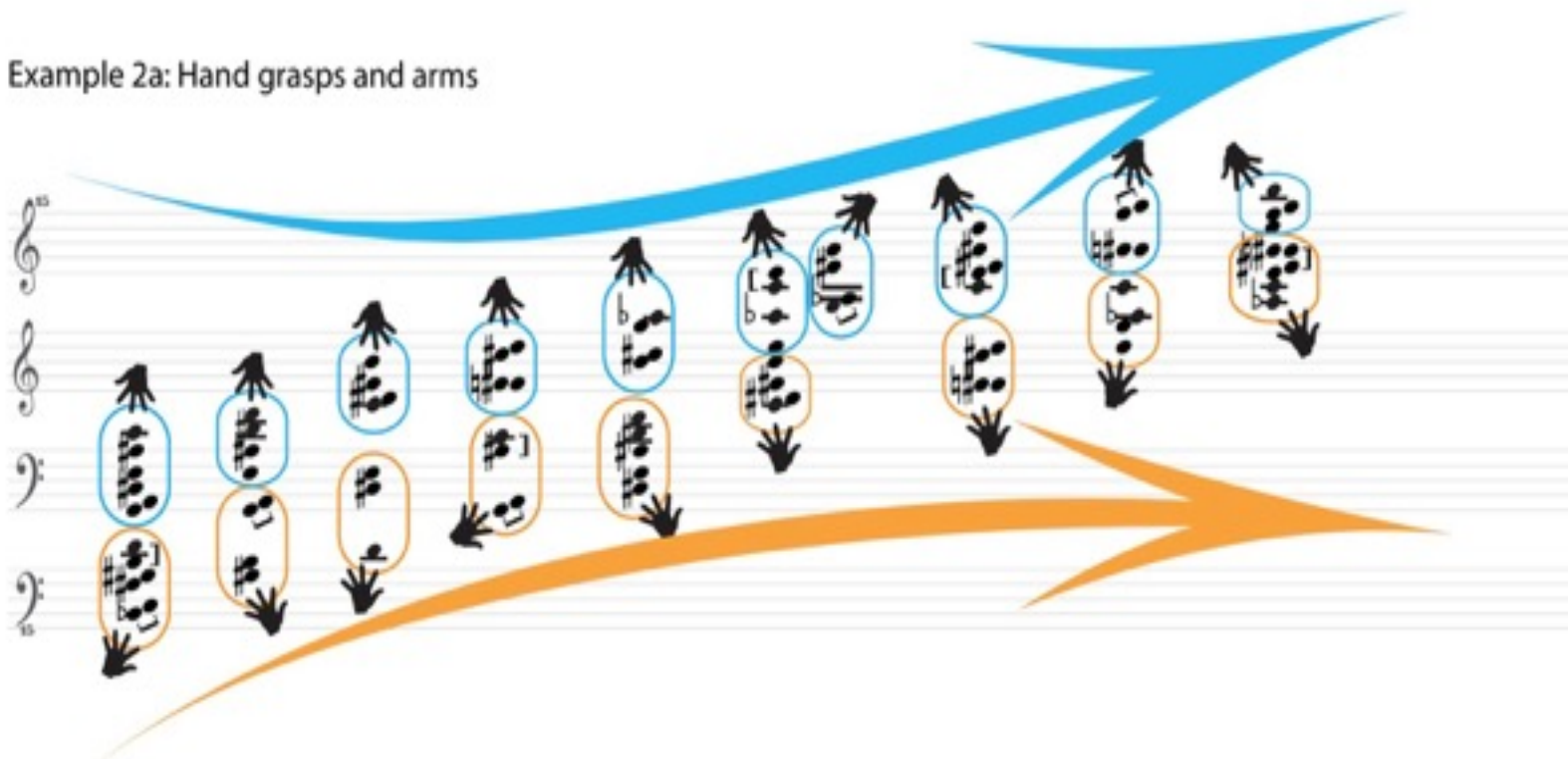


Example 2d: Navigation as coupling of macro rhythmic elements and embodied layers

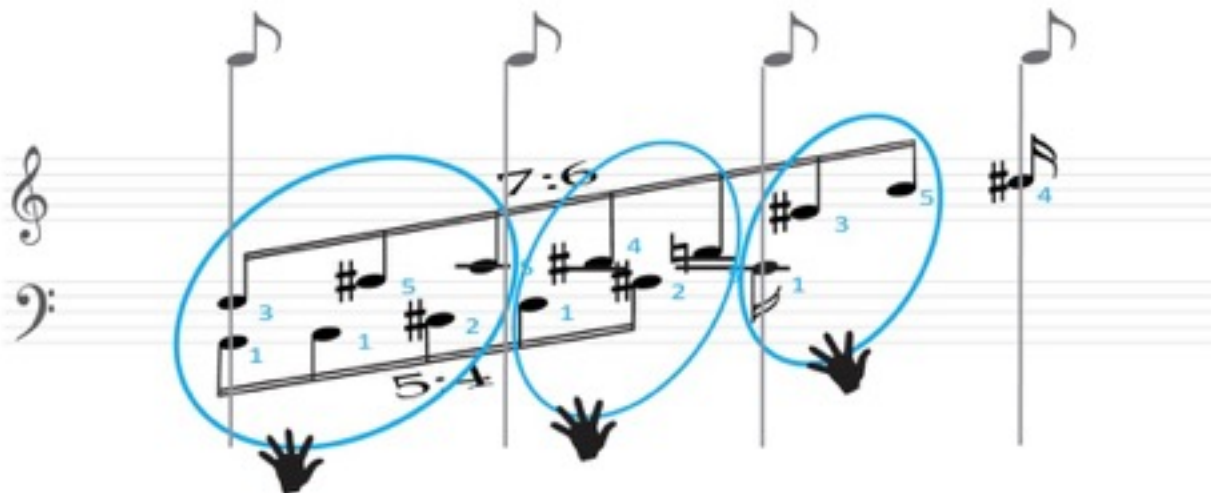


4/4

Example 2a: Hand grasps and arms



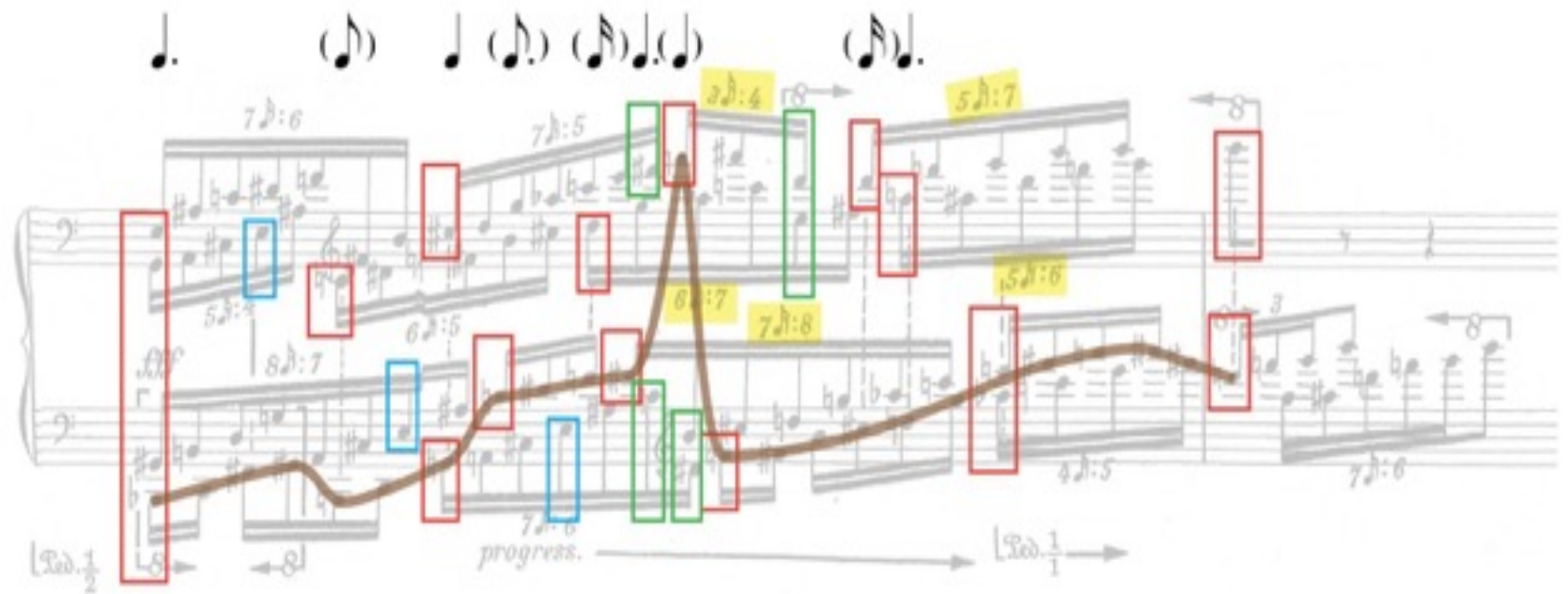
Example 2b: Coupling of pulse-based rhythm and hand-grasps
(single-handed rhythmic structure)



Handwritten musical score for 'The Rose Tree' in G major. The score is written on two staves, Treble and Bass. It includes various musical notations such as notes, rests, and dynamic markings. The key signature is one sharp (F#), and the time signature is 2/4. The score is divided into measures, with some measures containing multiple notes. The notation is handwritten and includes some corrections and annotations.

Example 2cii: Coupling of decimal-based rhythm and fingers (two-handed rhythmic structure)

Example 2d: Navigation as coupling of
macro-rhythmic elements and embodied layers



Brian Ferneyhough

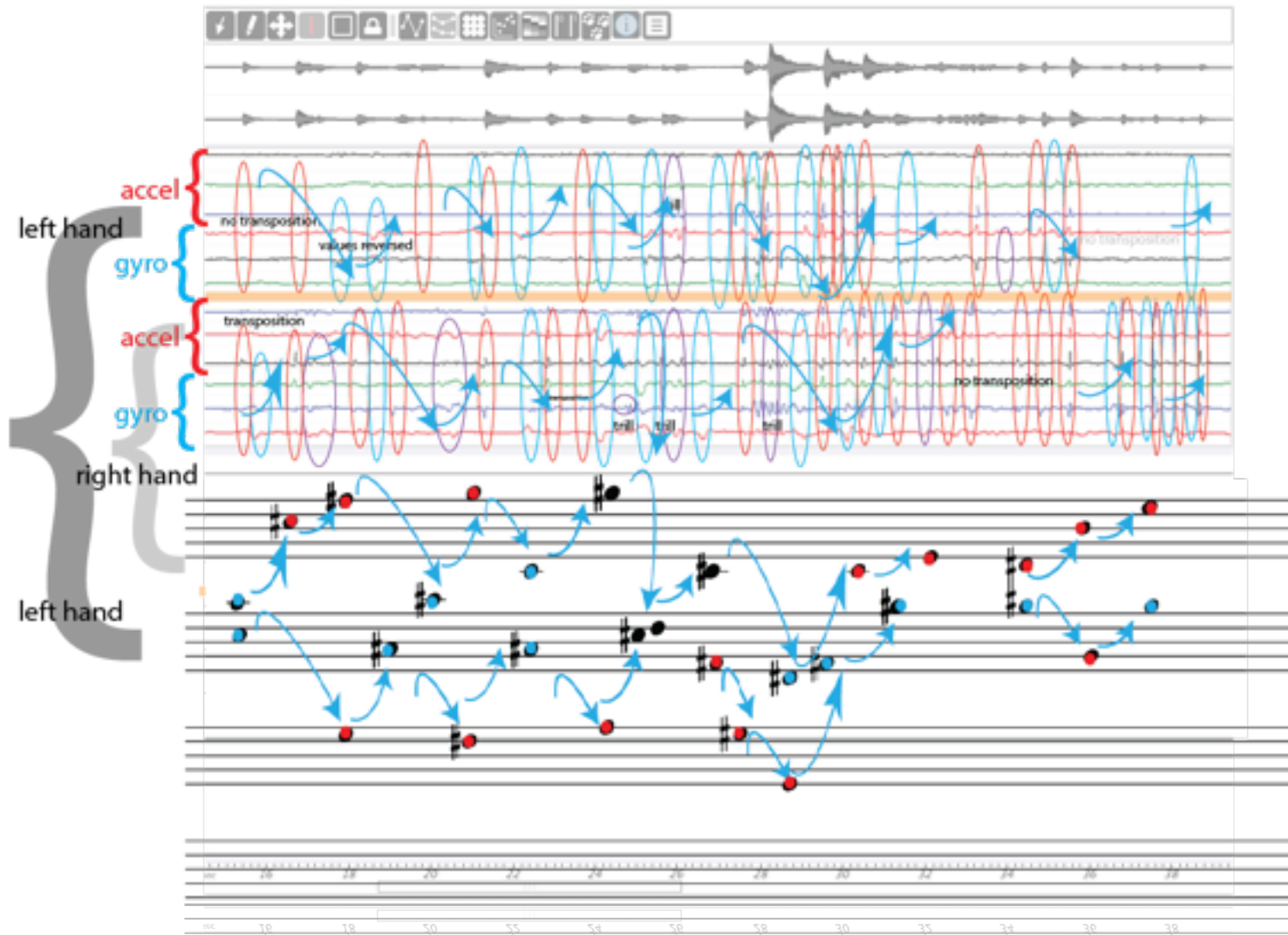


" A notation which demands of the performer the formulation of a conscious selection procedure of [...] the information [...] and a determination of the combination of elements (strata) which are to be assigned preferential status at any given stage of the realization process"

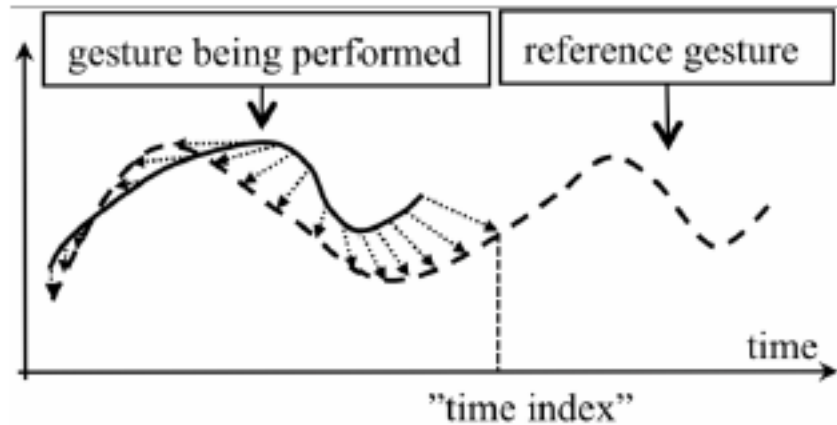
Collected Writings / Aspects of Notational and Compositional Practice

- notation and tradition - how does a notational language evolve?
- new instruments - how does the role of notation change with new technologies?
- the symbol and the material - do new ergonomic and timbral affordances require new symbolism?
- how does a notation system evolve, and how do we understand that evolution?
- what does a musical notation system mediate?

gestural patterning

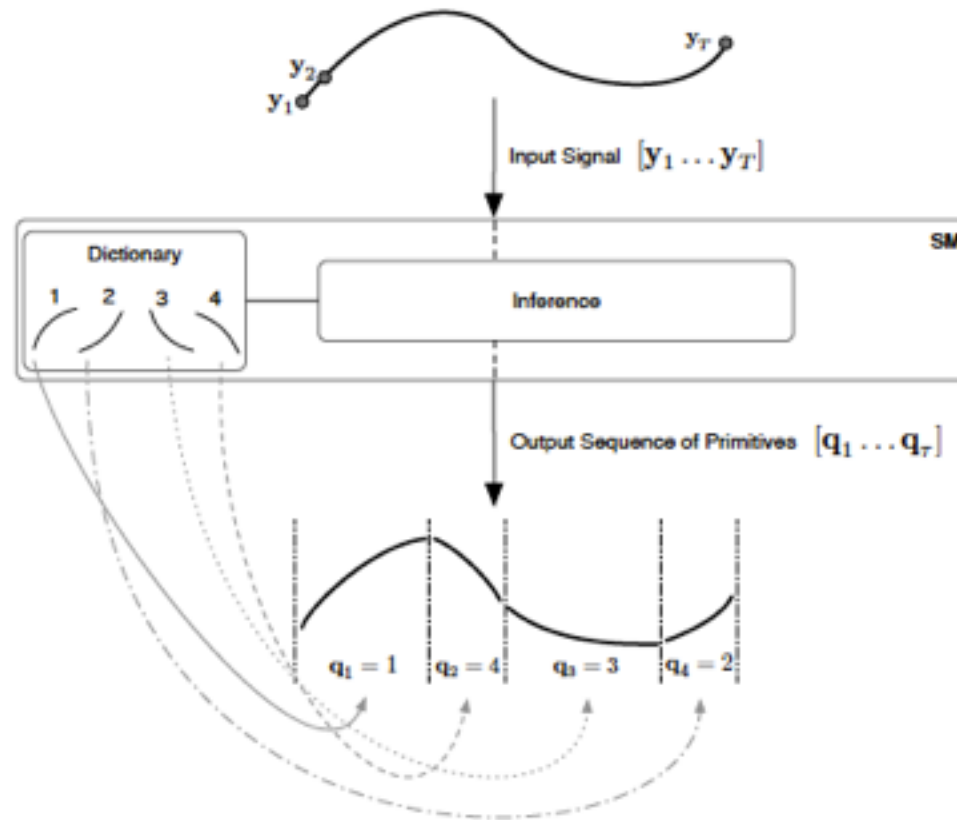


gesture following



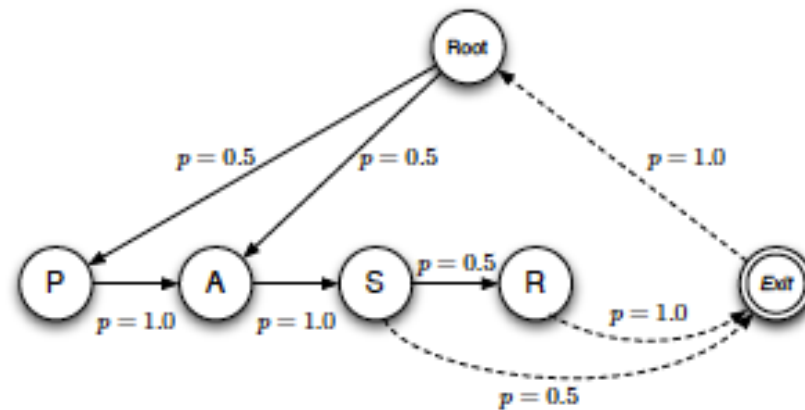
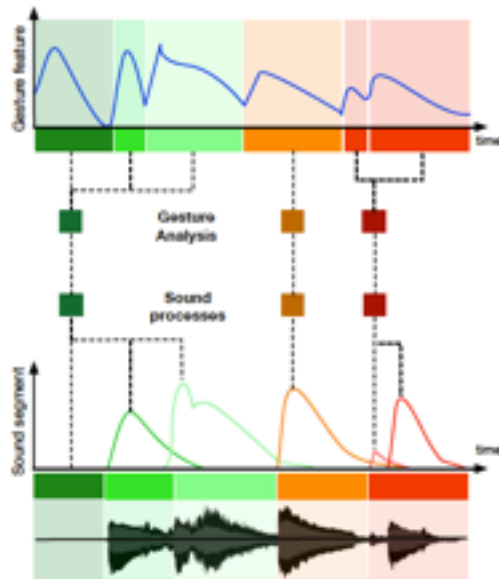
Frédéric Bevilacqua

segmental HMM

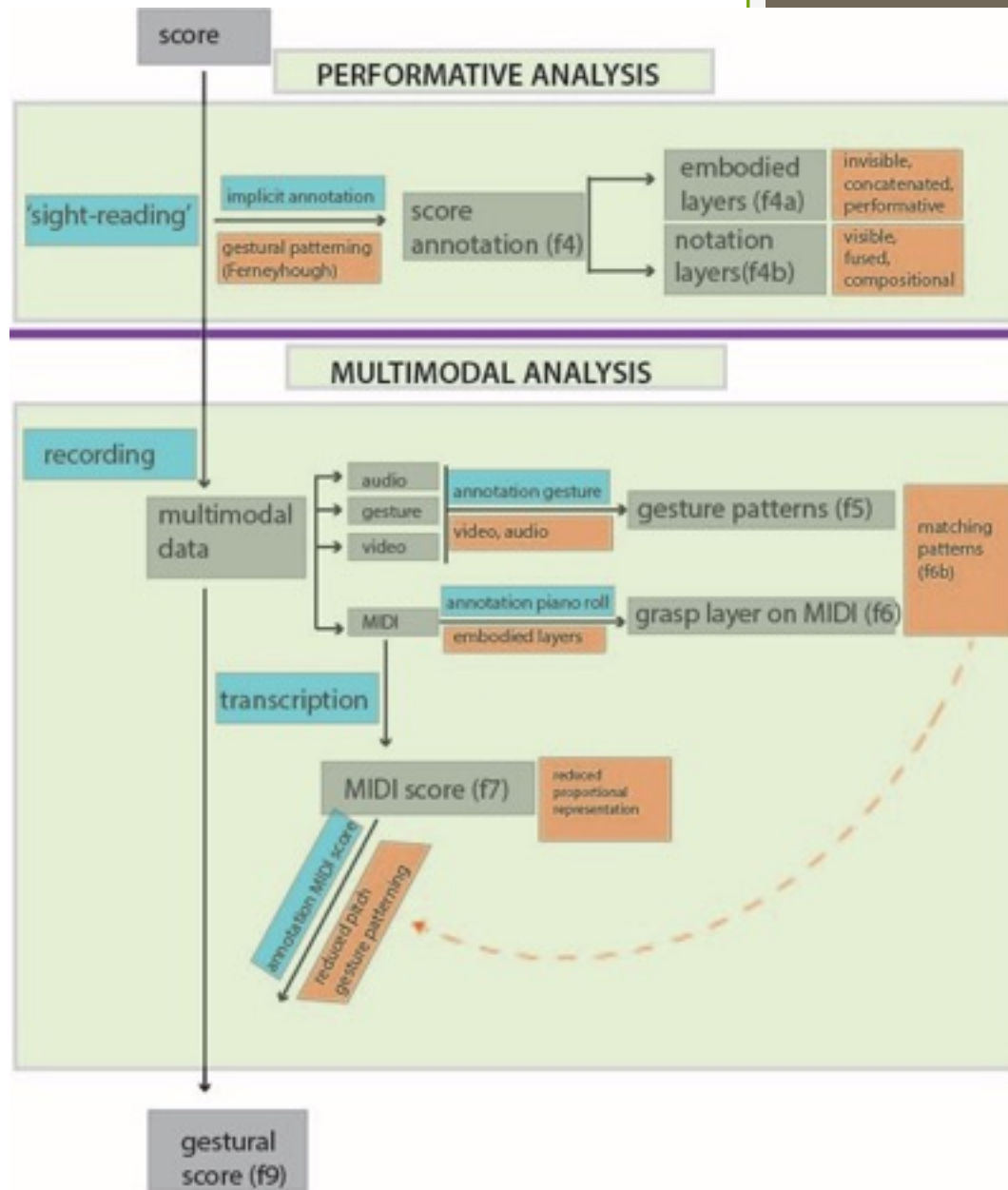


Baptiste Caramiaux

mapping gesture to sound



Jules Françoise



"Tout est hiéroglyphique" (Baudelaire)

Lemma-Icon-Epigram

For Maximiliano Damerini

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fig 3a: gestural patterning

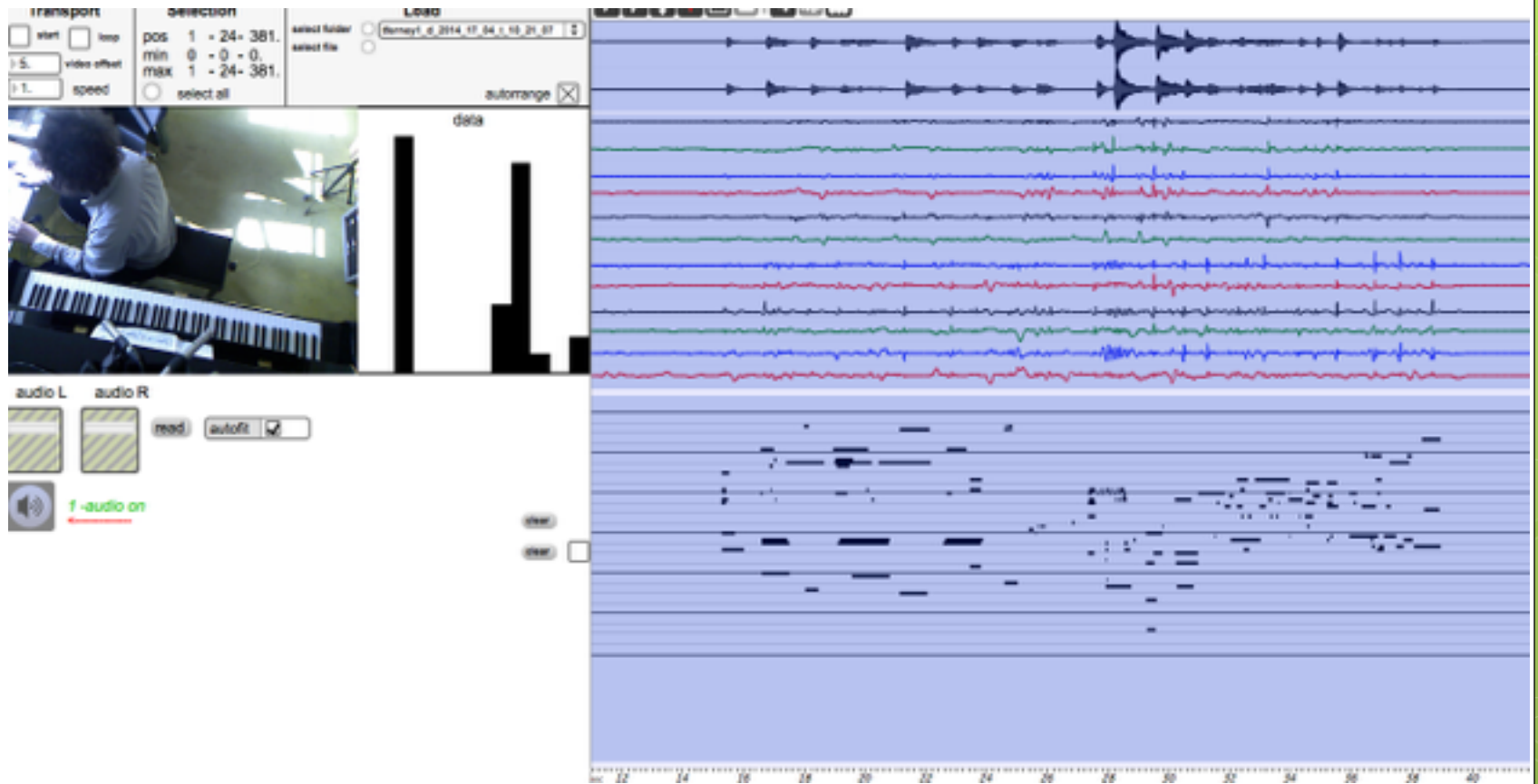
"Tout est hiéroglyphique" (Baudelaire)

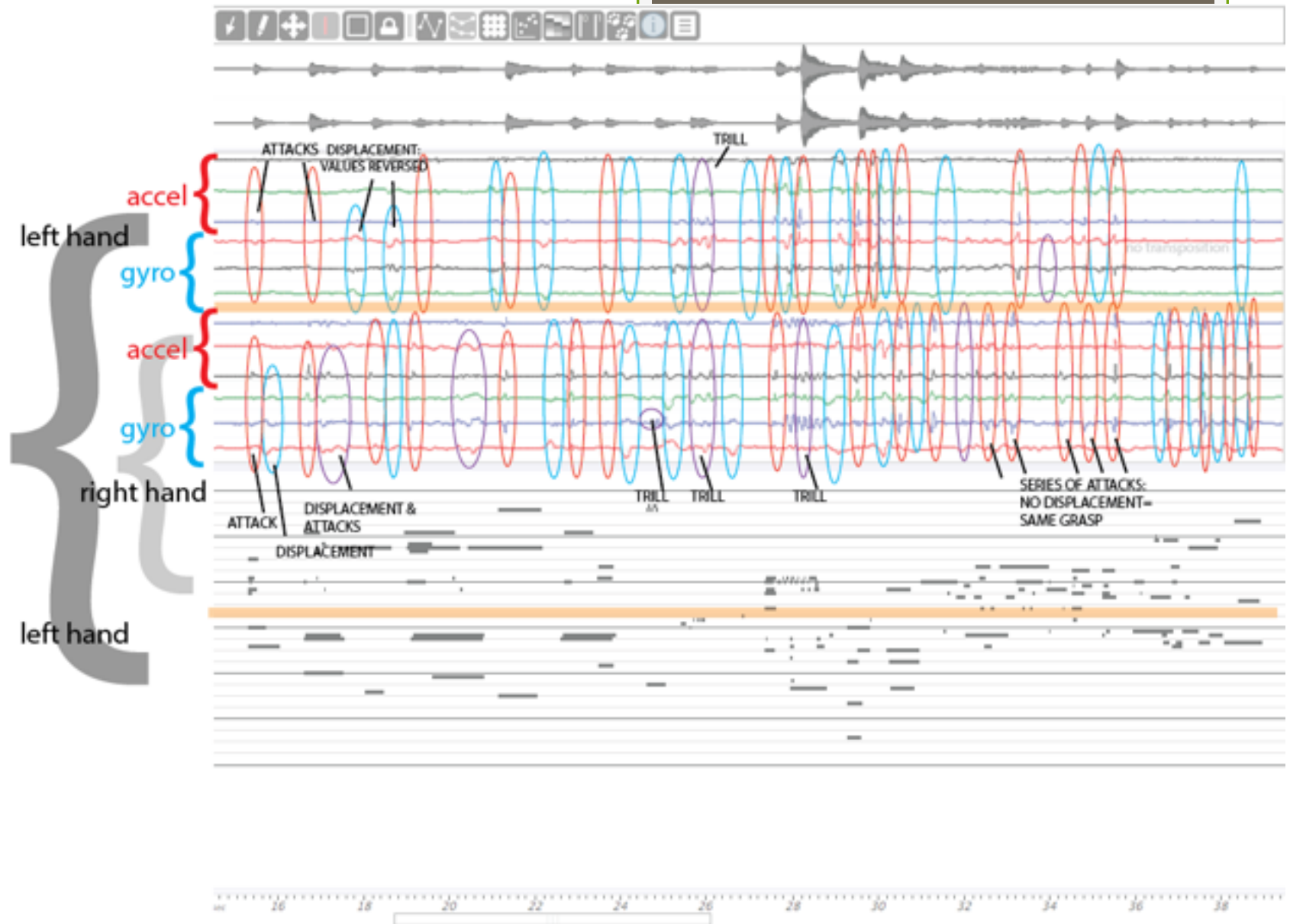
Lemma-Icon-Epigram

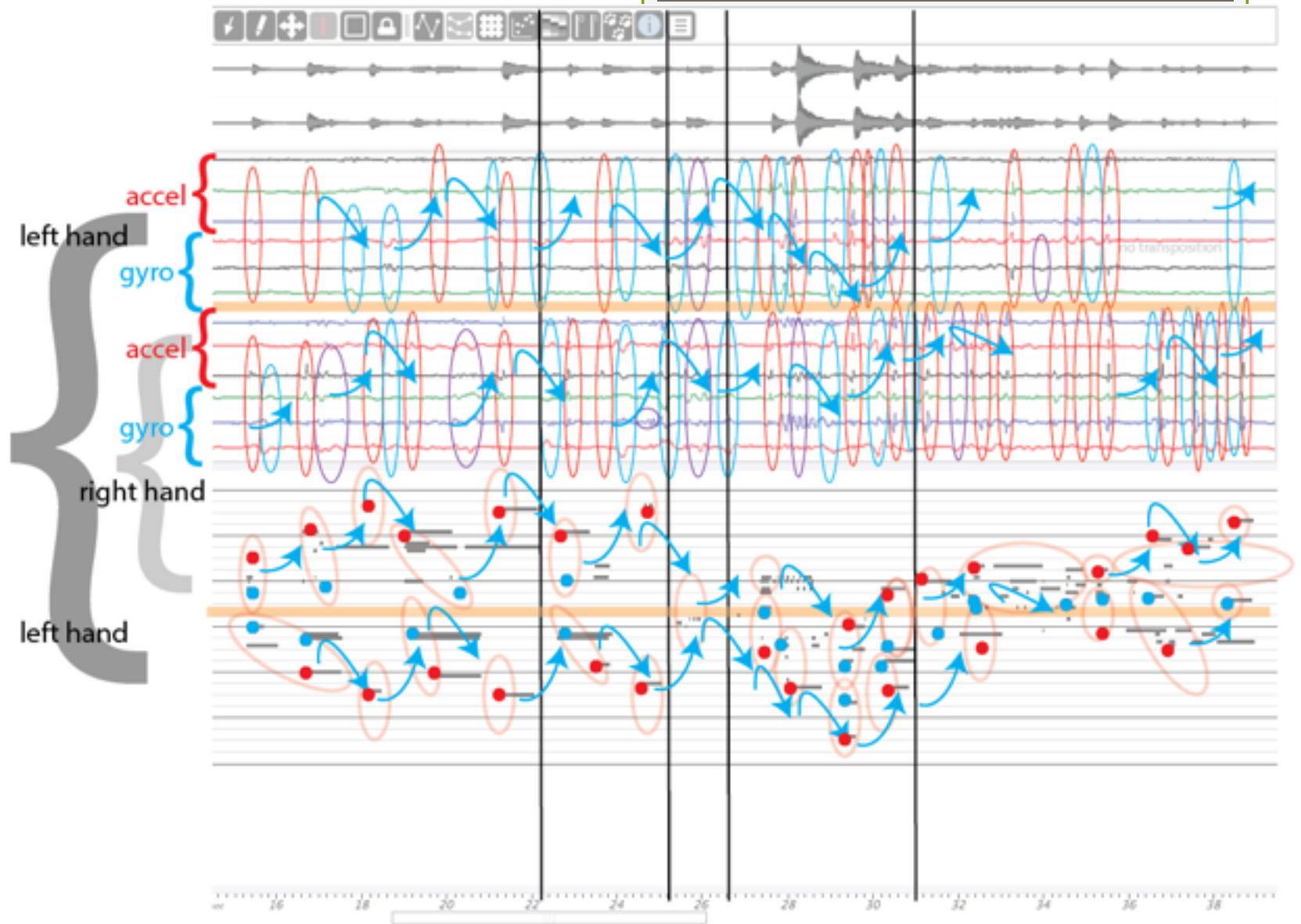
For Maximiliano Damerini

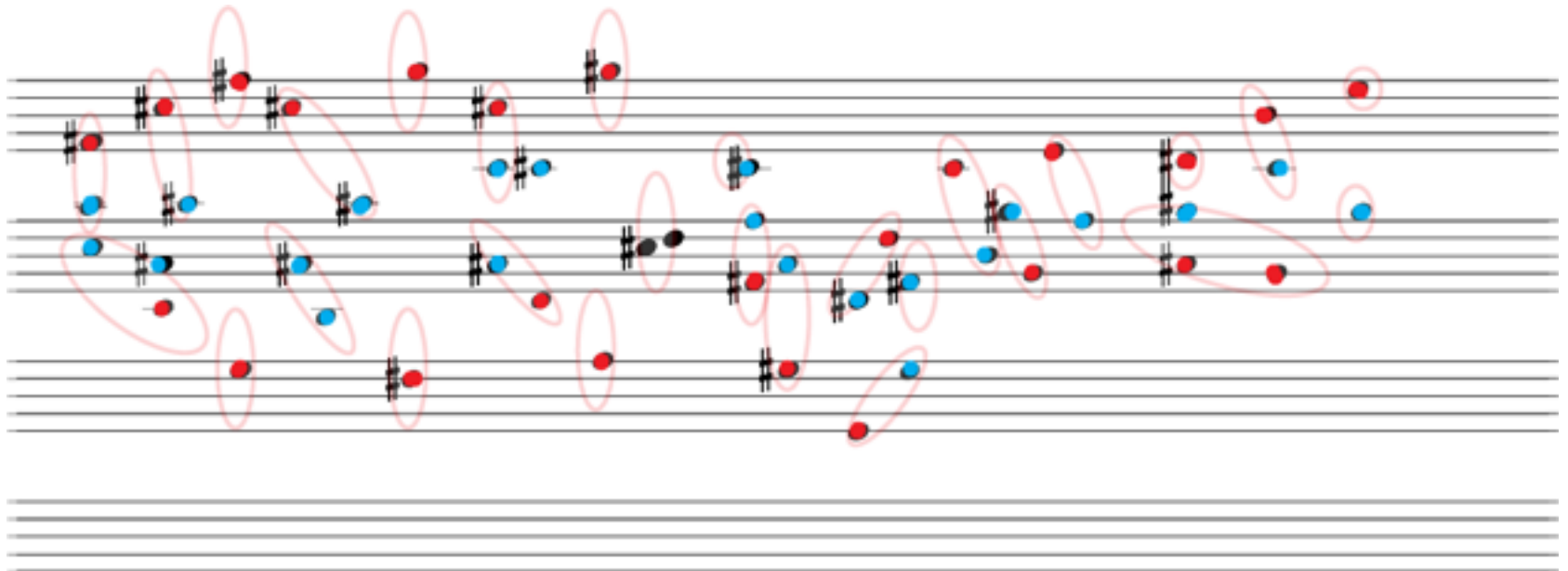
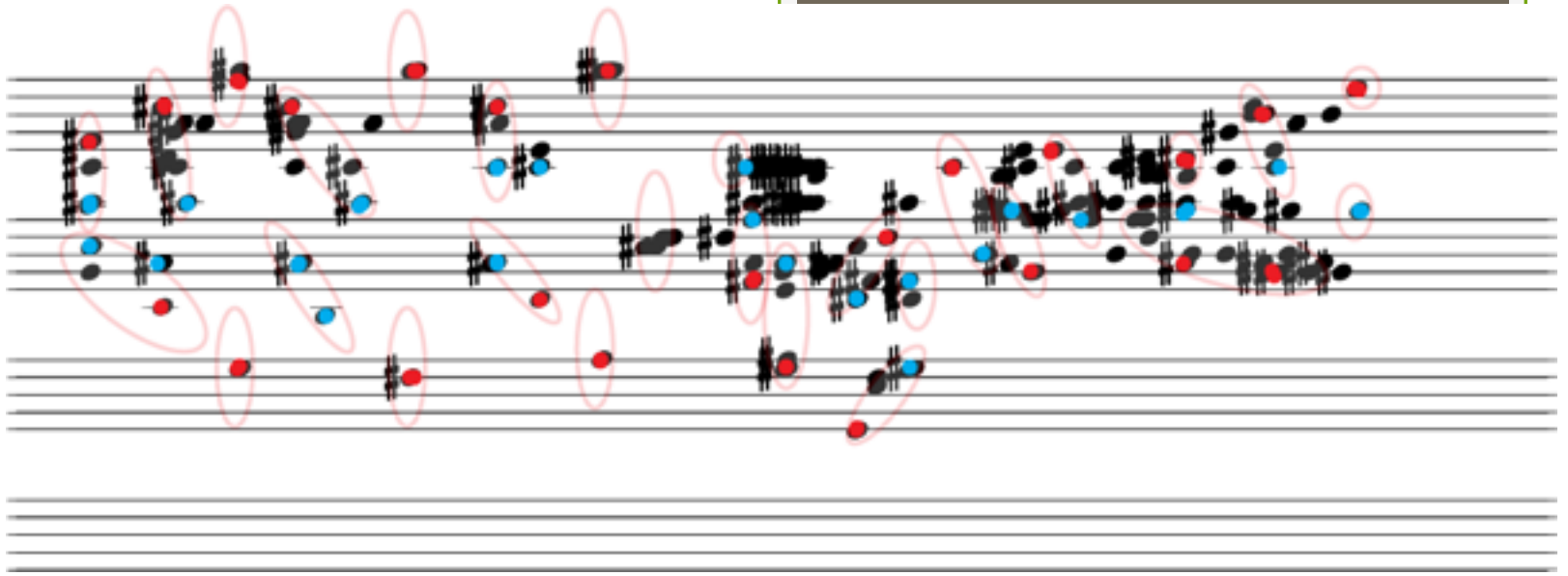
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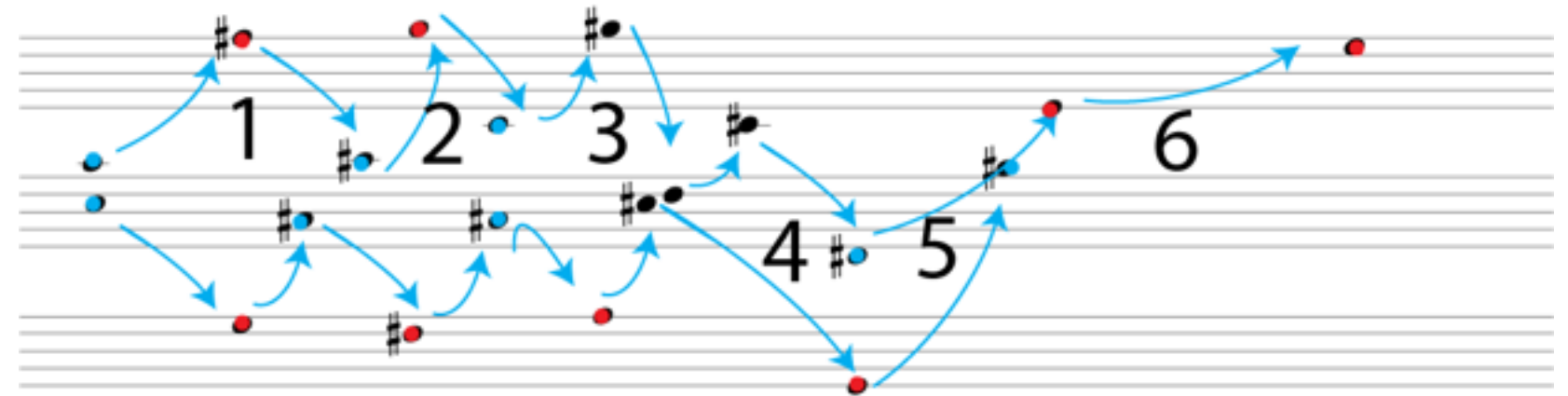
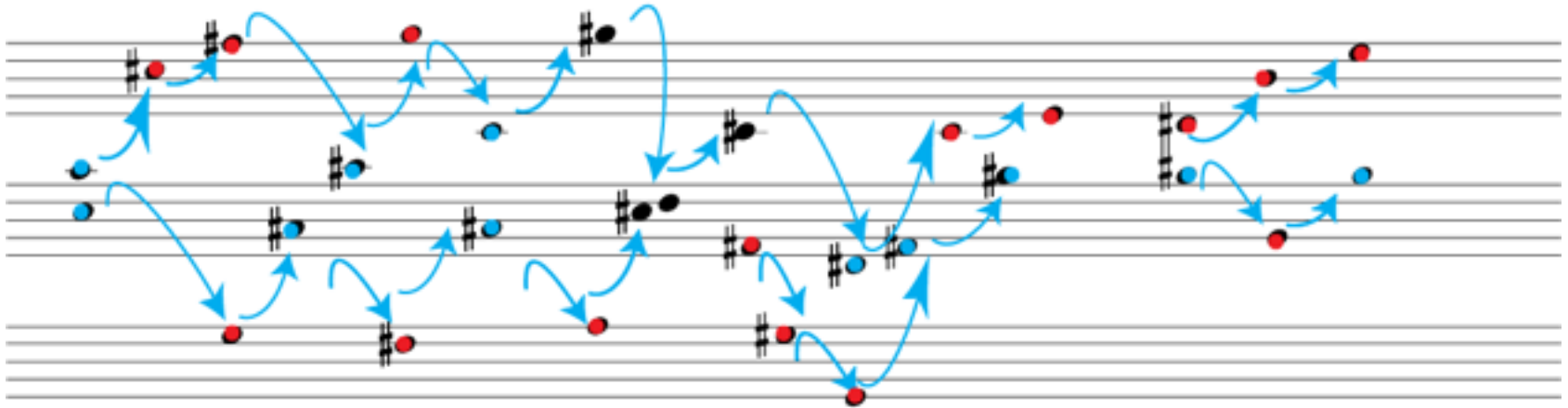
fig 3b: grasp layer











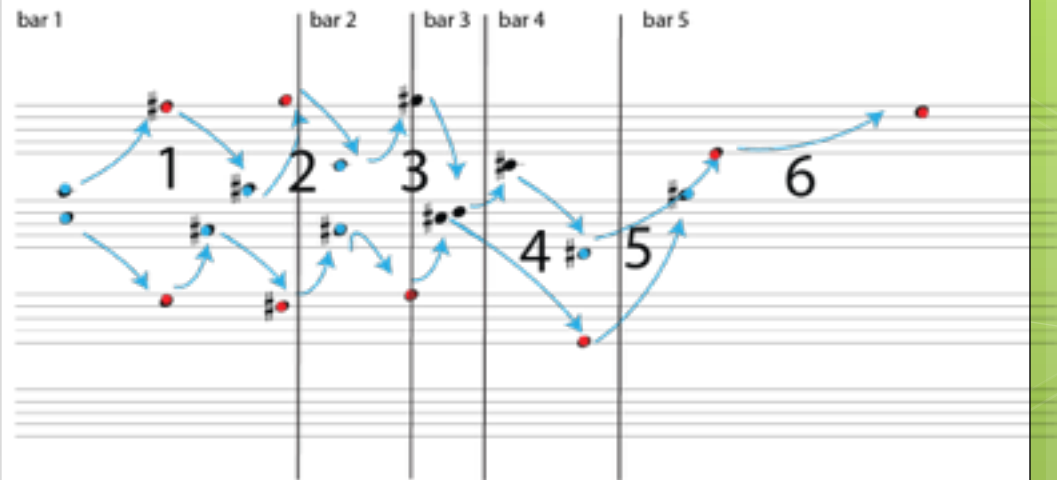
automatic extraction

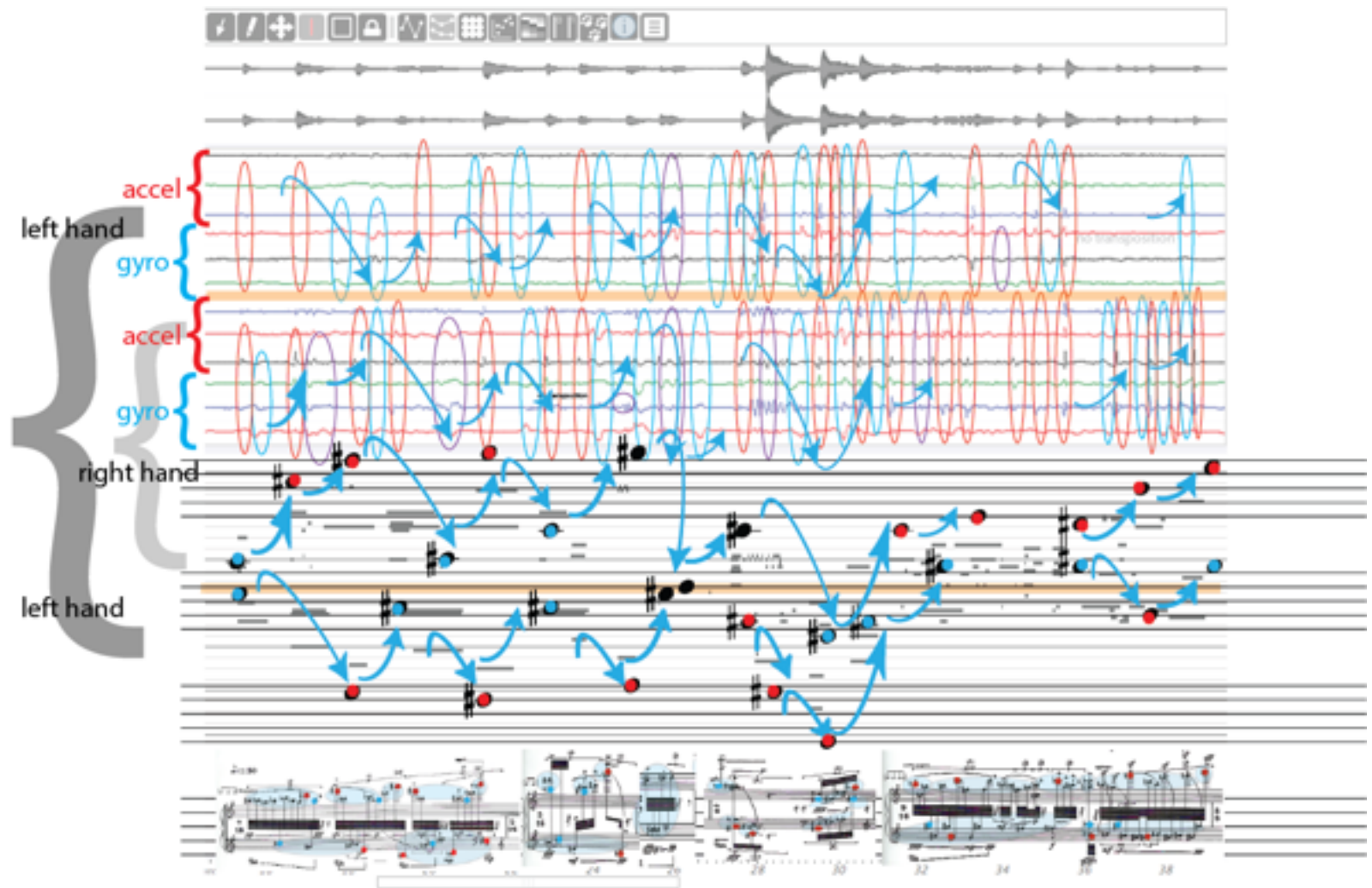
"Tou en hétéroclite" (Budelair)

Lemni-Icon-Epigram
for Maximilian Dornier

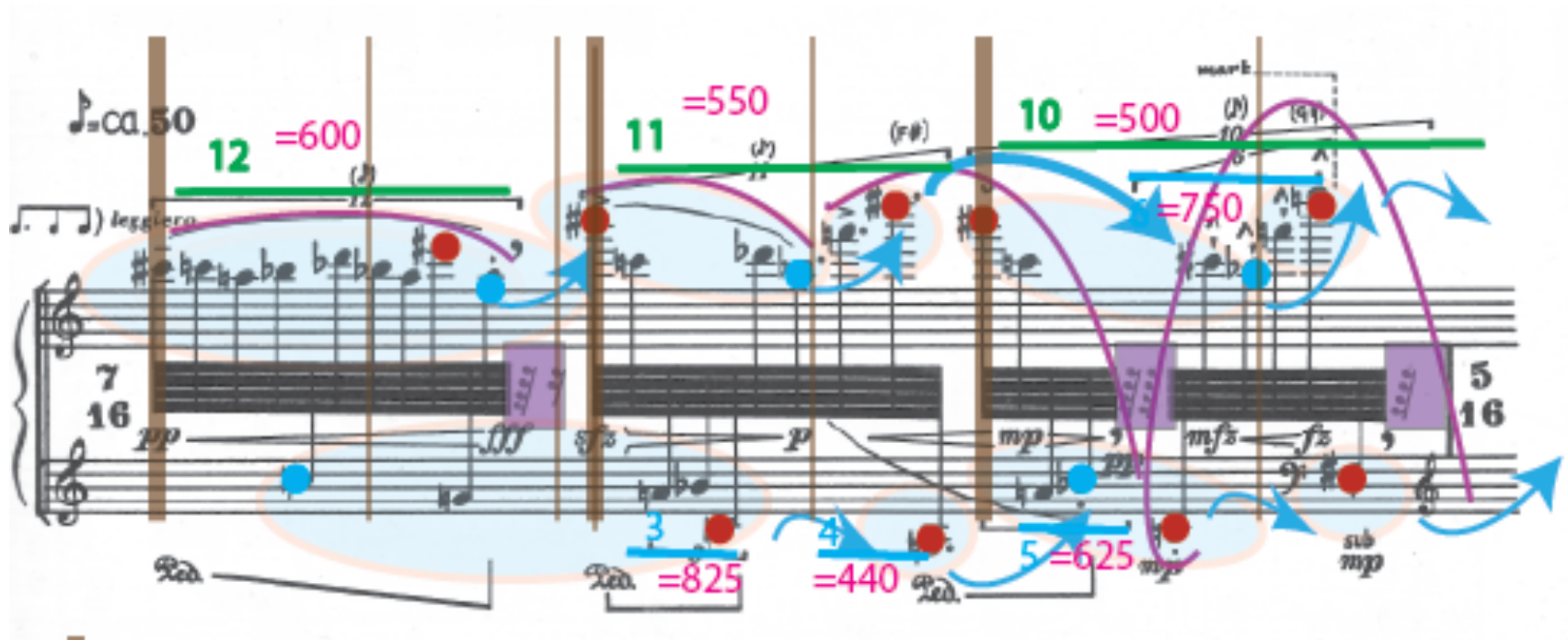
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mapping gesture on rhythm



"Tout est hiéroglyphique" (Baudelaire)

Lemma-Ikon-Epigram

For Massimiliano Damerini

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gestural clicktrack

7 5 2 3 9
16 16 8 8 16

The image displays a musical score for a gestural clicktrack. The top staff features a series of rhythmic marks, including eighth and sixteenth notes, grouped into measures. Above these marks are the numbers 7, 5, 2, 3, and 9, and below them are the numbers 16, 16, 8, 8, and 16. The lower staves show a complex arrangement of vertical lines, red and blue dots, and blue arrows, representing a gestural clicktrack. The red dots and blue arrows form a continuous, flowing pattern across the staves, indicating a sequence of gestures or clicks. The vertical lines are positioned at regular intervals, corresponding to the rhythmic marks in the top staff.

tool : GesTCom

interactive multimodal tablature
generated and controlled by gesture
augmented multimodal feedback
documentation of learning and performance

<https://www.youtube.com/watch?v=KV9nQUhhyul>

conclusion

action-oriented view of notation

new interfaces

human-machine interaction

gesture modeling

interactive multimodal tablature

gesture-to-notation mappings

real-time gestural processing of notation