From Rehearsal to Performance:

Ensemble Learning in Open Orchestra and Distributed Rehearsal for World Opera

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Long-Distance Mentoring
(Stratford – Manhattan School of Music)

Wieslaw Woszczyk writes:

"Pace [was] coaching a student trumpet player at the MSM using the Polycom. The latency was workable (200-300 ms perhaps)."

Nota Bene: Technological Demands Differ

mentoring

≠

rehearsal or performance

"Playing Together" experiment*

New York-Ottawa, Remote Masters class, Dec. 8, 2000

Pinchas Zuckerman,
Columbia U, NYC

Wu Ji,
Canarie ARDNOC, Ottawa

*used Litton MPEG-2 codec @ 10 Mbps

or put another way...

Latency:
The Interaction-Killer

Real World Communication Latencies

acceptable telephony[1]

typical H.264[3]

(real videoconferencing systems)

idealized MPEG[2]

acquire *compress* *transmit*

0 20 40 60 80 100 120 140 160 180ms

light speed: Montreal-LA

light speed: anywhere on earth

AVC-Intra

uncompressed video

DV over IP

1. ITU standard G.114 for acceptable conversation quality.

2. Includes only buffering time for one frame of NTSC video, as required for forward frame prediction, and assumes zero encoding and decoding delay.

3. Average measurement of Apple iChat on a local 1 Gbps connection; Xmeeting (H.264) obtained latency of 140 ms with significantly degraded quality; a Polycom (H.263+) hardware unit yielded measurements of 255 ms latency.


Tromsø
Video: 175 ms – Audio: 135 ms
Montreal
Video: 75 ms – Audio: 35 ms
San Francisco
New York
Video: 100 ms – Audio: 60ms
“performers deal rather well with [latency], but they certainly need time to adjust”
Image from Google maps

Ultra-Videoconferencing:
Low-Latency for Musical Interaction

RISQ ‘01

McGill-Ottawa, Feb ‘02

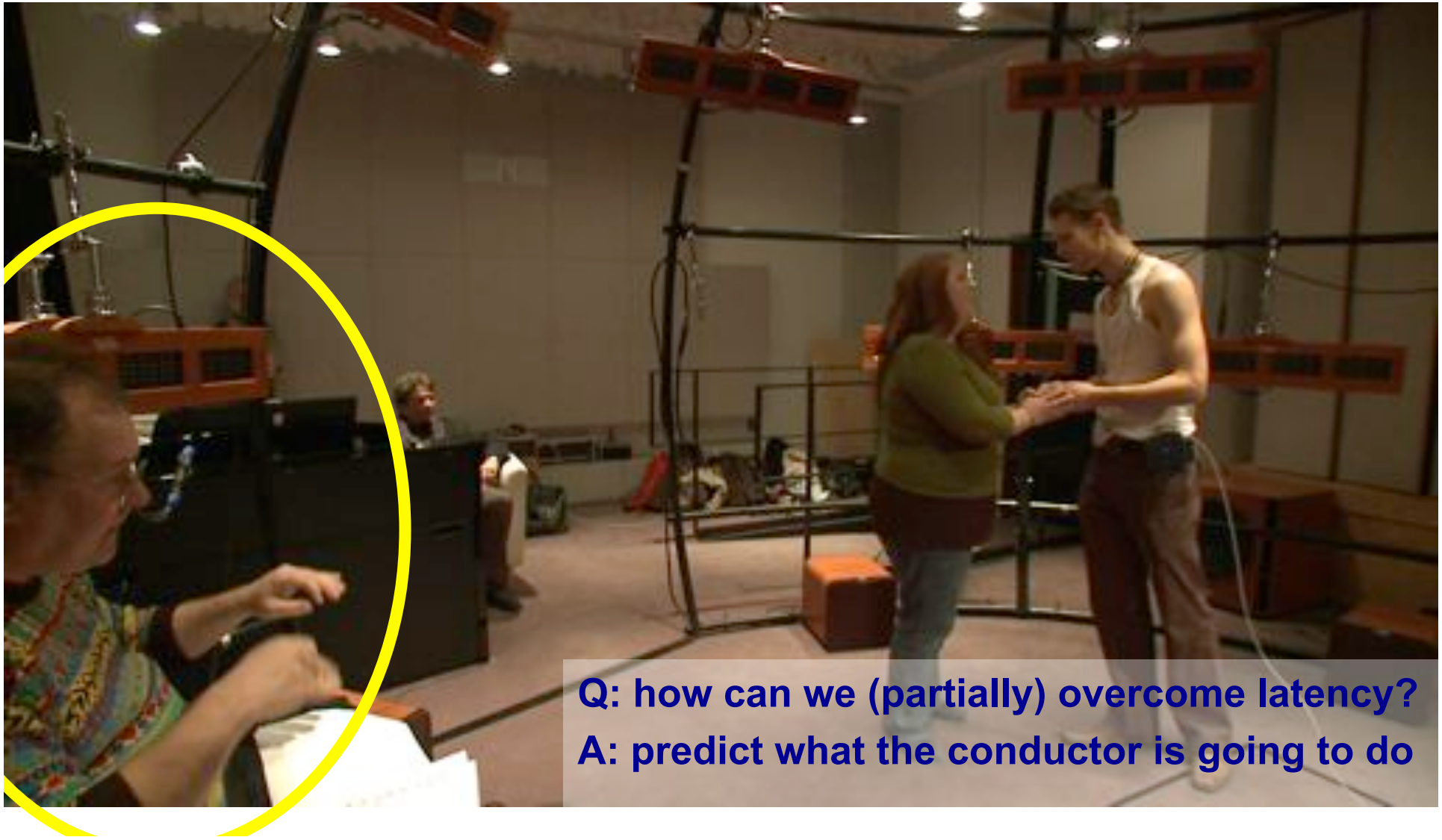
McGill-CCRMA Oct‘02

ultravideo.mcgill.ca/download.html

Ultra-Videoconferencing:
Low-Latency for Musical Interaction

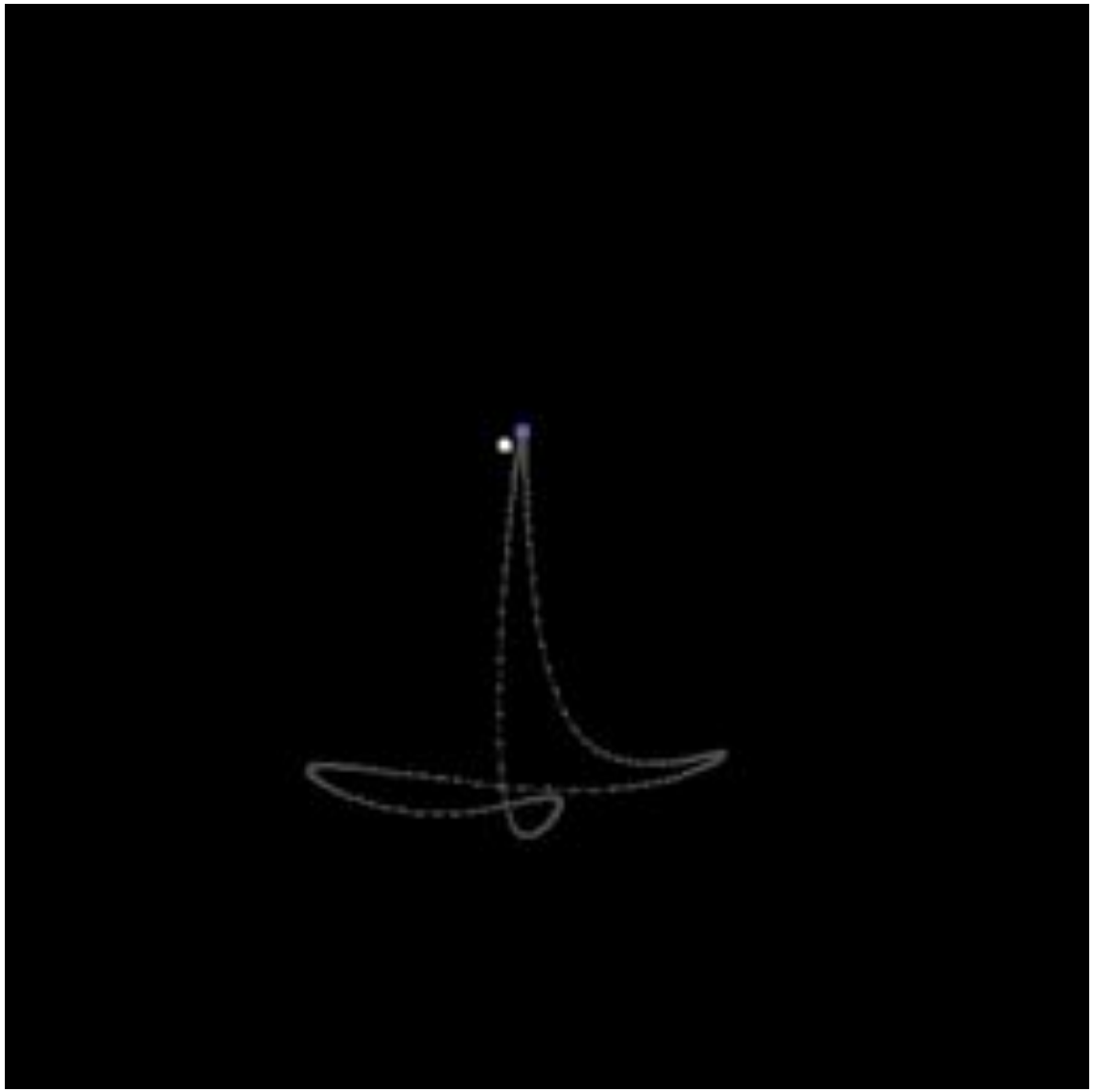
ACM Supercomputing, Oct. 2005, 3 x HD720p60 @ 4.5 Gbps

The World Opera



Predictive Modeling: Training

(work with Don Dansereau and Nathan Brock)



the gray lines and dots show a generic template tracking the input, the red line/purple dot show the adapted template being formed

Prediction with 250 ms

the large white dot represents the input trajectory (real baton position)

the large purple dot represents the tracked position on the template, and the smaller white/green dot shows the predicted baton position

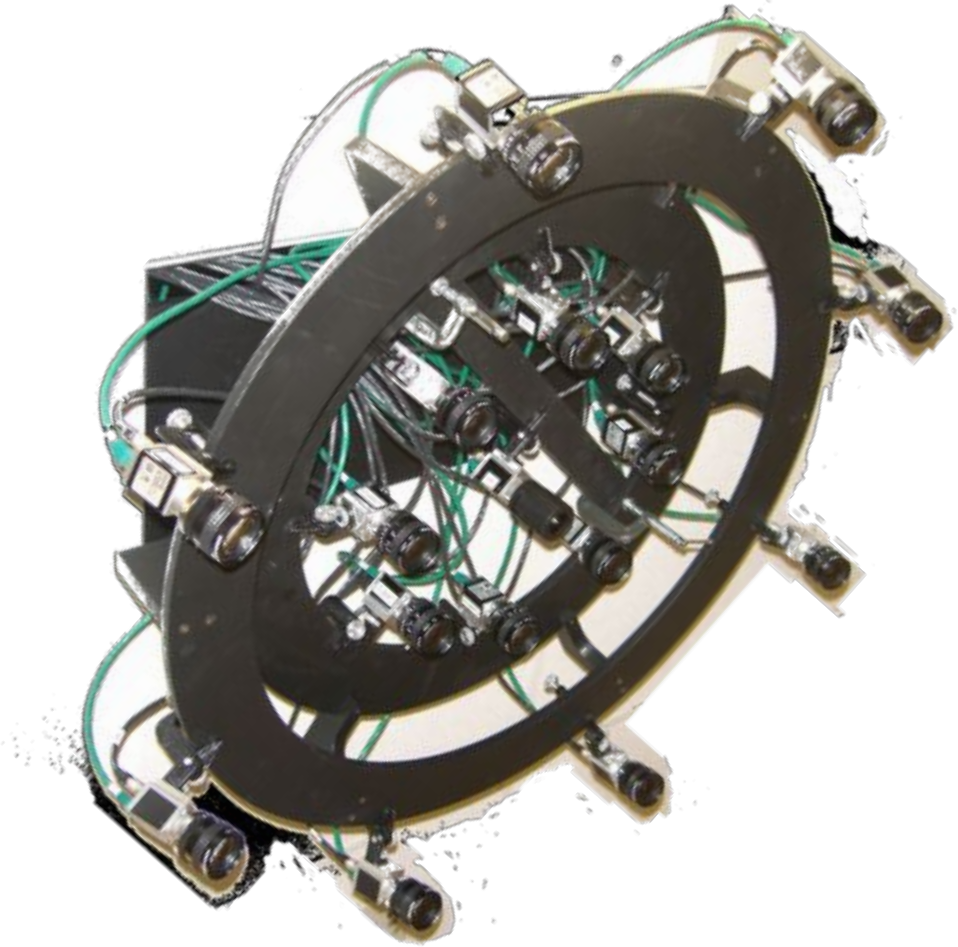
Eye Contact and Gaze Issues


Do [performers] face the camera? Do they see one another?
How do they interact? Are they facing out into an audience?

Solving the Acquisition Problem
HP Coliseum (2006)

But performers don’t (always) sit in chairs

(work with Stéphane Pelletier, Jeff Blum and others)



Representation – life-size human form
(work with Roel Vertegaal and others)

Augmenting a (Distributed) Performance

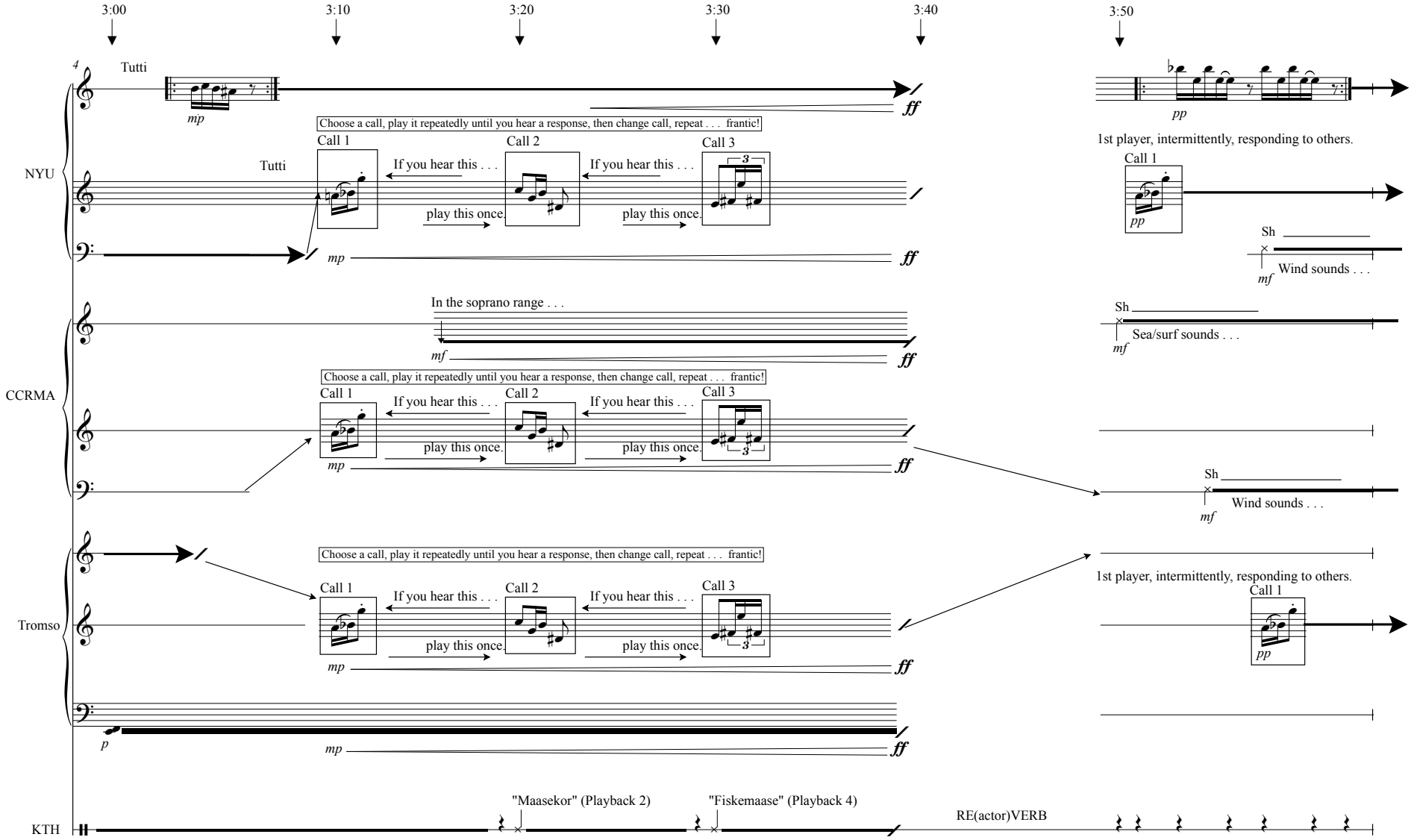
(work with Dalia El-Shimy and Thomas Hermann)

Collaboration for Distributed Performance

Pilot Graduate Program with Tromsø, KTH, NYU, Stanford, McGill

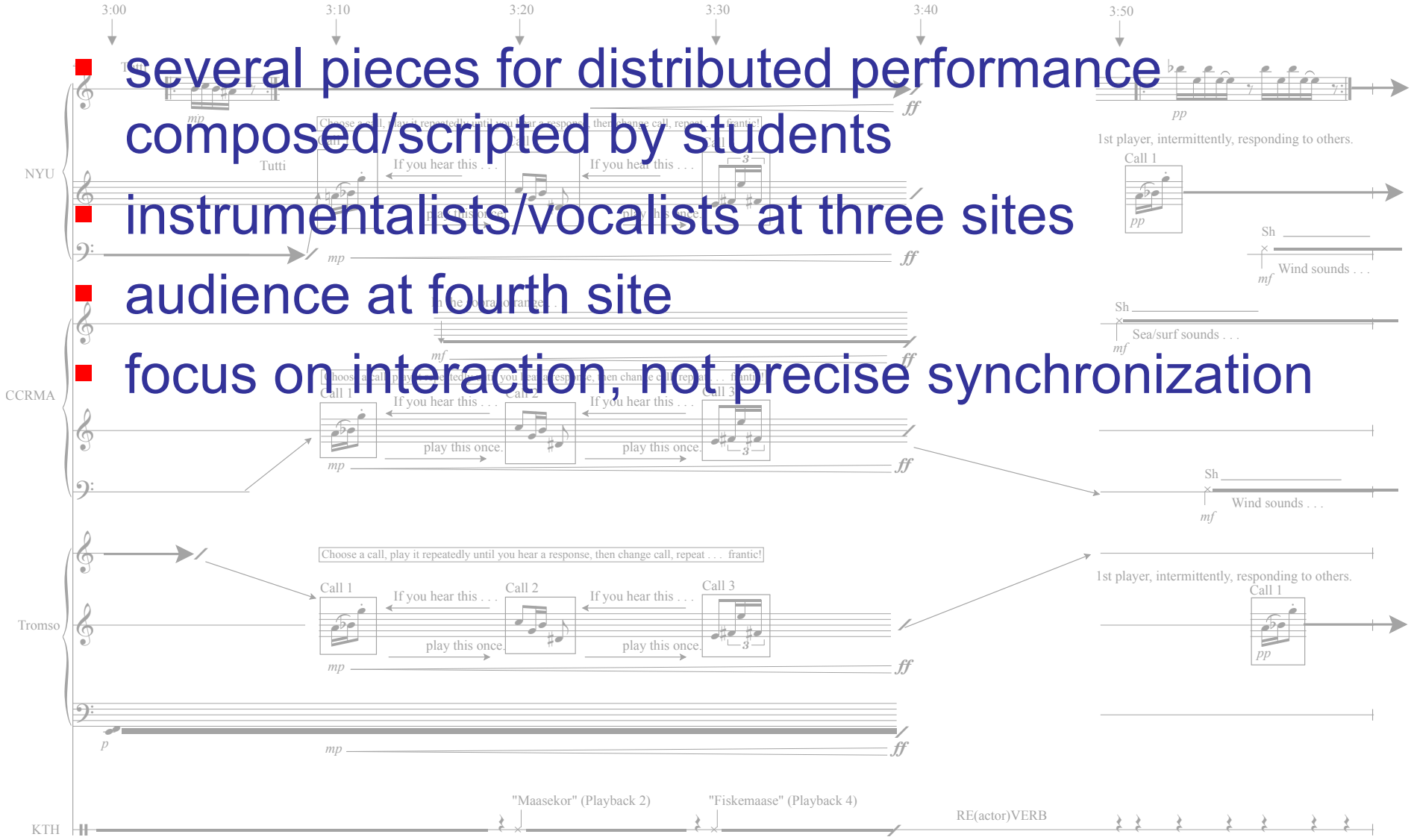
- student assignments, papers, and thesis
- teaching materials (textbooks, scores, guides to tools and programs)
- documentation for assessment (audio, video and other kinds of net based multimedia)
- structure of sessions with hands-on experiments, teacher/student presentations and discussion

Experiments



Experiments

- several pieces for distributed performance composed/scripted by students
- instrumentalists/vocalists at three sites
- audience at fourth site
- focus on interaction, not precise synchronization




Dancers perform across the network utilizing Ultra-videoconferencing for video transmission. Pianists in all 3 spaces are reacting to the movements of both local and remote dancers.
Stockholm
Tromsø
NYU

Group rehearsal vs. solo practice

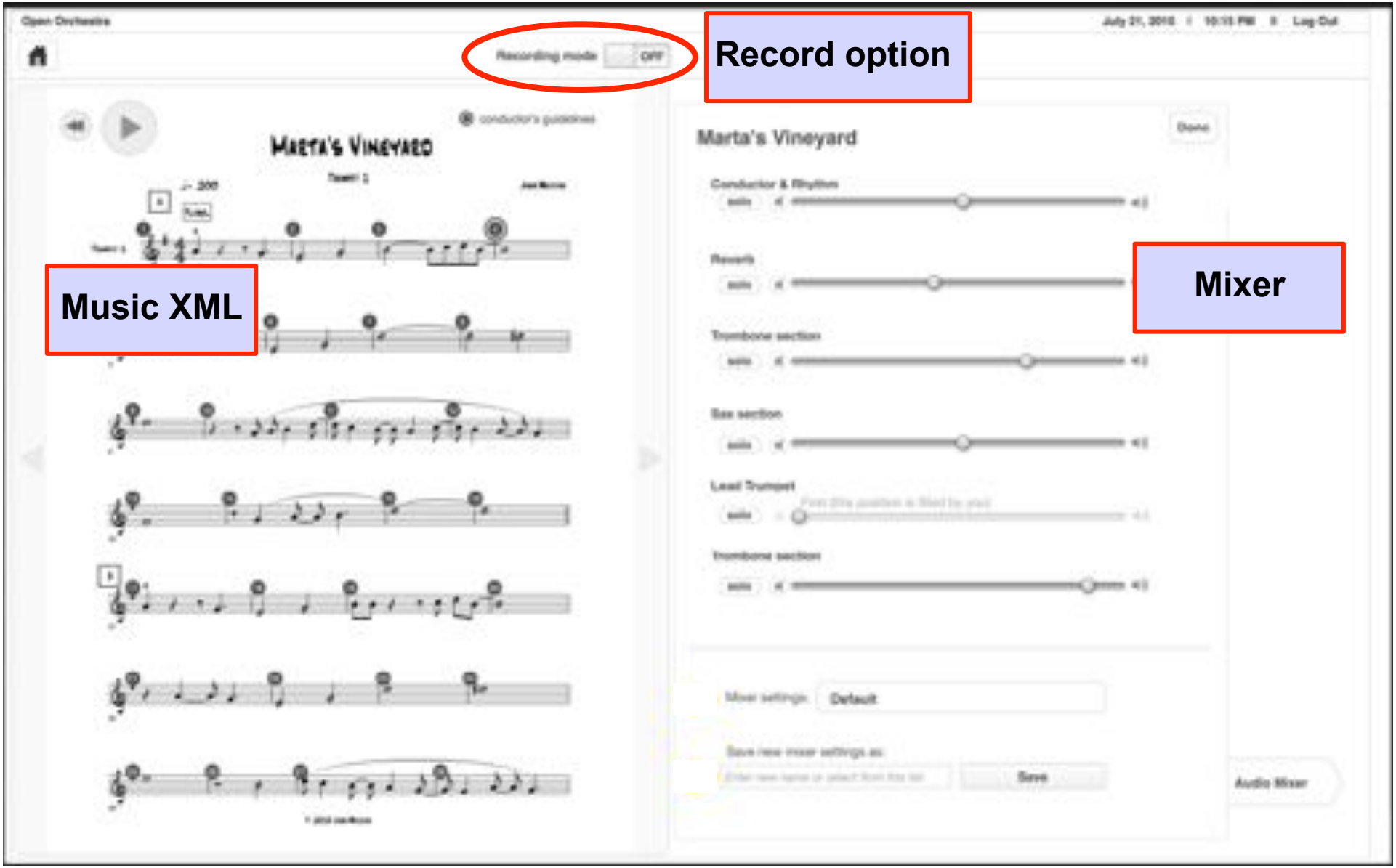
(work with Adriana Olmos and others)

[in the orchestra] I practice for listening… I tune to listen to the lead trumpet and the drummer to find my cues

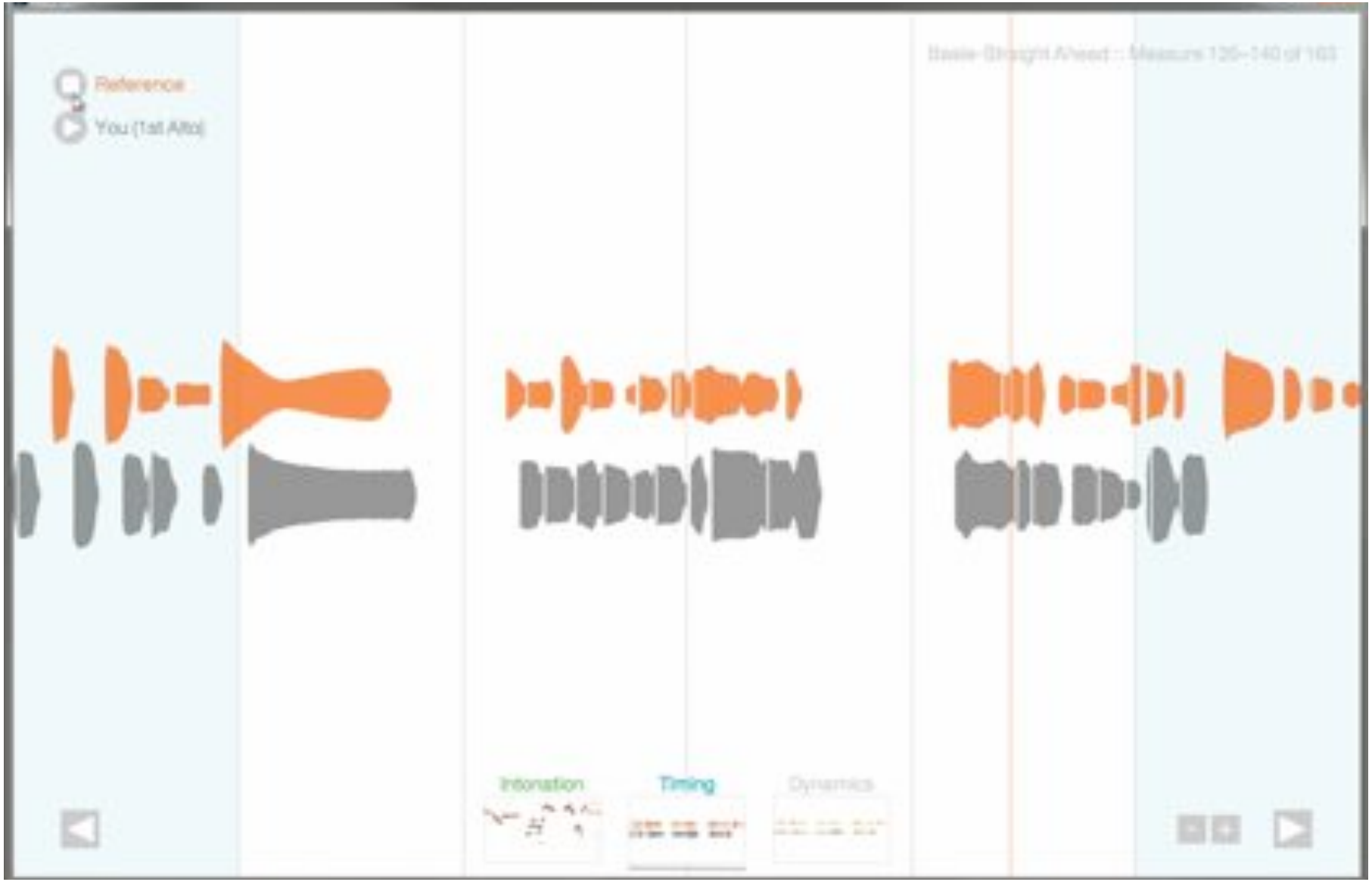
at home is more for learning, practicing the piece

Open Orchestra Rehearsal System

Digital Music Part



Visualizing your play



“Real” vs. Open Orchestra Rehearsal

“I cannot *pause* the conductor during the rehearsal”

“Here, yes.”

(Audio) image preferences

egocentric (binaural) performer perspective, or…

rendered from the audience position

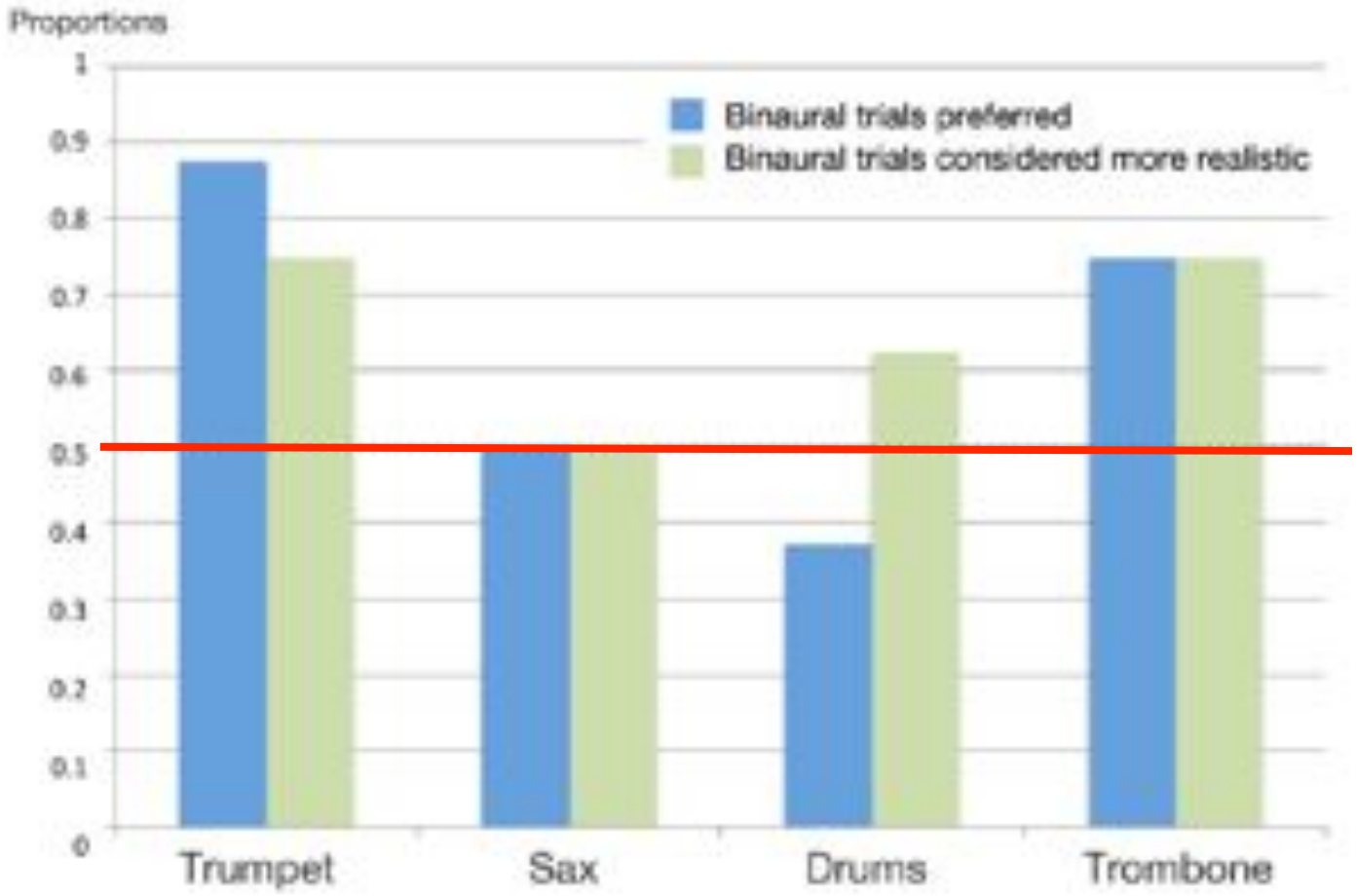
- which is more realistic? does it affect the performance?

Experiment Design

- Audio conditions
  - instrumentalist perspective
  - audience perspective
- Music Students:
  - 4 McGill Jazz Band I
  - 4 from a different band
- Instruments:
  - trumpet
  - alto sax
  - drums
  - trombone

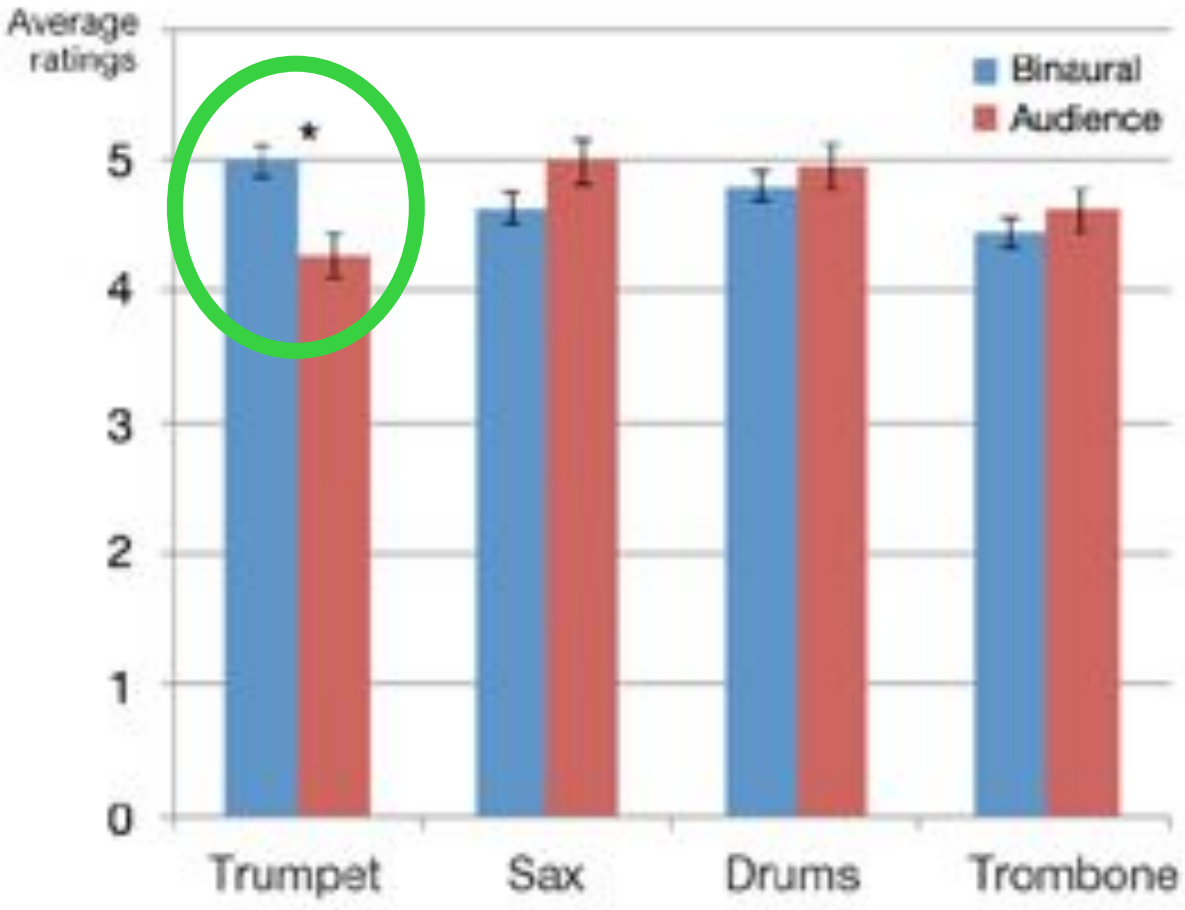
Musicians' preference

- egocentric (binaural) condition favoured in 20/32 blocks



Expert Review

- binaural tracks assigned higher rating (17/32 blocks across subjects)



Discussion
Pilot Study

- lead trumpet: binaural makes a significant difference in performance
- lead trombone: no significant difference, but happy hearing more of the brass section
- alto sax: no preference
- drums: “as long as I can hear the bass, I’m happy”

Further information available:

http://www.cim.mcgill.ca/sre