Context and main focus

Of all musical instruments, piano is far and away the most popular- over 85% of young students who register for music examination are pianists. Paradoxically, we still know very little about the factor that contributes to piano students' success. The drop-out rate is very high and piano teachers usually fall back on the useful stereotype of the "talented" or "non-talented" student to explain results. Even though we recognize that learning the piano is particularly demanding and complex, the underline processes and their consequences for musical development are still not well understood. Elucidating the individual student's fine motor skills, the capacity for auditory perception and the acquisition of expertise.

This round table distinguished itself by its multidisciplinary nature, drawing on humanities and sciences methodologies from music, education, psychology, neurosciences and engineering. The multidisciplinary composition of the panel is designed to approach problems from several complementary perspectives and encourage progress and the synthesis of both theoretical and practical knowledge.

Title: Timing mechanisms in piano performance
Researchers: Ramesh Balasubramaniam, Human Kinetics and Neurosciences, University of Ottawa; Donald Russell, Mechanical and Aerospace Engineering, Carleton University; Gilles Comeau, Music, University of Ottawa
Speaker: Donald Russell, Mechanical and Aerospace Engineering, Carleton University
Abstract: Musical performance involves the movement of various segments of the body that have to be controlled in a systematic and meaningful way. Studying how the human brain puts together theses movements involves a good understanding of sensory processes, cognitive skills and motor control. This presentation will give an initial overview of how the brain handles sensory information and acts on it during musical performance. It will specifically focus on timing in piano performance and learning. Acts such as playing the piano involve the repetitive movement of certain effectors (wrist, finger, arm), with respect to external events such as a metronome, a musical score or even the movements of other musicians. From studying the timing aspect of such motor behavior, we can understand 1) how the brain organizes sequential movements 2) how rhythmic structure might be represented in the brain and 3) how sequences are learned and encoded. This presentation will bring together evidence from

neurophysiologic and behavioral data in presenting a coherent view of the neutral representation of timing in the acquisition and development of musical skills.

Title: Contributions of age and pattern of practice to motor skill learning: Implications for musical training
Speaker: Virginia Penhune, Psychology, Concordia University
Abstract: Research in my laboratory is focused on developmental contributions to learning of complex motor skills, similar to playing the piano. I will present a series of studies looking at the effect of age and pattern of practice on the ability to learn such skills. The first study examined the effect of the age of onset of musical training on motor performance in adult musicians. The results showed that musicians who began training early (before age 7), showed a better ability to produce precisely timed motor responses than those who began later. The next set of experiments looked at the effect of the pattern of practice on learning multiple motor sequences in a single session. These results indicate that learning of finger movements generalizes from one sequence to another, while timing of movements does not. Finally, I will present the results of a recently completed study examining motor learning and memory in 6, 8 and 10 year old children.

Title: An exploration on the muscle groups used in piano performance
Researchers: Runa Das, Psychology, Carleton University; Gilles Comeau, Music, University of Ottawa; Ramesh Balasubramaniam, Human Kinetics and Neurosciences, University of Ottawa
Speaker: Runa Das, Psychology, Carleton University
Abstract: The purpose of the present study was to investigate the effects of reversing the roles of the two hands during piano performance. More specifically, participants were required to play musical passages that transcribed fingerings from one hand to the other. Performances were then examined in terms of homologous muscle groups versus non-homologous muscle groups. Our hands are mirror images of one and other and therefore do not use the same fingerings for performing identical passages. As such, it would be of great interest to see whether or not fingering changes make a difference in left and right hand piano performances. The present experiment, therefore, investigated the spatio-temporal and musical constraints in motor coordination during piano performance.

Title: Biomechanical implications inherent in descriptions of piano playing

Researchers: Donald Russell, Mechanical and Aerospace Engineering, Carleton University; Christianne Vant, Mechanical and Aerospace Engineering, Carletong University; Jason Ray, Music, University of Ottawa; Julia Brook, Music, University of Ottawa; Gilles Comeau, Music, University of Ottawa
Speaker: Donald Russell, Mechanical and Aerospace Engineering, Carleton University
Abstract: A wide variety of approaches to piano instruction exist and each describes the movements and technical aspects of piano performance in a different way. The published descriptions describe the movements underlying “proper” piano technique with varying levels of detail. In addition, because of the need to communicate these techniques to students who generally do not have a background in biomechanics the information is exposed by using metaphor. The biomechanical requirements of each approach were identified and summarized after careful study and evaluation of the published descriptions. The results clearly show extensive similarities as well as striking differences between the approaches. We also believe that in many cases apparent differences exist only in terms of the manner in which the movements are described or learned. When the techniques are well developed and applied to piano performance we hypothesize that a number of the differences between the approaches loose significance. This presentation will summarize the results, focusing on the major differences and similarities between the implied biomechanical requirements for piano technique inherent in each of the studied approaches.

Title: Microstructure dans la mémorisation de partitions de piano
Speaker: Francis Dubé, Musique, Université Laval
Abstract: La mémorisation d’une partition de piano repose sur quatre types de mémoires : auditive, visuelle, kinesthésique et conceptuelle. Les trois premières sont des mémoires sensorielles s’enregistrant principalement à l’insu du pianiste au fil des répétitions. La mémoire conceptuelle, en revanche, se grave dans le cerveau de façon intentionnelle. Bien que la documentation spécialisée actuelle ne permette pas d’affirmer si l’une des stratégies sensorielles d’apprentissage s’avère plus efficace qu’une autre, plusieurs études ont toutefois observé que la mémoire conceptuelle, acquise à l’aide de stratégies analytiques ou structurales, permet au pianiste de se rappeler de la notation musicale, de sa réalisation au clavier et l’aiderait également à se sentir plus rassuré sur le plan mnémonique. L’analyse microstructurale est particulièrement intéressante car elle s’élabore à partir du point de vue et du vocabulaire propre à l’instrumentiste. Ce type d’analyse vise l’individualisation et la prise de

conscience des différentes micro-étapes rencontrées par le pianiste pendant sont travail de mémorisation. En d'autres mots, le but de l'analyse microstructurale est d'identifier les singularités de la notation musicale et de sa réalisation à l'instrument afin de mieux s'en souvenir.

Title: Music reading skills of young piano students: taxonomy of the musical codes
Researchers: Gilles Comeau, Music, University of Ottawa; Catherine Lemay, Music, University of Ottawa
Speaker: Gilles Comeau, Music, University of Ottawa
Abstract: Music reading is one of the most fundamental skills a beginner pianist must acquire to achieve even a modest level of musical competence. Little is known about the early stages of music literacy development and only a few measures of music reading performance have been developed for or adapted to young music students. The primary goal of our research is to extend our understanding of how young music student learn to read musical notation and express this information through well-controlled gestures at the keyboard. We are first carrying out an exhaustive analysis of piano method books, textbooks and other educational materials in order to extract and classify the cognitive and psychomotor components of music literacy. Such an analysis is needed because these components are often introduced implicitly, rather than explicitly, in piano method books (e.g., through the selection of pieces to be mastered). The result of this analysis will take the form of a systematic taxonomy whereby these components are organized hierarchically with a clear specification of their level of class-inclusion and complexity. The resulting taxonomy (and associated graphic and narrative descriptions) is providing a comprehensive description of the skills involved in music reading, from the simplest to the most complex, and, thereby, ensure that the entire domain of music reading is adequately covered. It underscores the components and the variables that must be considered in order to understand what young piano students must learn to master musical notation and express this information through well-controlled gestures at the keyboard.

Title: Motivation: The challenge of Young Piano Students
Researchers: Nisreen Jardaneh, Music, University of Ottawa; Gilles Comeau, Music, University of Ottawa
Speaker: Nisreen Jardaneh, Music, University of Ottawa
Abstract: This presentation will provide a description of the various steps involved in the development of a scale to measure the degree of

motivation of young piano students. The main steps include the theoretical framing of motivation, choice of a measurement scale, formulation of instructions and motivational items, data collection and analysis, revision of the instrument, and the analysis of its predictive power. It will be followed by discussing and illustrating type of analysis drawn from a study carried out.