

Université de Montréal

**The expression and production of piano timbre: gestural control and technique,  
perception and verbalisation in the context of piano performance and practice**

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Cette thèse intitulée:

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## RÉSUMÉ

Cette thèse a pour objet l'étude interdisciplinaire et systématique de l'expression du timbre au piano par les pianistes de haut niveau, dans le contexte de l'interprétation et la pratique musicales. En premier lieu sont exposées la problématique générale et les différentes définitions et perspectives sur le timbre au piano, selon les points de vue scientifiques et musicaux. Suite à la présentation de la conception du timbre au piano telle qu'établie par les pianistes dans les traités pédagogiques, la perception et la verbalisation du timbre au piano sont examinées à l'aide de méthodes scientifiques expérimentales et quantitatives. Les mots dont usent les pianistes pour décrire et parler de différentes nuances de timbre sont étudiés de façon quantitative, en fonction de leurs relations sémantiques, et une carte sémantique des descripteurs de timbre communs est dressée. Dans deux différentes études, la perception du timbre au piano par les pianistes de haut niveau est examinée. Les résultats suggèrent que les pianistes peuvent identifier et nommer les nuances de timbre contrôlées par l'interprète dans des enregistrements audio, de façon consistante et convergente entre production et perception. Enfin, la production et le contrôle gestuel du timbre au piano en interprétation musicale est explorée à l'aide du système d'enregistrement d'interprétation Bösendorfer CEUS. La PianoTouch *toolbox*, développée spécialement sous MATLAB afin d'extraire des descripteurs d'interprétation à partir de données de clavier et pédales à haute résolution, est présentée puis mise en œuvre pour étudier la production expressive du timbre au piano par le toucher et le geste au sein d'interprétations par quatre pianistes exprimant cinq nuances de timbre et enregistrées avec le système CEUS. Les espaces et portraits gestuels des nuances de timbre ainsi obtenus présentent différents degrés d'intensité, attaque, équilibre entre les mains, articulation et usage des pédales. Ces résultats représentent des stratégies communément employées pour l'expression de chaque nuance de timbre en interprétation au piano.

**Mots-clés:** piano, timbre, expression, interprétation, geste, toucher, perception, description verbale, Bösendorfer CEUS

## ABSTRACT

This dissertation presents an interdisciplinary, systematic study of the expression of piano timbre by advanced-level pianists in the context of musical performance and practice. To begin, general issues and aims are introduced, as well as differing definitions and perspectives on piano timbre from scientific and musical points of view. After the conception of piano timbre is presented as documented by pianists in pedagogical treatises, the perception and verbalisation of piano timbre is investigated with experimental and quantitative scientific methods. The words that pianists use to describe and talk about different timbral nuances are studied quantitatively, according to their semantic relationships, and a semantic map of common piano timbre descriptors is drawn out. In two separate studies, the perception of piano timbre by highly skilled pianists is investigated. Results suggest that advanced pianists can identify and label performer-controlled timbral nuances in audio recordings with consistency and agreement from production to perception. Finally, the production and gestural control of piano timbre in musical performance is explored using the Bösendorfer CEUS piano performance recording system. The PianoTouch toolbox, specifically developed in MATLAB for extracting performance features from high-resolution keyboard and pedalling data, is presented and used to study the expressive production of piano timbre through touch and gesture in CEUS-recorded performances by four pianists in five timbral nuances. Gestural spaces and portraits of the timbral nuances are obtained with differing patterns in intensity, attack, balance between hands, articulation and pedalling. The data represents common strategies used for the expression of each timbral nuance in piano performance.

**Keywords:** piano, timbre, expression, performance, gesture, touch, perception, verbal description, Bösendorfer CEUS

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