



3rd workshop on Social Behaviour in Music

ACM ICMI 2012 – 26th October

Can naïve observers distinguish a violinist's solo from an ensemble performance? A pilot study

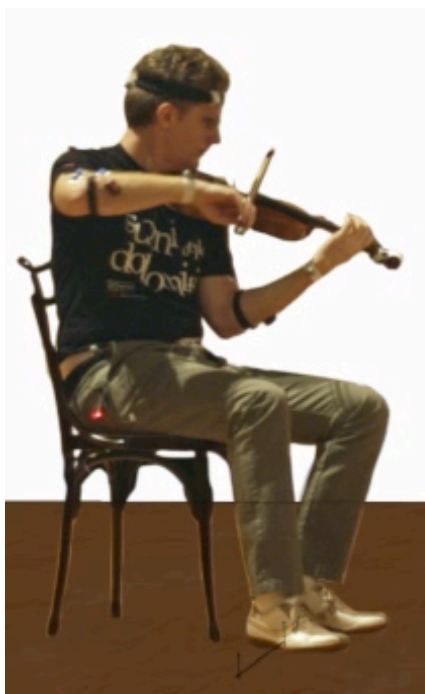
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³ DISFOR (UNIGE, Italy)

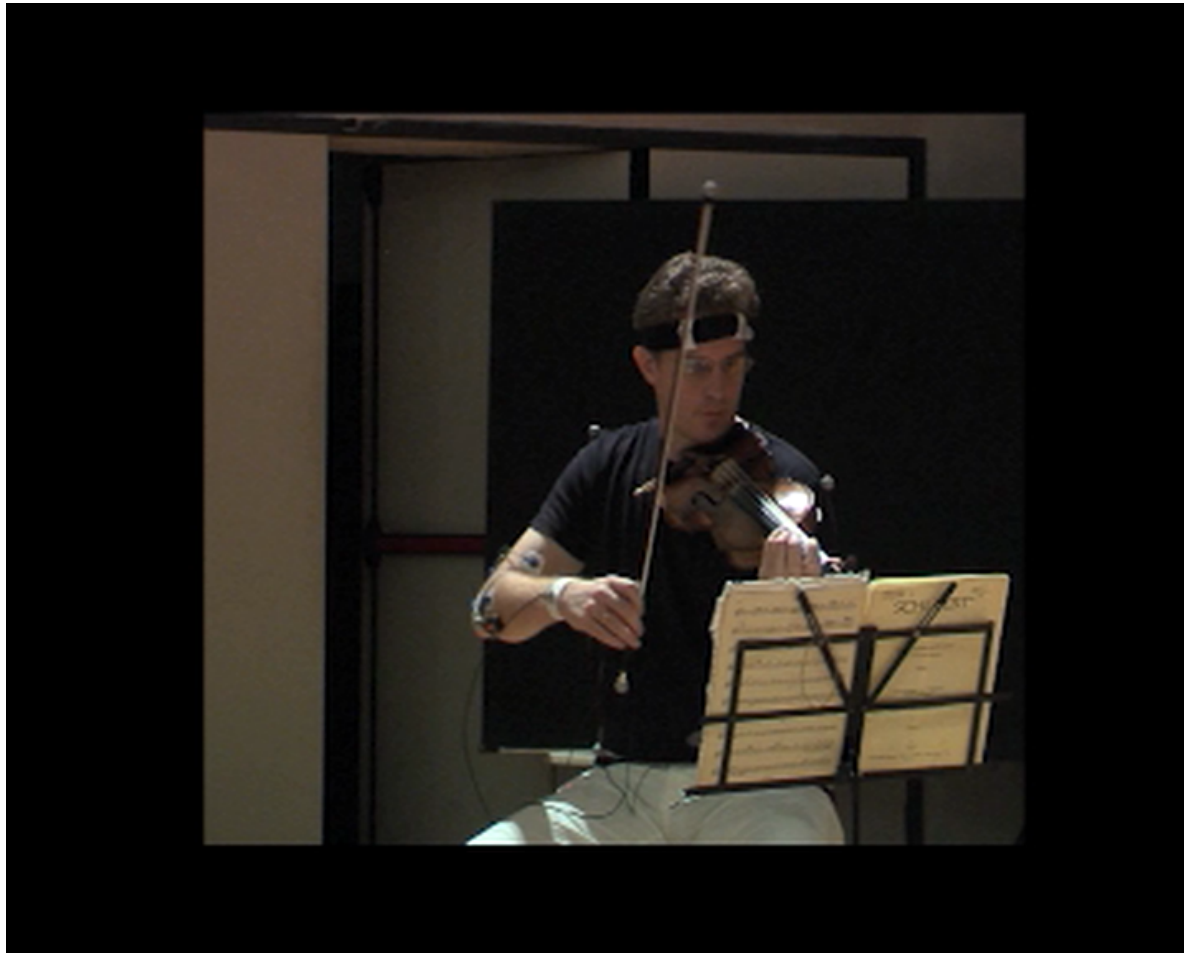
Solo or...



Ensemble



Test: Solo or Ensemble?



Test: Solo or Ensemble?



Research Question

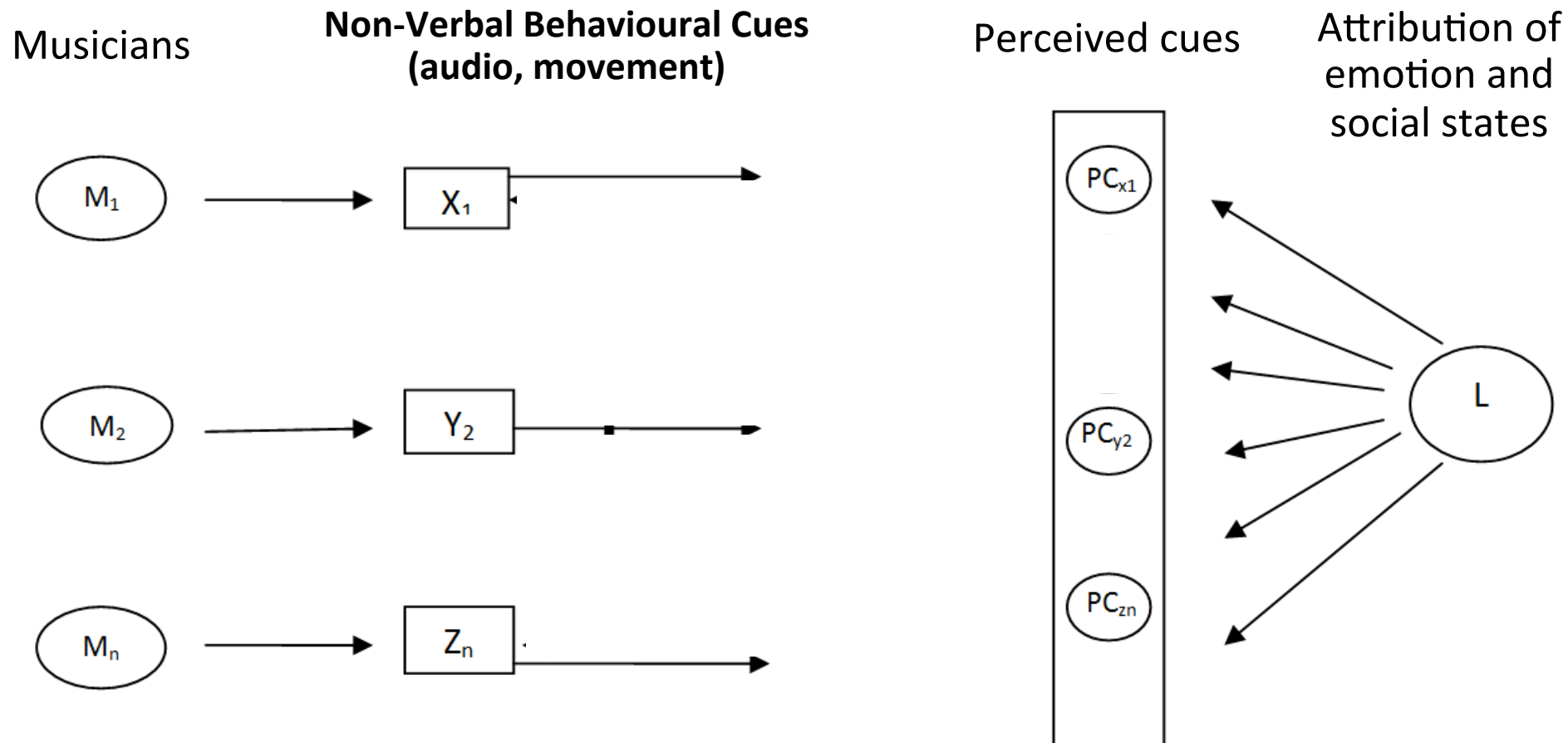
- Are they non-verbal behavioural variables that enable to distinguish between performing an action alone or jointly in a group?

Hypothesis

- Playing music jointly with others may affect individual behaviour.
 - Joint performance requires strategies to cope with others' actions and to adapt one's behaviour accordingly. [Knoblich et al. 2011](#)
- Auditory and visual non-verbal behavioural cues may help in distinguishing between a solo and a group performance
 - Non verbal cues, potentially used by the audience characterize the social behavior and the emotional reactions of musicians. [Keller et al. 2010](#)

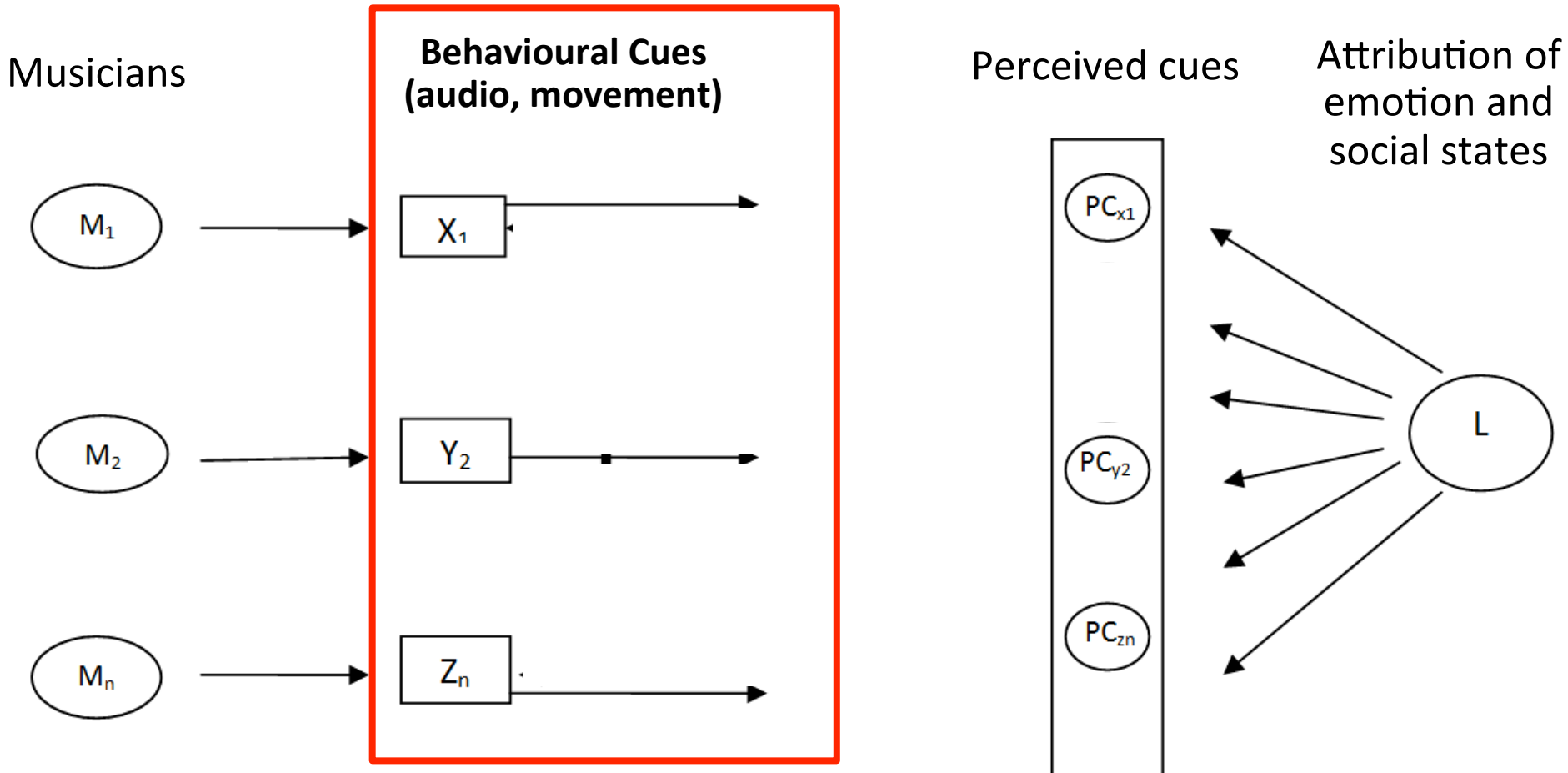
Communication performers/observers

Adapted Lens Model [Juslin & Lindstrom, 2010](#)



Communication **performers**/observers

Adapted Lens Model [Juslin & Lindstrom, 2010](#)



Behavioural cues in music performance

1) key gestures using upper-body parts [**examples**]

-Examples

- head's nod to indicate a synchronous start [Davidson 2005](#)
- gaze interaction to capture co-performers' attention [Thompson 2005](#)

- dynamic aspects of motion features are complementary to postural and gesture shape- related information [Castellano 2008](#)

- self-explanatory gestures (e.g., nods) Vs. specific gestures typical of musicians [Davidson 2005](#)

Behavioural cues in music performance

2) long-range behavioural variations

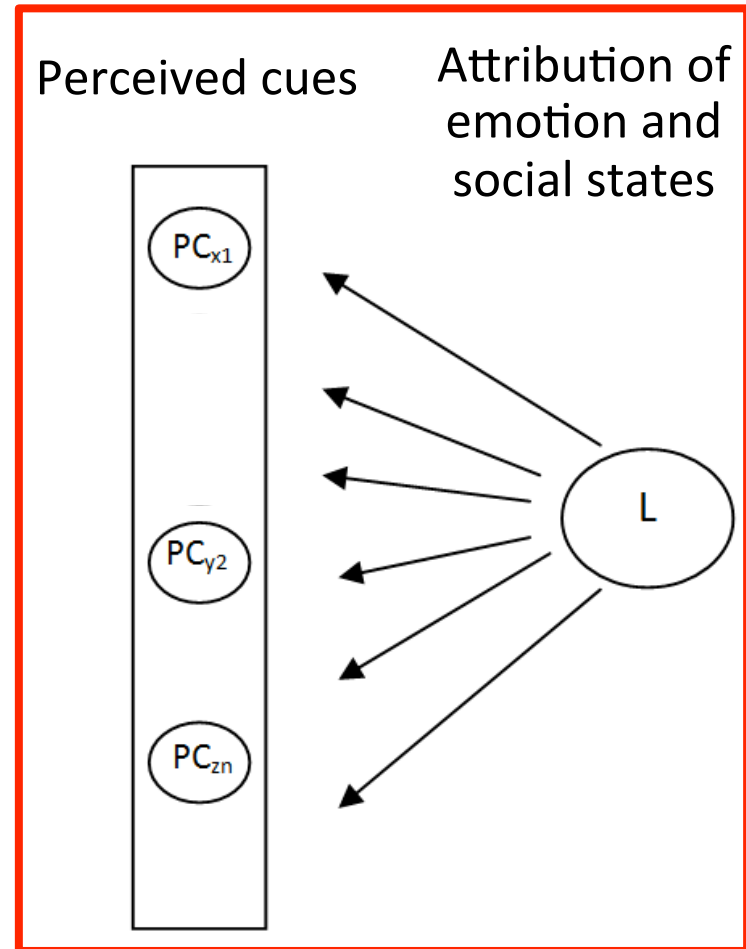
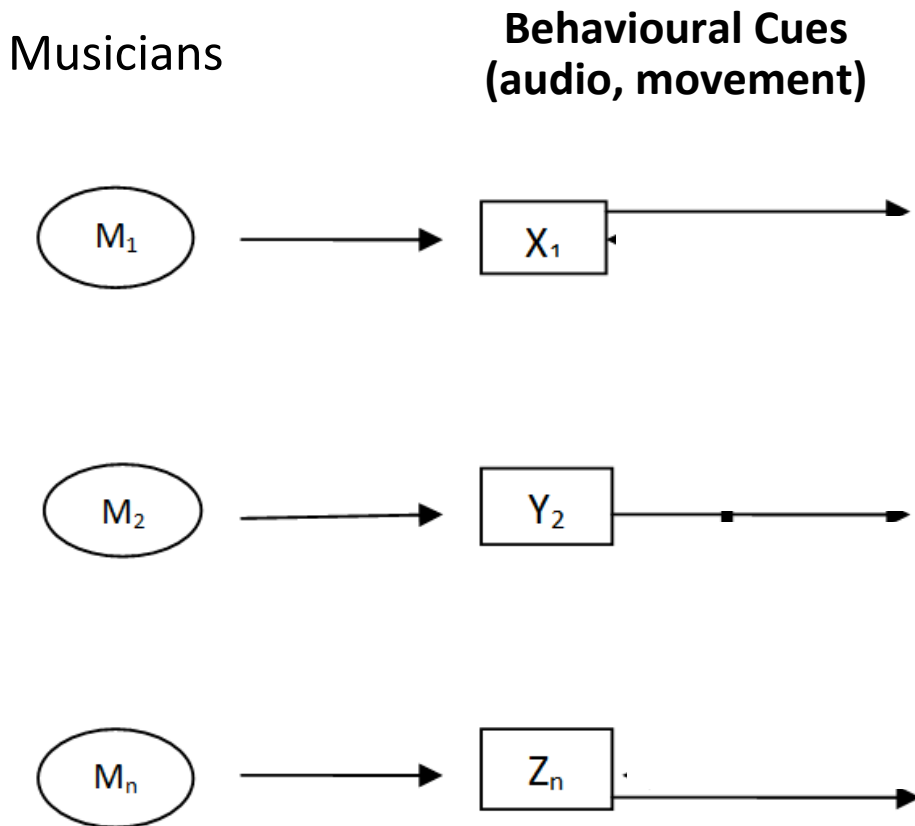
- gradual and not salient (different from key gestures)

- refer to implicit adaptation and co-ordination processes of musicians during the performance

[Glowinski et al. 2010](#), [Varni et al. 2011](#), [Panos et al. 2012](#)

Communication performers/**observers**

Adapted Lens Model [Juslin & Lindstrom, 2010](#)



Perceptual Experiments

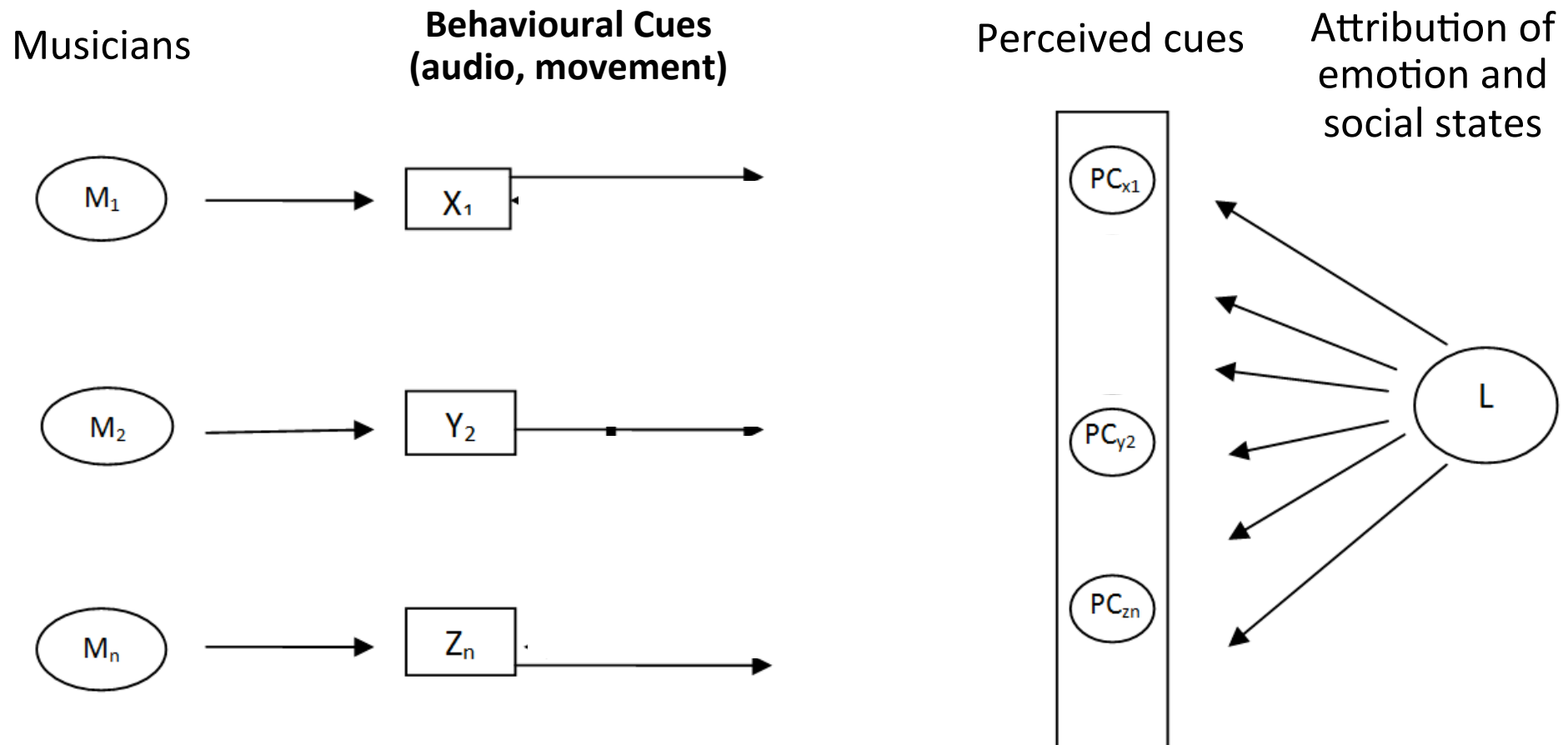
- Multimodal features are used in the evaluation of music performance expressivity [**examples**]
 - Audio features (e.g., timing) [Juslin 2005](#)
 - Video features (e.g., energy) [Vines et al. 2006](#)
- Specific contributions of body parts and kinematic information for communicating expressivity
 - Video-processed material [Dahl et al 2007](#)
 - Point light display [Keller et al. 2010](#)

What about the effect of playing with an ensemble?

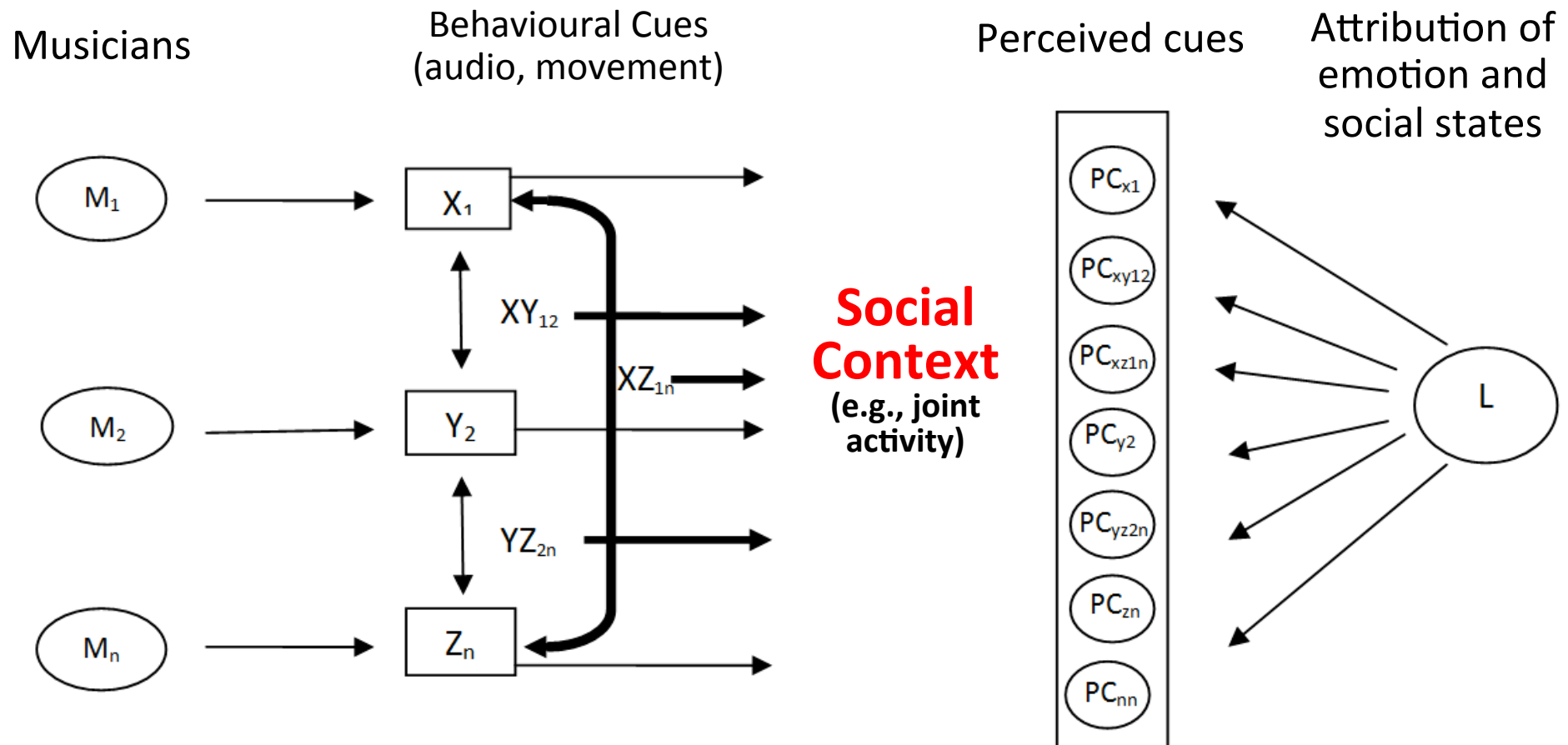
- How joint activity of musician may impact upon the observer's perception?
- > **Revisiting** adapted Lens Model under a social perspective

Adapted Lens Model

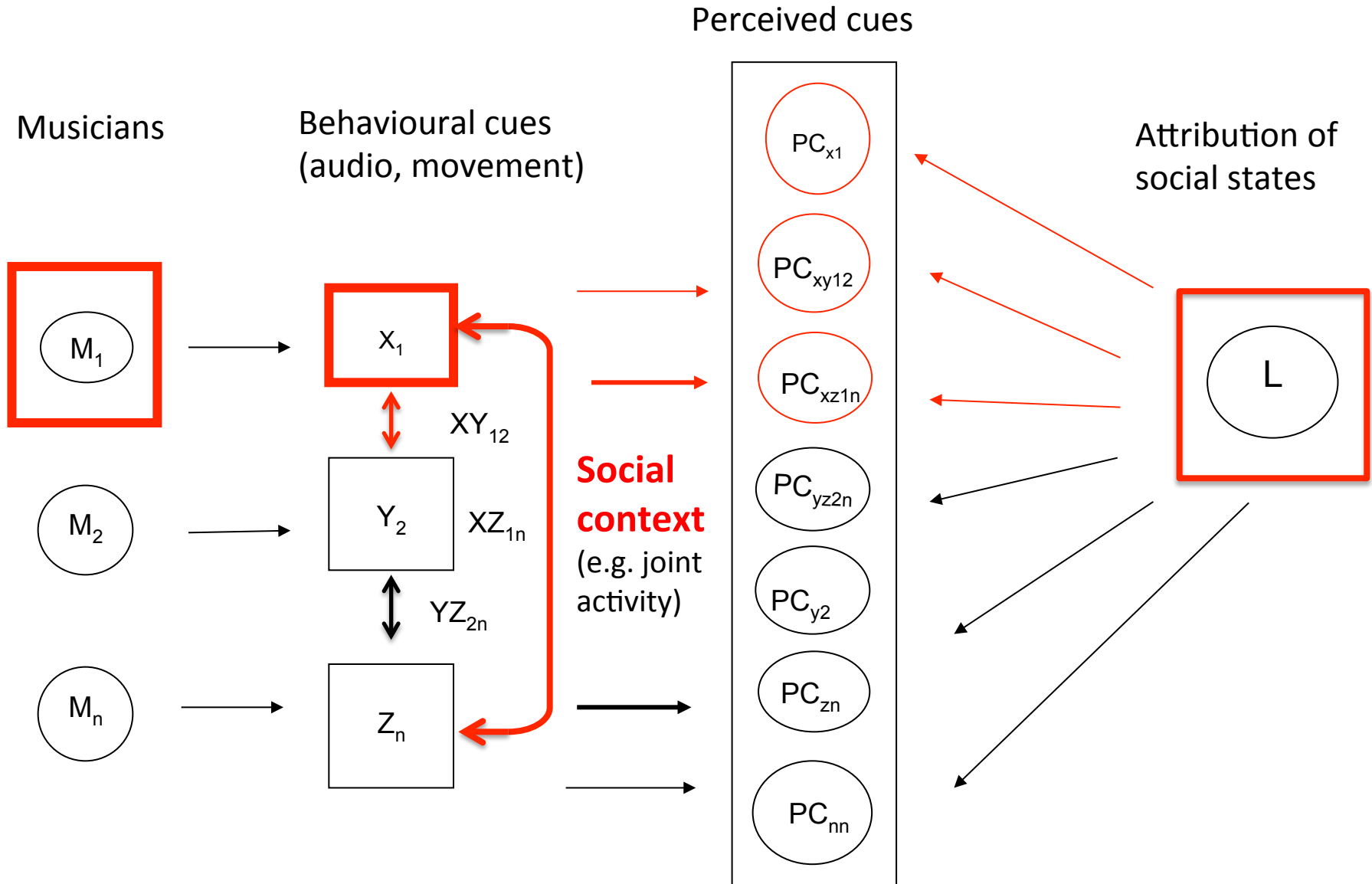
(Juslin & Lindstrom, 2010)



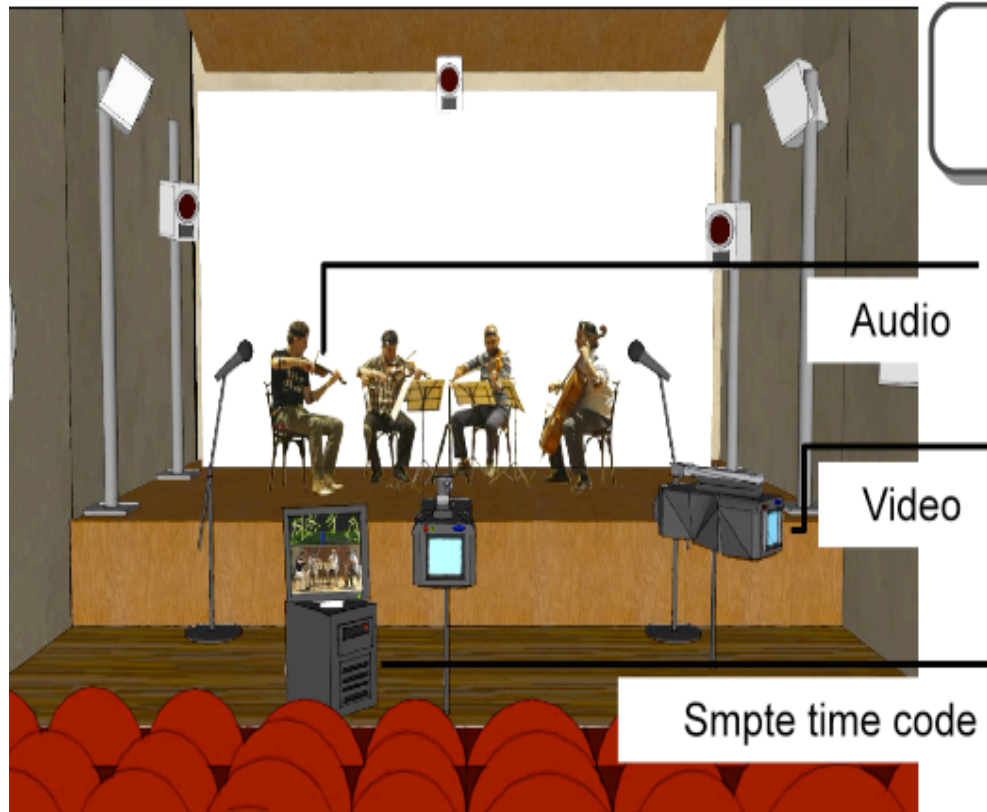
Revisited Lens Model



Revisited Lens Model



Stimulus



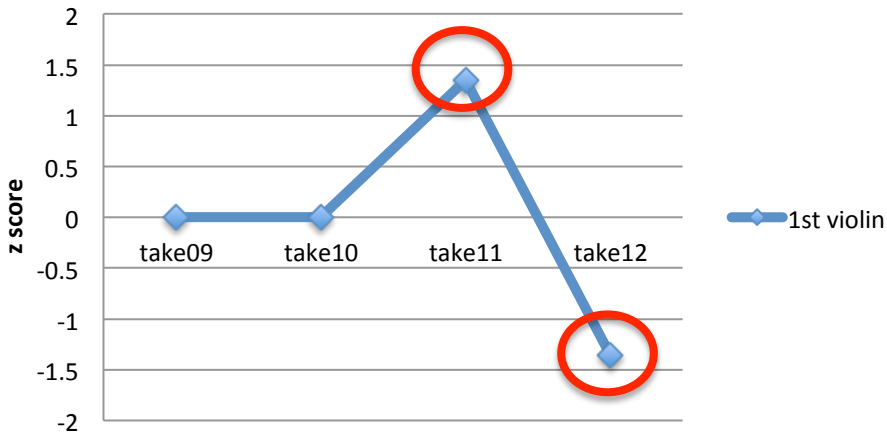
Synchronized Audio-Video Material
used for the perceptual experiment



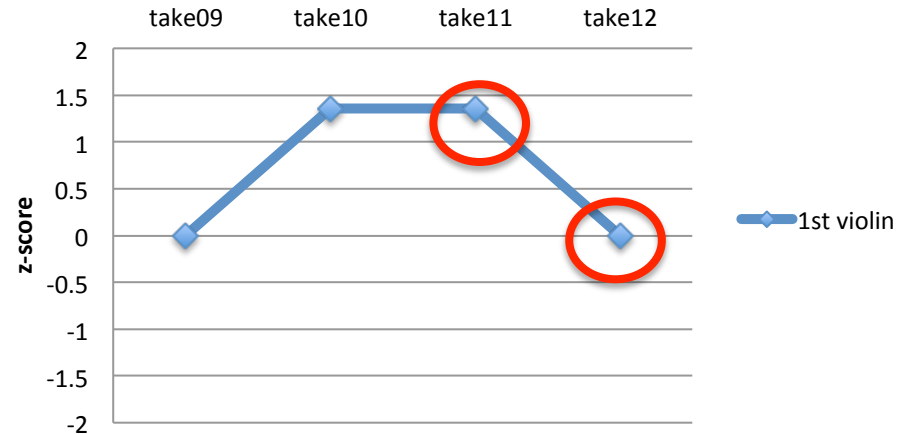
Stimulus

- **60** Selected Audio/Video samples represent a broad range of expressive performance (see post-performance ratings)

Satisfaction



Expressivity



Experimental Design

Factors (IV)

- Condition (Solo Vs Ensemble)



- Music Segment



Measure (DV)

Perception

- Perceived Condition (Solo Vs Ensemble)
- Level of Confidence (0 -> 100)

Emotion

- 9 GEMS dimension (0 -> 100)

Wonder
Tenderness
Tension
Sadness
Transcendence
Joyful
Activation
Nostalgia
Power
Peacefulness

Body features

- Final Report

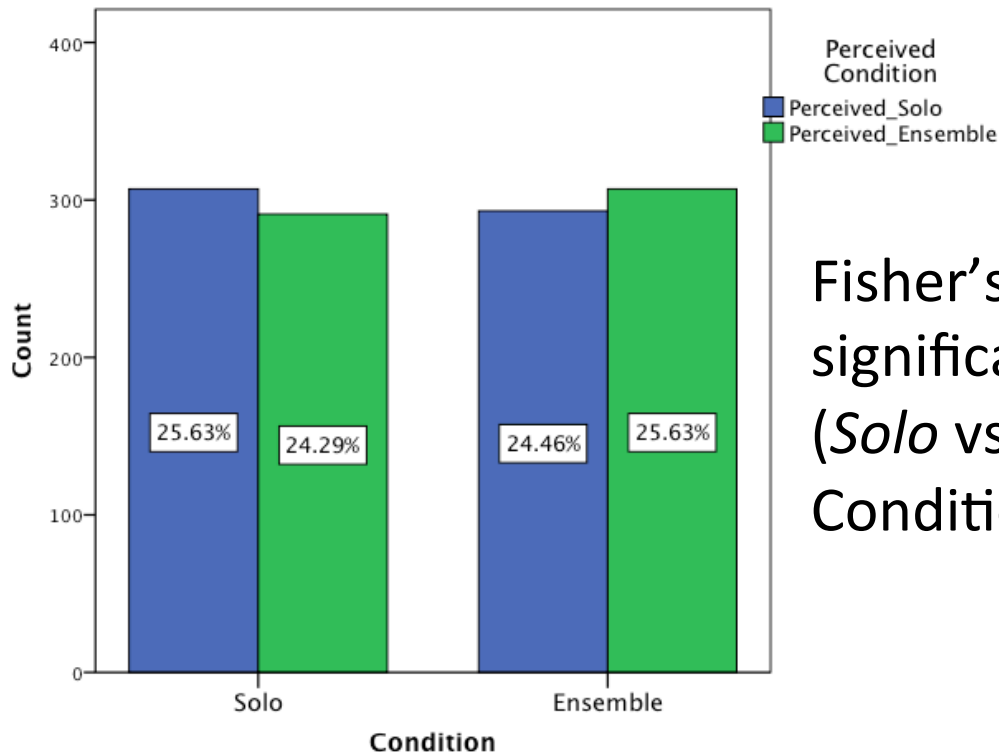
Participants

- 20 participants (5 males) from the University of Geneva
- Mean age 23.3 ± 2.9 years, range 18–31
- Experiment duration : 1h20

Results

- Did participants successfully **distinguish** between *Solo* Vs *Ensemble* performance?

> **no**



Fisher's exact test showed no significant association of Condition (*Solo vs Ensemble*) with the Perceived Condition

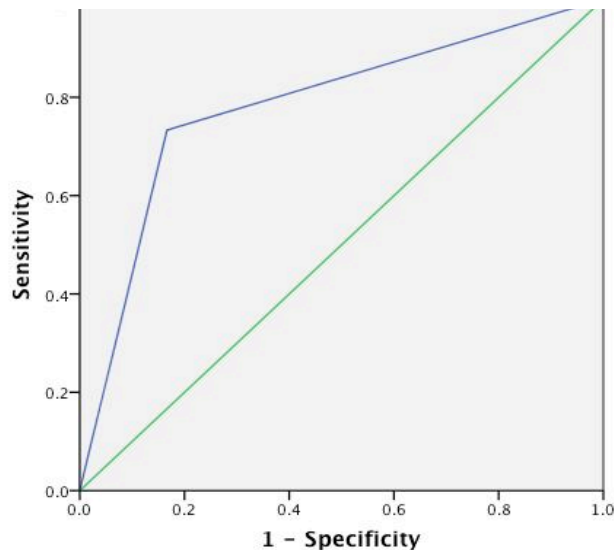
Results

- Was it possible to correctly distinguishing between the two conditions?

> **yes**

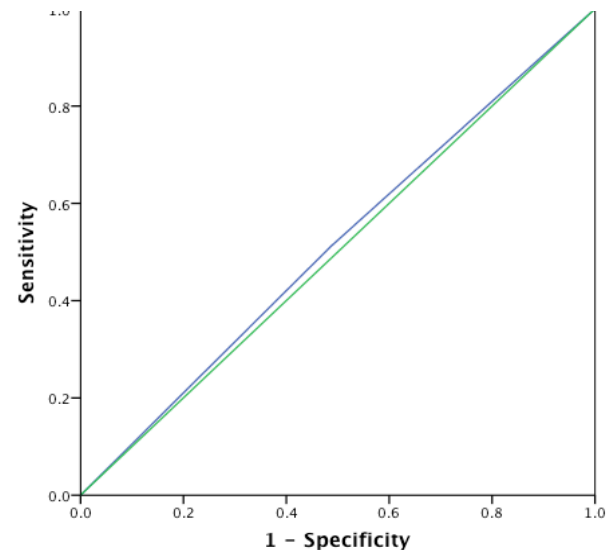
Received Operator Characteristics (ROC) curves were employed to assess each participant's "diagnostic" **accuracy**

Successful participant (AUC = .783)



Diagonal segments are produced by ties.

Not successful participant (AUC= .513)



Diagonal segments are produced by ties.

Results

- Analysis of the participants' ratings suggest they may adopt **strategies** to decode social behaviour

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Generalized Linear Mixed Model (GLMM) to study fixed effects of Condition on *Level of Confidence*, *Music Segment* and *Emotion*

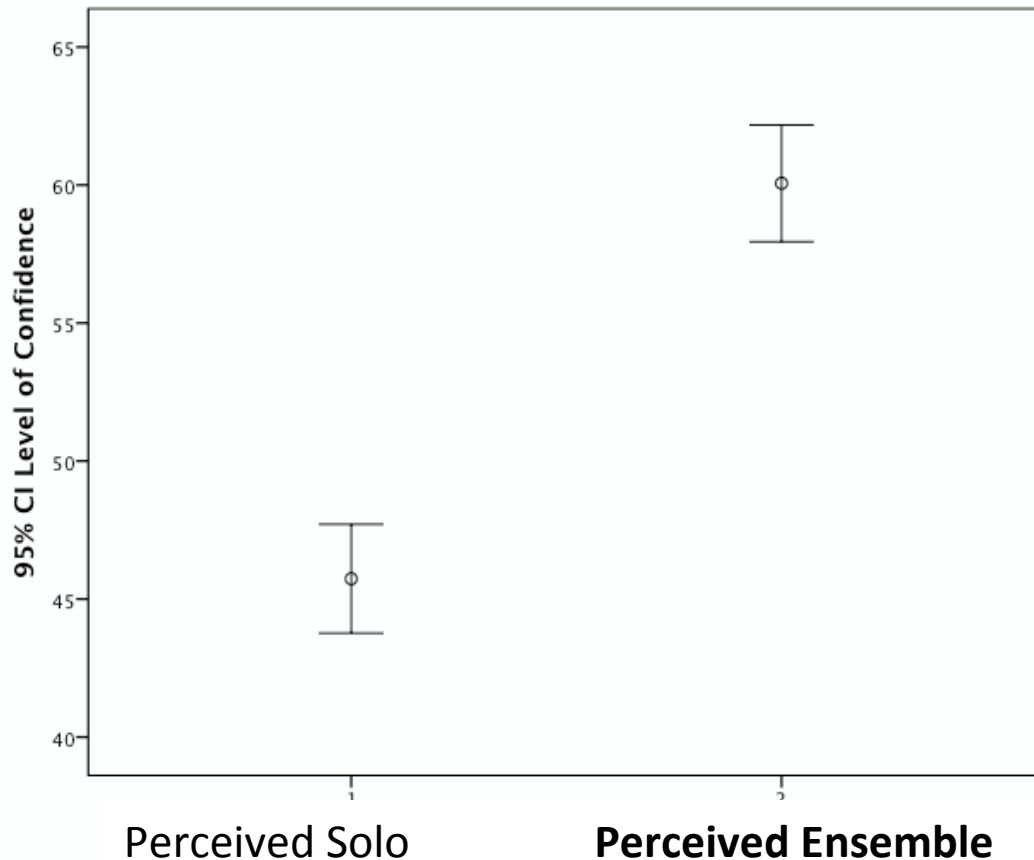
Fixed Effect				
<i>Target: Answer (Perceived_Solo vs Perceived_Ensemble)^a</i>				
<i>Source</i>	<i>F</i>	<i>df1</i>	<i>df2</i>	<i>Sig.</i>
Level of Confidence	4.959	1	976	.026
Music Segment	7.968	4	976	.000 ^b
Condition x Sadness	9.941	1	976	.002
Condition x Nostalgia	9.128	1	976	.003
Level of Conf. x Tenderness	4.033	1	976	.045
Segment x Joy	4.409	4	976	.002
Segment x Serenity	2.493	4	976	.042

Level of Confidence

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Level of Confidence

- Higher confidence level when reporting first violinist's performance as being within an **Ensemble**



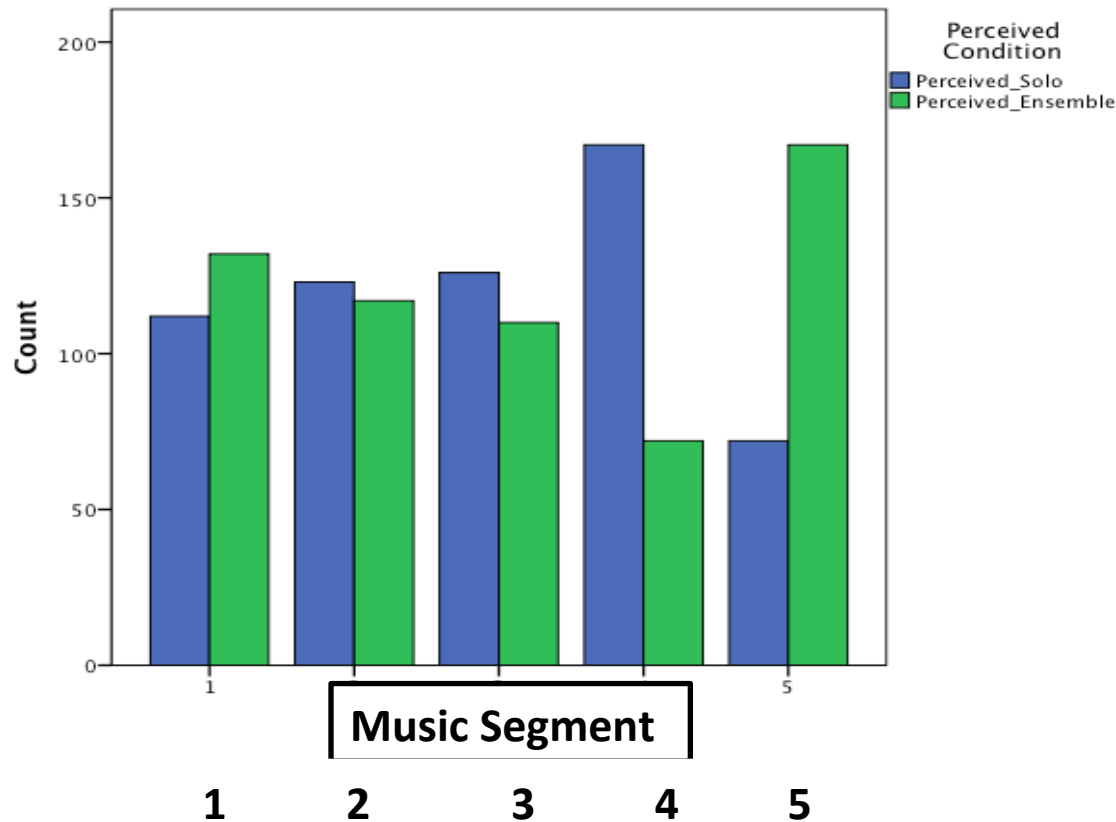
Level of Confidence on perceived condition (solo vs ensemble)

Music Segment

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Music Segment

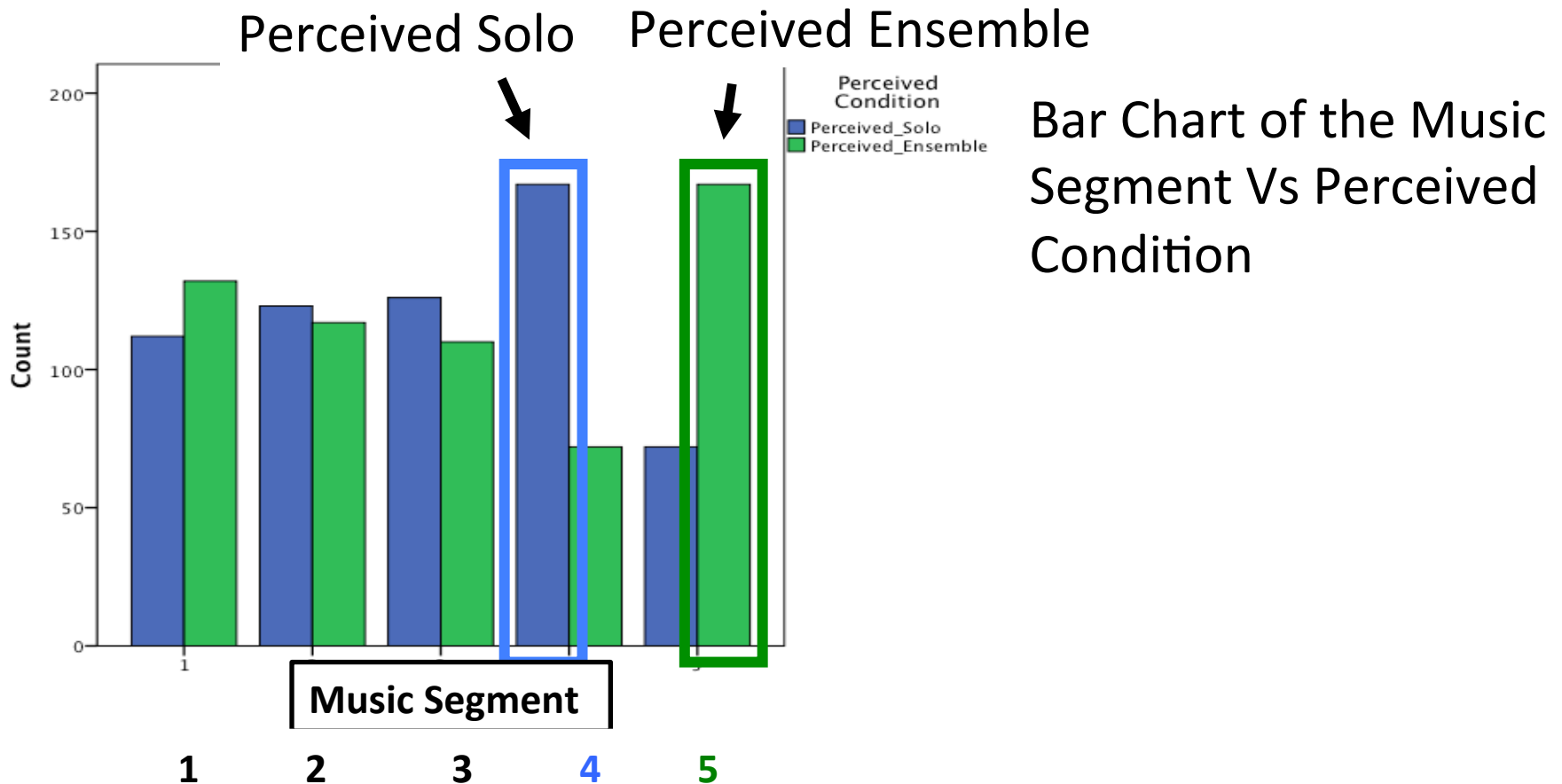
- Music Segment effect on participants' judgments.



Bar Chart of the Music Segment Vs Perceived Condition

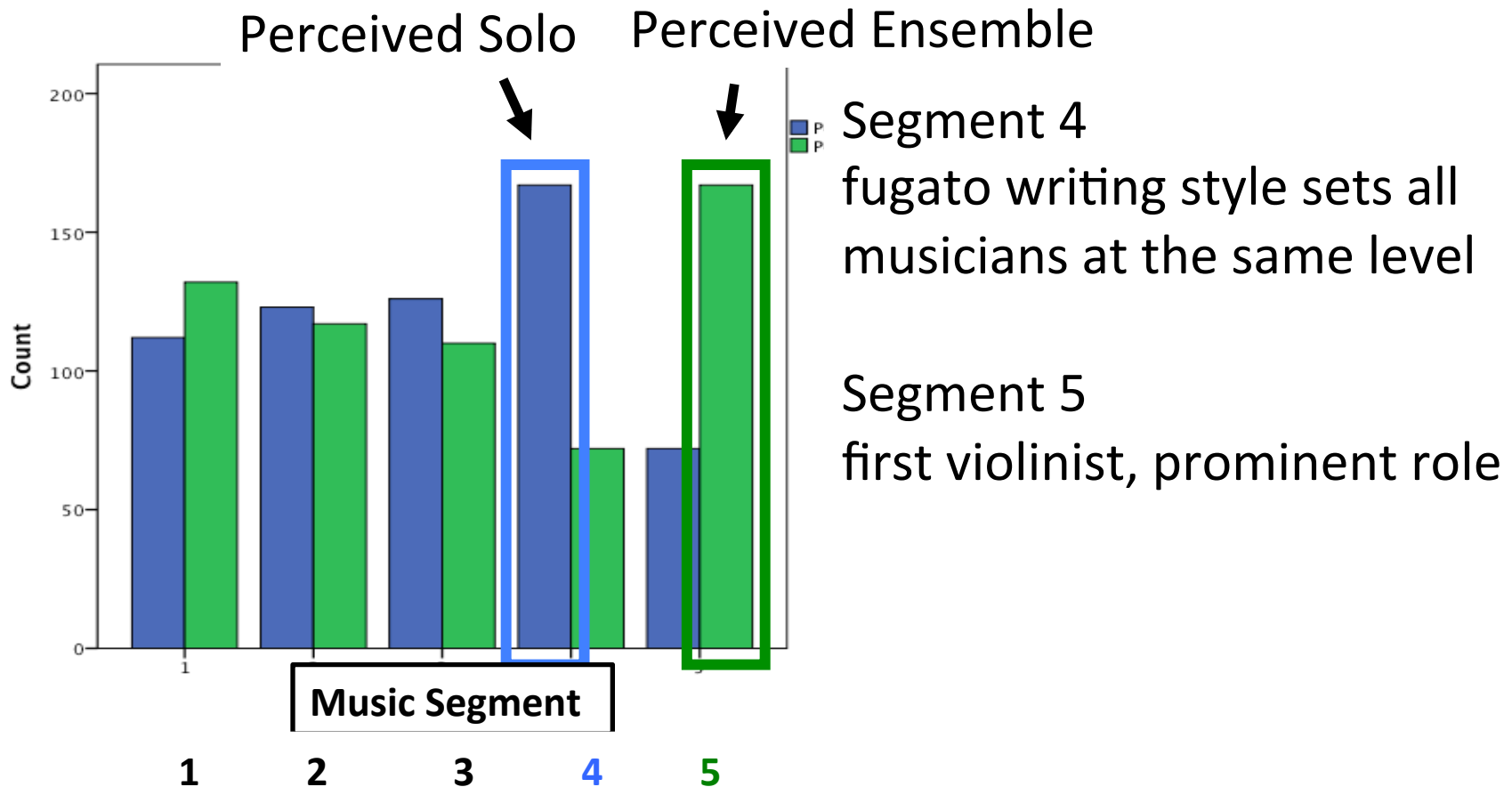
Music Segment

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Emotions

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Emotions

- Emotions effect on participants' judgments:
- ✓ ***Joy*** and ***Serenity*** more frequently associated with Solo condition
- ✓ Significant positive correlation between ***Tenderness*** and level of confidence when correctly recognizing Ensemble condition
- ✓ Higher ratings of ***Nostalgia*** and ***Sadness*** when correctly recognizing Solo and Ensemble condition

Emotions

- Emotions effect on participants' judgments:
- ✓ *Joy* and *Serenity* more frequently associated with Solo condition => emotion as a social marker?
- ✓ Significant positive correlation between *Tenderness* and level of confidence when correctly recognizing Ensemble condition
- ✓ Higher ratings of *Nostalgia* and *Sadness* when correctly recognizing Solo and Ensemble condition
=> arousal of emotion related to self-confidence
in social judgments?

Conclusion

- A first attempt to investigate perception of social behaviour in music performance
 - original experimental procedure (Solo Vs Ensemble)
 - Revisiting model of communication between observer / performers
- Reveal possible strategies of non-expert to decode social behaviour based on non-verbal cues

Future work

- Possible tracks for future research include:
 - (i) addressing one modality at a time
 - (ii) addressing experts (creation of focus group)
 - (iii) correlating the results of the perceptual experiments with automated behavioural analysis of musicians.

