



Laboratoire de recherche
en pédagogie du piano

Piano Pedagogy
Research Laboratory

• Annual Report • 2005

Message from the Director

The event we are celebrating today is the result of four long years of work. At the beginning, it was just a dream of having a space specifically designed for research in piano pedagogy. Next came the demanding job of defining the project down to the smallest detail, in order to produce an original and convincing proposal. At the end of the lengthy grant application process, funding for the project was provided by The Canadian Foundation for Innovation, the Ontario Innovation Trust, the University of Ottawa, and some private sector partners. Now the first research laboratory in the world specializing in piano pedagogy has become a reality.



The length of time it took to build the Piano Pedagogy Research Laboratory is proof of the complexity and originality of its infrastructure, but little by little the project took shape and the space has been transformed into a hive of activity. A rich partnership with many different researchers has allowed us to put together multidisciplinary teams which draw upon psychology, cognitive sciences, neuropsychology, computer engineering, biomedical engineering, health sciences and communications—the kind of expertise needed to study all the subtleties of learning to play the piano. At the same time, bringing graduate students into the lab is allowing us to train young researchers who are eager to advance the boundaries of knowledge in piano pedagogy.

So we are here today to celebrate the official opening of a magnificent laboratory with almost unlimited possibilities. This achievement was possible because of the remarkable expertise and dedication of all the individual people who worked on each step of the project, and it's this formidable team that I am here to thank today.

And I am very grateful to all my colleagues and friends who have come to join with me and the University of Ottawa to celebrate this important accomplishment.

Milestones

2002 Grant of \$494,657 from CFI to create the Piano Pedagogy Research Laboratory at the University of Ottawa

2003 Matching grant of \$494,657 from OIT for the creation of the Piano Laboratory Graduate Certificate in Piano Pedagogy Research approved
Piano teaching by video-conference begun

- Connection with Kangiqsualujjuaq (Northern Quebec) for distance piano group classes
- Connection with Khumo (Finland) for a master class featuring the possibilities of the Disklavier for distance teaching and learning

An additional \$257,328 from the University of Ottawa, Yamaha Canada and other partners brings total funding to \$1,246,642

2004 Undergraduate Certificate in Piano Pedagogy approved

Media Coverage

OTTAWA CITIZEN

Professors tune in to musicians' pain: Carpal tunnel syndrome, other conditions could be eased using new imaging system
February 2005

Da Capo

Quoi de neuf : Laboratoire de recherche en pédagogie du piano
Pérez News: Piano Pedagogy Research Laboratory
Septembre 2005 / September 2005

g a z e t t e

Le piano intelligent
Décembre 2002

Des cours de piano à Kangiqsualujjuaq
Janvier 2004

TIME

The Finger Fixer: Gilles Comeau
June 2005

LeDroit

Inuits au diapason d'Ottawa
Janvier 2005

TABARET

Harmonie au laboratoire
Printemps 2005

[PERSPECTIVES SUR LA RECHERCHE]

Un vide à combler : la science au service de la musique
Hiver 2003

A Unique Research Facility

The University of Ottawa has established a unique research laboratory specializing in piano pedagogy, thanks to a \$1.2 million grant from the **Canada Foundation for Innovation**, the **Ontario Innovation Trust**, **Yamaha Canada**, the **University of Ottawa**, and other partners.

Two Principal Functions

- Advanced scientific research in piano pedagogy
- Specialized hands-on training in piano pedagogy research

A laboratory of this calibre and specialization is unique. The benefits from its accessibility to students, researchers and teachers in this field of research will be far reaching and significant.

Studio

Equipment:

- Two 7'6" acoustic pianos with optical sensors and integrated MIDI operating systems (Disklaviers)
- Analog and digital video cameras
- Two LCD (liquid crystal display) screens
- Specialized software capable of collecting and generating data (e.g., instant video replay)
- **Recording studio acoustics:**
- Moveable acoustic panels allowing the customization of spatial resonance within the room
- Soundproof walls impeding sound pollution from exterior sources



Conference Room

Multi-purpose environment ideal for:

- Seminars
- Lectures
- Workshops
- Comprehensive training sessions
- Primary location for video conferences
- Equipped with analog/digital video cameras and LCD screens



Resource Centre

Large reference collection for researchers:

- Theses and research texts
- Piano teaching materials
- Scores
- Audiovisual materials



Multi-Media Control Centre

The technological hub of the laboratory, adjacent to the Studio

Analog and digital video equipment:

- Records piano lessons directly onto VHS, DVD, or mini DV format
- Generates picture-in-picture and instant video replay

Video conferencing capacity:

- Connects international research teams by way of overseas MIDI transfer
- Facilitates two-way piano teaching between the laboratory and distant, often remote, locations

Production centre:

- Enables timely and cost-effective management of all audio and visual files – recording, editing, formatting, transferring

Period Instrument Studio

A selective collection of historic instruments:

- 6-octave Viennese Graf pianoforte (built by R. J. Regier)
- John Morley London clavichord (reproduction)
- Children's Butterfly piano (original instrument reconstructed by Don Côté)

Soon to arrive...

- Lindholm-Söderström clavichord (built by Andrew Lagerquist)
- Dulcken harpsichord (built by Yves Beaupré)

Research

Information Technology and Innovative Curriculum Development

This study focuses on how new technology can be used to study piano playing and piano learning.

- Computer analysis tools are being developed to evaluate how well variations of dynamics and timing in performance match the intended patterns of tension and relaxation of a score.
- Software is designed to:
 - Allow the use of electronic keyboards to measure beginner skills in sight-reading, keyboard technique, ear training, etc.
 - Enable broadband videoconferencing for collecting piano performance data as well as creating measures to assess the outcome of piano distance teaching and video-mediated learning.

Researchers:

- Gilles Comeau (Music, University of Ottawa)
- Alain Desrochers (Psychology, University of Ottawa)
- Martin Brooks (National Research Council Canada)
- John Spence (Communications Research Centre Canada)

Music Grid

Distance education brings a wealth of knowledge to children living in widespread and remote global communities. The Music Grid, a project of the National Research Council Canada and Communications Research Centre Canada, was designed to help establish music programs in Canadian communities where music education is limited. Over the last two years, the Piano Pedagogy Research Laboratory has joined this research team and collaborated on a project that involves keyboard lessons via video conferencing to a group of young children in Kangiqsualujjuaq, Northern Quebec.

- Erin Parkes, a graduate student in the Music Department at the University of Ottawa, has been using the Yamaha piano method for the group lessons.

Researchers:

- Martin Brooks (National Research Council Canada)
- John Spence (Communications Research Centre Canada)
- Gilles Comeau (Music, University of Ottawa)

Trans-Atlantic Piano Teaching: The Alliance of Technology and Pedagogy

This project brings a multidisciplinary approach to piano pedagogy in broadband learning environments.

- Its aim is to develop a set of technologies for video indexing and cognitive modelling to facilitate the systematic study of distance piano learning.
- The researchers utilize prototype tools in authentic learning environments and explore the teachers' and learners' responses to these tools.

Researchers:

- Gilles Comeau (Music, University of Ottawa)
- Bruno Edmond (National Research Council Canada)
- Martin Brooks (National Research Council Canada)
- Dmitry Gorodnichy (National Research Council Canada)
- Philip Donner (Virtuosi, International Centre of Chamber Music, Finland)
- Matti Ruippo (Sibelius Academy, Finland)



Research

Development of New Computer Vision Technologies for Monitoring and Analyzing the Complex Physical Movements Involved in Piano Playing

The main thrust of this project is to develop a prototype for a visual monitoring and feedback system for piano teachers, to be called the *Teacher Assistant*. Based on classical computer-vision, image-processing and pattern-recognition techniques, the *Teacher Assistant* will measure 3D displacements of the piano player's upper body, arms, and hands.

Researchers:

- Pierre Payeur (School of Information Technology & Engineering/ SITE, University of Ottawa)
- Gilles Comeau (Music, University of Ottawa)

Video-Mediated Learning

Piano teachers rely extensively on subjective visual observation of posture and gestures to help their students improve their performance. Experts in piano pedagogy recognize a need for the close monitoring of upper-body movement and overall posture in piano playing.

- Video monitoring assists piano teachers and students to evaluate performance, either in real time with instant video replay, or in post analysis with VHS, DVD, or mini-DV recordings.
- Research and development in the field of video-mediated learning is essential to the use of audio-visual technology in a studio setting.

Researchers:

- Gilles Comeau (Music, University of Ottawa)
- Martin Brooks (National Research Council Canada)
- John Spence (Communications Research Centre Canada)

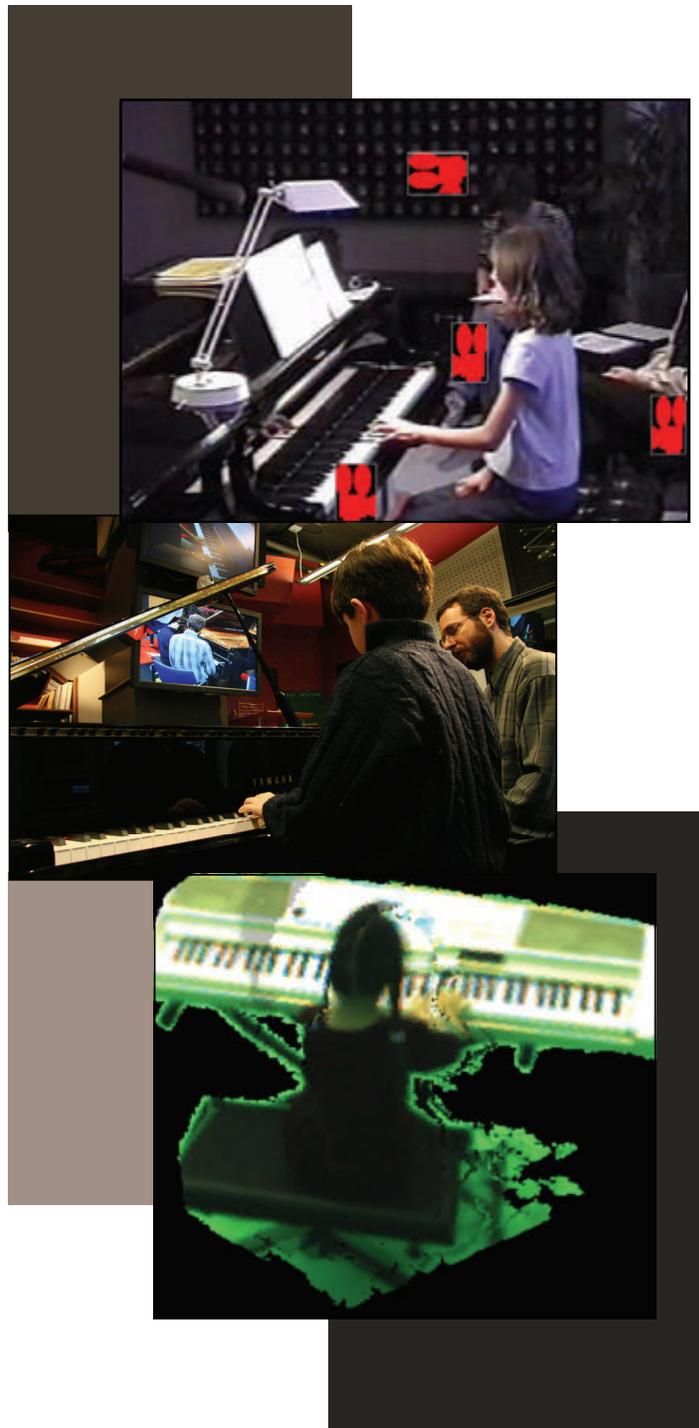
Virtual Reality Based Piano Pedagogy

Virtual reality based pedagogy with 3D video is the next generation of video-mediated learning and distance education for keyboard teaching. The research will devise novel methods to provide both instructor and student with a rich and unprecedented experience in a virtual 3D environment within the studio itself or from a remote location.

- The Zaxel system uses multiple cameras to capture a student playing piano and recreates a 3D image which can be remotely viewed in real time.
- A student's performance can be played back in a 3D reconstruction model.
- In a delayed distance-teaching situation, students can have access to 3D mentoring from their own home in a delayed distance-teaching situation, or real-time master classes between two locations using 3D video support.

Researchers:

- Gilles Comeau (Music, University of Ottawa)
- Abdulmotaleb El Saddik (SITE, University of Ottawa)
- Shervin Shirmohammadi (SITE, University of Ottawa)



Research

Motivation: A Survey of Musical Interests

The first stage of this research entailed the development of a psychometric scale that successfully measures the motivational levels of students undertaking piano studies.

- The motivation scale is used to investigate the correlation between a student's motivation and his or her depth of involvement in piano studies.
- Data generated from the scale will assess the quantity and quality of a student's practice as well as the factors affecting his or her motivational drive to continue or cease piano playing and its related activities.

The study will include a cross-cultural analysis with results coming in from Canada, Finland, and China.

Researchers:

- Alain Desrochers (Psychology, University of Ottawa)
- Gilles Comeau (Music, University of Ottawa)
- Isabelle Green-Demers (Psychology, Université du Québec en Outaouais)
- Philip Donner (Virtuosi, International Centre of Chamber Music Finland)



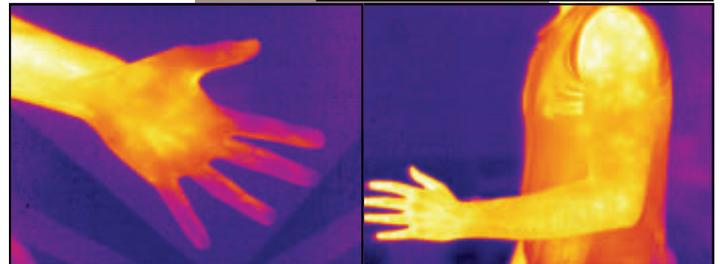
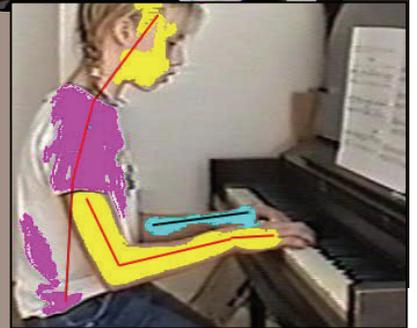
Thermal Imaging

An average of 61% of classically trained professional pianists and 45% of piano students experience piano-playing related health problems (PRHPs) at some time during their lives.

- Infrared video technology is used to monitor performers' temperatures while playing, enabling researchers to pinpoint underlying muscle tension and inflammation.
- Thermal imaging research will thus contribute significantly to the understanding, diagnosis, treatment and prevention of PRHPs.

Researchers:

- Monique Frize (SITE, University of Ottawa)
- Christophe Herry (Systems and Computer Engineering, Carleton University)
- Gilles Comeau (Music, University of Ottawa)



Analyzing Movement, Force and Timing in Piano Performance

This group of studies will develop experimental models and modes of analysis to explain timing control at various stages of piano learning. The factors affecting timing and force mechanisms will be characterized using repeated responses to an auditory metronome.

- The Vicon 3D motion-capture system tracks the movement of small reflective globes affixed to a player's hands, arms, and head.
- 3D skeletons are then created based on the movement of the globes using multiple infrared cameras that record movement kinematics at 200Hz. The data will be analyzed to study how technical movements are being produced at the piano.

Researchers:

- Ramesh Balasubramaniam (Human Kinetics, University of Ottawa)
- Donald Russell (Engineering, Carleton University)
- Gilles Comeau (Music, University of Ottawa)



Research

MIDlator Software

The scientific study of the knowledge and processes underlying piano playing requires sophisticated software which captures and quantifies a pianist's motor activities while playing.

- MIDI interfaces measure time changes in milliseconds and sound intensity in fractions of decibels. The MIDlator software is designed to generate a graphical representation of the specialized data captured by MIDI interfaces.

Researchers:

- Gilles Comeau (Music, University of Ottawa)
- Shervin Shirmohammadi (SITE, University of Ottawa)

Establishing the Field of Study for Piano Pedagogy Research

Piano pedagogy is rooted in several established disciplines: piano performance, musicology, education, psychology of musical perception, cognitive psychology, child psychology, physiology, etc. As such, determining the field of study for piano pedagogy research poses a particular challenge that has yet to be comprehensively addressed. Our research aims to define the composite aspects of piano pedagogy and propose an internal organizational model that will present the field of study from a new point of view and firmly establish it as an independent area of research.

Researcher:

- Gilles Comeau (Music, University of Ottawa)

PianoGrid Project

This project installs prototype tools in authentic learning environments and employs anthropologically derived research methods to assess the effectiveness of piano teaching by means of audiovisual communication technologies. Building on the existing work in broadband video conferencing, video servers, and video-mediated learning tools, this study measures how the development and application of synchronous, asynchronous, and visualization tools can enhance piano learning.

Researchers:

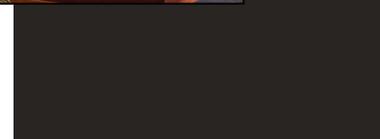
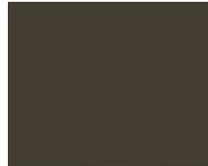
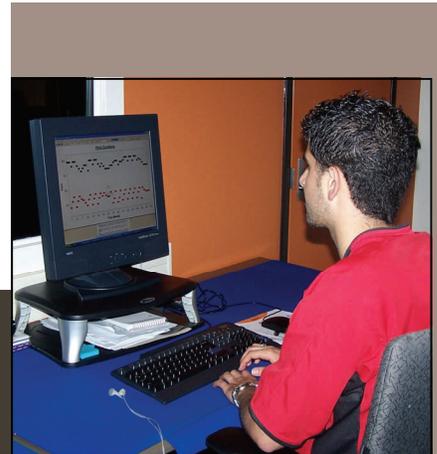
- Philip Donner (Virtuosi, International Centre of Chamber Music - Finland)
- Gilles Comeau (Music, University of Ottawa)
- Elaine Keillor (Music, Carleton University)
- Martin Brooks (Information Technology, National Research Council Canada)

The Coordination of Eye and Hand Movements while Reading Music at the Piano

This project aims to extend our fundamental understanding of music reading processes in young piano students, and how these processes relate to the execution of motor actions in piano playing.

Researchers:

- Gilles Comeau (Music, University of Ottawa)
- Ramesh Balasubramaniam (Human Kinetics, University of Ottawa)
- Alain Desrochers (Psychology, University of Ottawa)



Funding Partners



Ottawa
Pianos

uOttawa
L'Université canadienne
Canada's university

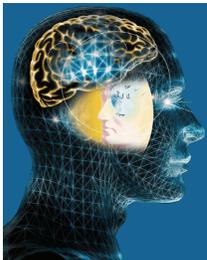
Research Partners



National Research Council Canada
Conseil national de recherches Canada

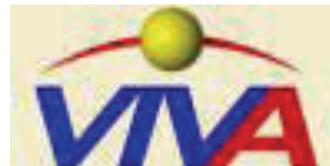


VIRTUOSI
International Centre of
Chamber Music
Finland



Sensorimotor
Neuroscience
Laboratory

University of Ottawa



Video Processing and Coding
Image Processing and Analysis
Computer Vision
Autonomous Systems

University of Ottawa

Communications Research Centre Canada
Centre de recherches sur les communications Canada

Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada