Gesteme: gesture as a means to understand the fabric of contemporary music
Reflective Conservatoire Conference 2015

How is emotion communicated during the creation of a contemporary piece?
Can we find convergent gestural elements between conductors, musicians and dancers that may contribute to such emotional communication?

OUTLINES

- Overview of the setup complexity and creative process
- Present and discuss a novel systematic approach on music, gesture and emotion based on the concept of metaphor
- Relative scientific projects
- Preliminary observations

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09/01/2014   12:27
• **Gesteme** is analogous, gesturally to the phoneme, the most elementary unit in language in linguistics.

• **Objective:** identifying the building blocks of gestural communication to understand the creative & emotional processes in music performance.

• **Towards a new “prism”:** Our hypothesis is that gesture-based approach may facilitate the understanding of challenging contemporary music where semantic cues such as familiar tonalities fail.

• Two-year project
• Parallel process
  ▪ composers (1 year ½)
  ▪ dancers (8 months)
• Two-year project
• Parallel process:
  • Rehearsal (10 days)
• Two public performances

Bâtiment des Forces Motrices (BFM) Genève, Switzerland

• Rehearsal (phase 1)

• Rehearsal (phase 2)

• Public Performance

GESTÈME
Four sessions in motion
4 young composers
• Artur Akshelyan: Spring (cello & orchestra)
• Oriol Saladrigues: Summer (orchestra)
• Shen-Ying Quian: Autumn (orchestra)
• Elvira Garifzyanova: Winter (drums & orchestra)
  from Jarref's class of composition
GESTÈME
Four seasons in motion
4 composers
12 dancers
120 musicians
2 renowned artists

Pierre Bleuse
(director, HEM)
Anne Martin
(CNSMD)

from Conservatoire National Supérieure de Lyon
CNSMD

from Haute Ecole de Musique (HEM)
Geneva, Switzerland

Aesthetics of Pina Bausch

University of Geneva
> Swiss Center for Affective Sciences

Haute Ecole de Musique (HEM)
Conservatoire National Supérieur de Lyon (CNSMD)
University of Geneva
Music, Gesture & Metaphors

The relation between gesture and emotion lies in the fact that when a composer imagines music, most of the time there is a form of imagined and/or expressed bodily gesture [Godoy, 2003].

Conceptual Metaphors: Understanding one idea in terms of another

E.g. understanding quantity in terms of directionality

Prices are rising.

Change of frequency

The melody goes up and down

"Composing (with) Gesture"

Numerous composers today make references to "gestures". The aspect of movement in music has become an essential issue in creations by young artists [Donin, 2014].

<table>
<thead>
<tr>
<th>Conceptual Metaphors: Understanding one idea in terms of another</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music</td>
</tr>
<tr>
<td>A theme</td>
</tr>
<tr>
<td>A musical structure</td>
</tr>
</tbody>
</table>
Including body

The source domain of conceptual metaphors allows to talk about music with similarities to the spatial dimension which includes correlated physical and gestural aspects.

Revisiting the Lens Model

Understanding the relationships between music, emotion and gesture will suppose to characterize the link between the use of metaphorical language and aspects of our physical and sensory experience.
COMMUNICATING EMOTION IN MUSIC
Juslin et al. 2003 – Brunswik Lens Model

 expression of emotion

M

behavioural cues

perceived cues

L

attributed emotion

COMMUNICATING EMOTION IN MUSIC
Revisiting the Lens Model: Glowinski et al. 2014

expression of emotion

M1

behavioural cues

perceived cues

L

attributed emotion

M2

Mn

GESTEME Conceptual Framework

composer

musician

listeners

• Ideas
• Gestures
• Conceptual metaphors

• Gestures when playing
• Gestures and movements like dance.
• Embodiment and body metaphors.

Methods

• Questionnaires
• Multimodal recordings

How can we use new technologies for inferring useful information from gesture?

Tools & Method

GESTEME Conceptual Framework

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• Ideas
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• Questionnaires
• Multimodal recordings

Video/audio/Motion Capture

GESTEME Conceptual Framework

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Methods

• Questionnaires
• Multimodal recordings

Video/audio/Motion Capture
• Recent trend of research investigating non-verbal communication process within music ensemble

Glowinski et al. 2013, 2014; Gnecco, Glowinski et al. 2013; D’Ascola et al., 2012

• String Quartet

• Orchestra

Relative studies

✓ Impact of joint activity on individual expressive performance

✓ Impact of expressive perturbation on group coordination
  [Glowinski et al., Journal Multimodal User Interfaces 2014]

✓ Impact of task complexity on sensorimotor communication
  [Badino et al., Journal of Neuropsychology 2013]

✓ Impact of music style writing on leadership patterns

✓ Impact of Audience behaviour on expressive gesture
  [Glowinski et al., EAI Transactions on Creative Technologies, 2015]

Gesture analysis

- Impact of expressive perturbation on group coordination

Which behavioral cues explain the difference between a creative performance and a simply correct - but «cold» - performance?

CONCERT-LIKE

PERTURBATED

■ Impact of expressive perturbation on group coordination

[Glowinski et al., Journal Multimodal User Interfaces 2014]

Ear

Partial Point of Convergence

Total Point of Convergence

1st vel.

Marginal higher convergence of gestures towards the ear in concert-like condition

Marginal lower variability of gesture convergence towards the ear in perturbed condition
Impact of joint activity on individual expressive performance


Impact of expressive perturbation on group coordination

[Glowinski et al., Journal Multimodal User Interfaces 2014]

Impact of task complexity on sensorimotor communication

[Badillo et al., Journal of Neurophysiology 2013]

Impact of music style writing on leadership patterns


Impact of Audience behaviour on expressive gesture

[Glowinski et al., EAI Transactions on Creative Technologies, 2015]

**RESULTS**

<table>
<thead>
<tr>
<th>Factors</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition* Solo vs Ensemble, p &lt; .001</td>
<td>Perception*</td>
</tr>
<tr>
<td>Music Segment* (p&lt;.001)</td>
<td>Perceived Condition (Solo vs Ensemble)</td>
</tr>
<tr>
<td>Display* Video vs mocap, p &lt; .001</td>
<td>Level of confidence</td>
</tr>
<tr>
<td>Subjects* Musician vs non-musician, p &lt; .001</td>
<td>Level of emotional expression</td>
</tr>
</tbody>
</table>

* Statistical significant difference (test with LMM-model)

**Automatic Analysis**

Nonverbal Expressive behaviour from production to perception

- Automatic description of static and dynamic non-verbal behavioural information
  - Non-linear spatiotemporal characteristics of expressive musicians’ gestures

[Glowinski et al., Journal on Multimodal User Interfaces, 2013]

**GESTEME**

Expressive gesture analysis: from production to expression

- Modeling perceptual and brain processes underlying decoding of non-verbal expressive information
  - Evaluating contribution of spatial and dynamic properties of biological motion
Relative Studies

- Impact of joint activity on individual expressive performance
  [Glowinski et al., Proceedings of Pw, 2005; Glowinski et al., Percussive 2014]
- Impact of expressive perturbation on group coordination
  [Glowinski et al., Journal Multimedia User Interfaces 2014]
- Impact of task complexity on sensorimotor communication
  [Badino et al., Journal of Neurophysiology 2015]
- Impact of music style writing on leadership patterns
  [Glowinski et al., Sound Behaviors in Music, ACM 2017]
- Impact of Audience behaviour on expressive gesture
  [Glowinski et al., UIST Transactions on Creative Technologies, 2016]
**FACING the AUDIENCE in Virtual Reality Environment (BBL-IS)**

**M**

- Behavioural Cues
  - Expression of emotion
  - Attribution of emotion

**L**

- Perceived cues

**Context?**

**Musician** → **Observer**

**COMMUNICATING EMOTION IN MUSIC**

Revisiting the Lens Model: Glowinski et al. 2014

**GESTEME**

Expressive gesture analysis: from production to expression

- Automatic description of static and dynamic non-verbal behavioural information
- Using virtual reality setup to manipulate the context (e.g., light, audience)

High acceleration peak, jerk trajectories vs low acceleration peak, smooth trajectories.

Movement body pattern (spatio-temporal characteristics).

Automatic description of static and dynamic non-verbal behavioural information.

Using virtual reality setup to manipulate the context (e.g., light, audience).

RESULTS (1)

EFFECT OF EMOTIONAL EXPRESSIVITY

- Empirical evidence of body kinematic changes underlying emotional expressivity

RESULTS (2)

Refined analysis of body limb kinematic energy to get a detailed profile of movement activity.

METHOD

Participants

FACETING the AUDIENCE in Virtual Reality Environment (BBL-IS)

RESULTS (1)

EFFECT OF EMOTIONAL EXPRESSIVITY

- Empirical evidence of body kinematic changes underlying emotional expressivity

RESULTS (2)

Refined analysis of body limb kinematic energy to get a detailed profile of movement activity.

GESTEME

Expressive Gesture Analysis: From Production to Expression

Mimicry Project

Scientific Team:
- Professore D. Grandjean
- C. Jansen
- M. Ruppel
- Senior Researcher D. Delplanque
- D. Glowinski
- Student A. Collignon

Real-time data visualization: D. Glowinski

11/04/15
Coming back to GESTEME

Video & Motion Capture to characterize the conductor’s expressive gesture and existing exchanges between him and the musicians.

Thermography: to study skin temperature fluctuations of audience, which are linked to peripheral blood flow, a physiological component of emotion.

Preliminary observations
• Multi-faceted functions of the conductor gesture

| coordination |
| illustration |
| embodiment |
| expression |

[ref]
GESTEME
Preliminary observations

- Multi-faceted functions of the conductor gesture
  - coordination
  - illustration
  - embodiment
  - expression

How did conductor Pierre Bleuse accompany musician to these new music creations / new languages?

Conductor / musicians issue: Gestural communication may be achieved to foster the musicians' physical involvement and lead them to discover unexplored instrumental performance.

Gesture evolution over the period of rehearsal until the final public performance from Spring (public concert)
Conclusion

CONCLUSION
Multimodal corpus

- Presentation of a multidisciplinary approach supporting *metaphor* as an *emerging key concept* to investigate music & emotion.
- A multimodal & annotated corpus
- A set of tools for mixed-analysis combining qualitative and quantitative approaches

CONCLUSION
Institutional issues

- Our approach may also support Sloboda’s concerns and initiatives to make classical music available to a wider audience [Reflective Conservatoire.]
- Guidelines for multidisciplinary & multi-institutional collaborations

CONCLUSION
Future work

- Towards a more *systematic* approach to assess convergence in music/gesture mapping in musicians & dancer body expression
- Investigate *context-sensitivity* of such gesture expressivity: do body expression, music interpretation or dance expression contaminate one another during co-rehearse processes?

CONCLUSION
A New Research Center on Music & Emotion GEM

- **GEM**
- University of Geneva  Haute Ecole de Musique (HEM)
- e.g. Virtual Immersive Environment for Performance Evaluation

ACKNOWLEDGMENT

Team

- Alessia Panessia
- Samuel Albert