Open Orchestra: A High-Fidelity Immersive Music Simulator

John Roston, McGill
Mark Zuberbuhler, UBC
Objectives

- Provide a music student practicing alone the realistic experience of playing in an orchestra or singing in an opera.
- Provide an electronic music stand version of the score and custom audio controls.
- Allow the student to record himself or herself for later review by an instructor who may be at a remote location.
- Allow the student and instructor to communicate asynchronously with oral and written comments linked to points in the score.
Overview

- HD recording of jazz band, orchestra and opera
- All files stored on servers at McGill
- Student workstations deployed across Canada
- Individual workspace for each instructor and student
- CANARIE network used to deliver video and audio in real time
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Lead Institution

McGill, Schulich School of Music, Centre for Inter-disciplinary Research in Music, Media and Technology (CIRMMT)

McGill Team Leaders

- Video & Project Coordinator – John Roston
- Audio – Wieslaw Woszczyk
- Software & Networking – Jeremy Cooperstock
Partner Institutions & Team Leaders

- UBC, Centre for Teaching, Learning and Technology – Mark Zuberbuhler  
  (Lead institution for opera recording)
- Banff Centre – Theresa Leonard
- Humber College, School of Creative & Performing Arts – Steve Bellamy
- National Arts Centre Orchestra – Maurizio Ortolani
- National Youth Orchestra – Barbara Smith
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Technical Support & Funding

- Canarie Inc.

Collaborating Corporations

- Panasonic Inc.
- Melnik Resources Ltd.
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Student Workstation

- Panoramic HD video
- Three 32” monitors
- Monitor on each side angled at 45 degrees
- Touchscreen music stand displays electronic score and system controls
Student Workstation

- Surround audio via headphones
- Overhead mic for audio recording
- Webcam for video recording
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Student Workstation

- Electric lift for standing and sitting positions
- Monitors, touchscreen and computer move together.
- Workstation custom built by Melnik Resources in Ontario
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Student Workstation

- Touchscreen music stand shows the electronic score at left.
- System controls at right allow student to turn audio tracks on and off and adjust levels.
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**Student Workstation**

- Student selects his or her instrument.
- Student sees and hears what would be seen and heard at that position in the orchestra.
- Student can also choose to see and hear at conductor’s position.
Video & Audio Transmission

- Target HD video is three simultaneous streams of 720p60 H.264 AVC @ 25 Mbps each
- Flash file format
- Playback not yet stable @ 25 Mbps so have been using “triple stitched” stream @ 15 Mbps
- 128 kbps audio mixed at the server and transmitted separately
- Video & audio synchronized at client end
- Currently using Wowza to stream video and gstreamer for audio
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Camera Rig

Front: Cameras

Back: Monitors
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**Camera Rig**

- Electric lift mechanism for sitting and standing positions
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Camera Rig

- 3 Panasonic broadcast 720p60 cameras
- Mounted vertically looking into 45 degree angle front surface mirrors
Camera Rig

- Camera rig replaces trumpet player
Camera Rig

- Panoramic video display has 2 vertical blind spots between monitors where the monitor bezels meet.
- Cameras are aligned to allow for these blind spots.
Camera Rig

- To facilitate moving musicians out of these blind spots, laser beam transmitters are mounted on the camera rig to transmit a vertical line in the blind spot.
Audio Recording

- Multi-track system
- Musician replaced by camera does not play.
- This musician records post-sync track later in sound studio.
- Student can use this track to hear how he or she should sound.
- Student can play duet.
Audio Recording

- Student can hear how orchestra sounds at musician’s position or conductor’s position.
- Reference audio recorded at musician’s position using dummy head.
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**Opera Recording**

- Phase 1: static opera singers at music stands
- Camera rig replaces singer
Opera Recording

- Phase 2: moving opera singers on stage
- Camera rig must move as singer would move.
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Opera Recording

- Where the camera replaces one member of a couple moving together, a handle is used to keep the singer in position beside the camera.
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**Tasks Remaining**

- Solve Flash video player issues.
- Continue testing at 5 partner institutions.
- Improve system in response to feedback.
- Develop single screen home version.
More Information

- Web Site: http://canarie.mcgill.ca/project_nep2_index.html
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