

To My Mum

This artistic research was carried out at IPEM - Institute for Systematic Musicology, University of Ghent - in collaboration with the School of Arts of Ghent - KASK - Royal Conservatory.

The dissertation is published for non-profit educational purposes. Copyrighted material has been included under the guidelines of academic fair use.

On the cover page, the image *Hands working for emotions* (2014) by Alessandro Giorgi Art Photography is used with his permission.

MIRRORING THE INTENTIONALITY AND GESTURE OF A PIANO PERFORMANCE

An interpretation of *72 Etudes Karnatiques pour piano*

Giusy Caruso

A dissertation submitted to Ghent University
in partial fulfilment of the requirements for the degree of
Doctor of Arts: Music
Academic year 2017 - 2018

UNIVERSITEIT GENT
Faculteit Letteren en Wijsbegeerte
Vakgroep Kunst-, Muziek- en Theaterwetenschappen
KASK – SCHOOL OF ARTS
Gent Conservatorium

Promoters:

Prof. Dr. Marc Leman

Vakgroep Kunst-, Muziek- en Theaterwetenschappen - UGent

Prof. Daan Vandewalle

Gent Conservatorium, School of Arts of Ghent - KASK

Examination committee:

Prof. Dr. Marc Boone (Chairman)

Prof. Dr. Kathleen Coessens (Koninklijk Conservatorium Brussel)

Dr. Sofia Lourenço (Universidade Católica Portuguesa)

Dr. Bruno Forment (School of Arts of Ghent - KASK)

Dr. Luc Nijs (IPEM – UGent)

Dr. Edith Van Dyck (IPEM – UGent)

Prof. Dr. Pieter Jan Maes (IPEM – UGent)

Dr. Micheline Lesaffre (IPEM – UGent)

Dean (Ugent):

Prof. Dr. Marc Boone

Dean (KASK):

Prof. Dr. Wim De Temmerman

Rector:

Prof. Dr. Rik Van de Walle

Acknowledgements

The important teaching I had during my research work is that ideas come not only from intuitions, studies or practicing but mostly from discussions, reflections and meetings with different people.

First, my gratitude goes to the composer Jacques Charpentier (passed way 15 June 2017), who inspired the artistic topic of my dissertation, and to my promoters, Prof. Dr. Marc Leman and Prof. Daan Vandewalle, and my co-promoters, Dr. Sofia Lourenço and Dr. Luc Nijs.

I want to gratefully acknowledge Prof. Dr. Marc Leman, who made possible my working within the IPEM group and led me towards an interdisciplinary approach on artistic research. In particular, I am thankful to Dr. Luc Nijs, who with his positive outlook and constructive approach coached me to become a keener researcher.

I should also mention all my IPEM colleagues for the exchange of ideas we had every day at work and meetings (*Think Tank* and others) and for their warm friendship and welcome ever since my first arrival here in Ghent. Particular thanks go to Esther Coorevits, who contributed to my experiment, data analysis and publications; to Guy Van Belle for practical suggestions and for having provided the Dutch translation of the English summary of this dissertation; to Ivan Schepers, Bart Moens and Joren Six for technical supports in the Lab and to Katrien Debouck and Aagje Lachaert for administrative assistance.

The topic of my research gave me the opportunity to collaborate with professors, musicians and artists that I would thank here for the time they spent with me on rehearsing or just talking: the group who made possible my practice on Indian music and the *Re-Orient* project (Ayla Joncheere, Sandeep Kalathimekkad, Francesco Magarò and Carlo Strazzante); Prof. Dr. Geert Dhondt, Prof. Dr. Jan Van Landeghem, Prof. Roberto Perinu, Dr. Alessandra Carlotta Pellegrini, Prof. Dr. Francis Maes, Prof. Atau Tanaka, Prof. Gabriele Manca, Katherine Rondou, Katherine Gravet, Arthur Mari, Lucie De Ley, Lukas Huisman, Liselotte Sels, Alessandro Cervino, Bart Lyssens, Jonatan Lysens and Andrea Gallo Rosso.

I would also thank Mr. Vincent Moreau for sending me copies of his private documents concerning his studies on the composer Jacques Charpentier and the musicologist Brigitte Françoise Sappey for being present at my concert *Hommage à Jacques Charpentier* (Carcassonne, 26 November 2016) and for her letter on my performance, published as an introduction to my CD booklet.

Last but not least, I shall not forget all my friends in different countries for not letting me be tempted to work nonstop, and the members of my family for their immeasurable patience and the positive energies they always grant me, especially my loving mum who always follows and attends my work in first person.

My heartfelt thought goes to my friend and colleague Eleonora Kojucharov, capable to transfer an unusual vitality, enthusiasm with a special predisposition to overcome the difficulties life brings up. We worked together on ideas and projects but her dreams were interrupted too early; we will never forget you,
ciao Eleonora.

Brussels, February 2018
Giusy Caruso

Preface

This doctoral dissertation bears witness to the research interests that emerged from my artistic practice as a pianist and the related empirical studies I conducted as artist researcher at IPEM - University of Ghent, in collaboration with the KASK - School of Arts, Royal Conservatory of Ghent.

The topic concerns a study on my piano performance practice of the *72 Etudes Karnatiques pour piano* (1957-1985) by the French composer Jacques Charpentier (1933-2017).

This artistic research sprung from specific backgrounds: from one side, my interest on the philosophical aspects of music interpretation related to semiology, aesthetics, hermeneutics and cognitive psychology; on the other side, my experience within the pioneering artistic research program at the CODARTS (Rotterdam Conservatorium, 2004-2006) based on my interpretation of the *Huit Préludes* by Olivier Messiaen and on the influence of Indian Music in his piano compositions. By approaching Indian music, I discovered Charpentier's *72 Etudes Karnatiques pour piano*, a three-hour long piano work, which is a great example of a possible fusion of the Indian and the Western musical languages. Even if the composer clearly indicated at the beginning of each etude the correspondent Karnatic scale transcript in Western notation, aspects related to the interpretation of this music (especially on rhythm, timbre, pedal and articulation) needed, from my point of view, a deeper analysis.

Inspired by my previous research on Indian music at the CODARTS and intrigued to build an original interpretation of the *72 Etudes Karnatiques*, I set up a creative practice by involving the composer himself as well as some Indian music experts. I also decided to apply an empirical approach by using technology to explore the development of my performance gestures in relation to the changes of my interpretative intentions. In this way, technology became a useful means to study the "mirroring" relation between intentionality and gesture and to facilitate the understanding and the description of my inner artistic process converted into an artistic research.

English Summary

Nowadays, performance practice is a shared territory of research for artists and scientists. Artist-researchers are interested in searching for creative methodologies in describing the process of their artistic practice and production. Scientists are engaged in the understanding of the connection between subjective expressions and intentions, mostly directing their studies on gesture in performance practice. Focusing on the exploration of my piano performance practice and, specifically, on the “mirroring” relation between intentionality and gesture, my artistic research entails both the artistic and the scientific perspective.

In Chapter 1, I describe how my work started with the object of defining and refining my interpretation and performance of the contemporary piano work, *72 Etudes Karnatiques* by Jacques Charpentier (1933-2017). To arrive at a deep understanding of my performance practice and to systematically describe my artistic process (experimentation, performance and dissemination), this research work was embedded within the theoretical framework of embodied music cognition. I experimented with new practice strategies and produced new artistic performances, disseminating the knowledge gathered from this process. The analysis and dissemination of my artistic practice entailed not only traditional methods (written and verbal self-description, self-observation and self-evaluation) but also the use of technology as an “augmented mirror” for monitoring performance practice. The introspective look from the artistic approach and the empirical observation from systematic musicology are combined in a mixed methodology represented by a triangular artistic research system (TARS) which synthesizes theory, practice and production as constituent elements of the artistic process.

In Chapter 2, I present the historical and musicological analysis that substantiated my interpretation of the *72 Etudes Karnatiques* and inspired the creation of my multidisciplinary project *Re-Orient*. This analysis was based on the existing literature on Indian music (the Karnatic and Hindustani traditions), on my discussions with the composer Jacques Charpentier, and on my joint performance

practice with Indian music experts. It points at the Indian music heritage in the piano composition of Charpentier, connecting it to some piano works by his teacher, Olivier Messiaen. Differences and similarities in their approach to Indian music were highlighted specifically in the elaboration of rhythmical structures, melodic patterns, scales and piano timbre.

My analysis and interpretation of Charpentier's piano work introduces the issue of the development of gestures in contemporary music performance. Chapter 3 focuses on this issue by describing two methods (based on the theories of embodiment and enactment) which support researchers and musicians in the investigation of gestures in contemporary music performance. In addition to the method applied in my own artistic research, this chapter also presents the method used by Coorevits (2016). Both methods are incorporated into the performer-*assistive* method for music performance analysis. Coorevits's approach regards the performer-*inspired* analysis method, which implies a participative observation and dialogue between the researcher, the composer and the performer. The approach used in my research concerns the performer-*based* analysis method, which refers to the hybrid figure of those performer-researchers who want to deeply investigate their own artistic process, in particular the gestural development in their performance practice.

Chapter 4 describes the performative experiment in which the performer-*based* analysis method was applied to monitor my performance practice and to explore the "mirroring" relationship between gestures and intentions. The aim of this performative experiment was to empirically investigate the evolution of my gestures related to my musical intentions from an initial interpretation of the etudes to a developed performance informed by my practice with the composer and Indian music experts. This chapter provides the protocol of the experiment that was conducted, not in a laboratory, but in a natural performance condition on the grand piano of the Miry concert hall, at the Royal Conservatory of Ghent (2015). Technology was applied as an "augmented mirror" to obtain empirical data (video, audio, motion) to complement my subjective impressions intuitively achieved from my practicing. A performance model and a score annotation, that consist of the analysis of musical structures, technical features and interpretative cues, were used to systematize the description of my practice. This chapter ends with a discussion on the video, audio and motion analysis of a fragment selected from my performance of the 8th cycle of the *72 Etudes Karnatiques*. The results show a significant difference in terms of sound and gesture between my two approaches: the initial and the developed one.

Chapter 5 discusses the role of technology used as an "augmented mirror" in music performance practice. After having illustrated how performers in the past implemented different devices to enhance the efficiency of their practice, I refer to

the new sophisticated technologies as useful tools for monitoring music performance in artistic research. On the basis of my experience, I explain how the application of technology can constitute an added value for musician-researchers who engage in the systematic analysis of their performance.

Chapter 6 presents a narrative documentation in the form of a retrospective self-report to reconstruct all the activities inherent to my artistic practice. I outline the discussion I had with Charpentier and the various collaborations with musicians trained in the West-European conservatory tradition, artists and Indian music experts that contributed to my artistic growth. The documentation of this artistic activity was collected through traditional approaches (written and verbal self-description, self-observation and self-evaluation) and through the novel technology-enhanced mirror method. Some links to my media-portfolio and portfolio are provided as evidence of my artistic process. This retrospective self-report follows a triangular interplay between experimenting, performing and disseminating. Experimenting consists of my solo practice meetings with the composer, masterclasses and lessons with musicians and Indian music experts, as well as the empirical study I conducted for mapping my performance practice through technology. Performing is comprised of my solo performances of the *72 Etudes Karnatiques* and my multidisciplinary project *Re-Orient*. Disseminating was carried out in a considerable variety of manner: performances, projects, recordings and publications, lecture-recitals and students' supervision, as well as discussions with other professional researchers and musicians who, apart from having an influence on my own artistic work, contributed to spread the results of my research. My solo performance of the entire *72 Etudes Karnatiques* was recorded live during the concert event *Hommage à Jacques Charpentier* (Auditorium Francis Huster, Carcassonne 2016). The recording was published by the American label Centaur Records in three CDs (attached to this doctoral dissertation) which are a part of the artistic outcomes of my research. The multidisciplinary project *Re-Orient* (video recorded and partially published on YouTube) comprises a selection of the *72 Etudes Karnatiques* for piano, enriched by original vocal Karnatic music improvisations, Hindustani percussion accompaniments and Indian dance. This performance was conceived for stage experimentation. The process of embodying Indian music in a Western practice was prompted through a mirroring interaction between the gestures of the musicians (a Karnatic vocalist, two percussionists and me as pianist) and a dancer trained in Indian music. The visual impact provided by the dance would help to establish shared meanings other than to render more accessible and comprehensible (especially for a non-expert audience), the conceptual content of this piano work and the process of embodiment.

Chapter 7 is the conclusion of this doctoral dissertation. Here, the research process, based on the idea of "mirroring" intentionality and gesture of a piano

performance, is discussed in light of the relationship between art and science. The interdisciplinary approach applied to explore the evolution of my performance of the *72 Etudes Karnatiques* opens up the debate on the use of empirical methods and objective measurements to support the validity, credibility and reliability of the artistic research and on the need to incorporate subjective artistic perspectives to reconfirm the scientific findings on music performance analysis. In that sense, the co-developed performer-*based* analysis method and the use of technology-enhanced mirror proposed in my artistic research show potentialities to be refined and extended to other case studies (e.g. monitoring the practice of longer pieces of music, different styles, different performers, different instruments and ensembles). The artistic urge to explore and understand the mirroring relationship between intentionality and gesture in my own process of embodying a piano performance led to this pioneering study. Due to the combination of established artistic research practices and empirical analysis, this research fosters a synergic encounter between art and science and an artistic application of technology as new frontiers in music performance practice and research.

Nederlandse samenvatting

Tegenwoordig is de praktijk van performance/opvoering een gedeeld onderzoeksveld voor kunstenaars en wetenschappers. Bij het beschrijven van het proces van artistieke praktijk en productie zijn kunstenaar-onderzoekers geïnteresseerd in het zoeken naar creatieve methodologieën. Onderzoekers houden zich bezig met het proberen begrijpen van het verband tussen subjectieve expressies en intenties. Ze oriënteren hierbij hun studies vooral op 'gestures' (gebaren) tijdens de performance. Ik concentreer me in dit werk op het onderzoek naar mijn pianopraktijk en specifiek op de "spiegelende" relatie tussen intentionaliteit en gebaar. Dit artistiek onderzoek omvat zowel een artistiek als een wetenschappelijke perspectief.

In hoofdstuk 1 beschrijf ik hoe mijn werk begon vanuit de bedoeling de interpretatie en opvoering van het hedendaags pianowerk *72 Etudes Karnatiques* van Jacques Charpentier (1933-2017) te definiëren en verfijnen. Om de performance praktijk dieper te begrijpen, en het artistieke proces systematisch te beschrijven (met experimenten, uitvoeringen en disseminatie) werd het onderzoek ingebed in het theoretische kader van zgn. *embodied music cognition*. Ik experimenteerde daarbij met nieuwe uitvoeringsstrategieën en produceerde nieuwe artistieke performances, waarbij ik de kennis die in dit proces werd verzameld verder uitwerkte. De analyse en verspreiding van mijn artistieke praktijk omvat niet alleen traditionele methodes (uitgeschreven beschrijvingen, observaties en evaluaties), maar ook het gebruik van technologie als een *augmented mirror* voor de monitoring van de uitvoeringspraktijk. De introspectieve blik vanuit een artistieke onderzoeksbenadering samen met een empirische observatie vanuit de systematische musicologie, werden gecombineerd in een methodologie gerepresenteerd door een Triangulair Artistiek Research Systeem (TARS) dat theorie, praktijk en productie als onderdelen van het algemene artistieke proces combineert.

In hoofdstuk 2 geef ik de historische en musicologische analyse die aan de basis ligt van mijn interpretatie van de *72 Etudes Karnatiques* en die de creatie van mijn

multidisciplinair project *Re-Orient* inspireerde. Deze analyse is gebaseerd op de bestaande literatuur over Indiase muziek (de Karnatische en Hindostaanse traditie), mijn gesprekken met de componist Jacques Charpentier en mijn uitvoeringspraktijk samen met Indiase muziekexperts. Het verwijst naar het Indiase muzikale erfgoed in de piano composities van Charpentier en verbindt dit met sommige van de pianowerken van zijn leraar Olivier Messiaen. Hierbij worden verschillen en gelijkenissen in hun benadering van Indiase muziek belicht, meer specifiek in de uitwerking van ritmische structuren, melodische patronen, toonaarden en piano timbres. Mijn analyse en interpretatie van het pianowerk van Charpentier introduceert de notie van de ontwikkeling van *gestures* (gebaren) in hedendaagse muziekuitsvoeringen.

Hoofdstuk 3 focust zich verder daarop en introduceert twee methodes gebaseerd op de theorieën van *embodiment* (belichaming) en *enactment* (uitvoering) om onderzoekers en musici te ondersteunen in het onderzoek naar *gestures* (gebaren) in hedendaagse muziekperformances. Naast de methode die ik in mijn artistiek onderzoek heb toegepast, presenteert dit hoofdstuk ook de methode die werd gebruikt door Coorevits. Zij hanteert twee verschillende benaderingen van een overkoepelende uitvoerder-ondersteunende (*performer-assistive*) methode als performance analyse. Eén benadering is de door de performer geïnspireerde analysemethode die een participatieve observatie en dialoog tussen de onderzoeker, de componist en de uitvoerder impliceert. De andere benadering is de op uitvoerder gebaseerde analysemethode (gebruikt in mijn onderzoek) die verwijst naar de hybride positie van performer-onderzoekers die hun eigen artistieke proces, meer specifiek de ontwikkeling van gebaren in hun uitvoeringspraktijk, grondiger willen onderzoeken.

Hoofdstuk 4 beschrijft het experiment waarbij de performer gebaseerde analysemethode werd toegepast om mijn uitvoeringspraktijk te volgen en om de "spiegelende" relatie tussen gebaren en intenties te exploreren. Het doel van dit performatieve experiment bestond erin om empirisch de evolutie van mijn gebaren met betrekking tot mijn muzikale intenties te onderzoeken, vanaf een eerste interpretatie van het stuk tot een gevorderde uitvoering geïnspireerd door het inoefenen ervan samen met de componist en Indiase muziekexperts. Dit hoofdstuk bevat het protocol van het experiment dat niet in een laboratorium werd uitgevoerd, maar in een spontane uitvoeringstoestand op de vleugel van het Miry-concertgebouw in het KASK Conservatorium Gent (2015). De technologie werd aangewend als een *augmented mirror* om empirische gegevens (video, audio, beweging) te verzamelen voor de ondersteuning van mijn subjectieve indrukken die intuïtief werden opgebouwd tijdens het inoefenen. Om de beschrijving van mijn praktijk te systematiseren werden een performance model en partituur annotaties gebruikt. Dit bevatte de analyse van muzikale structuren, technische kenmerken

en interpretatie hints. Dit hoofdstuk eindigt met een discussie over de video-, audio- en bewegingsanalyse van een fragment dat werd geselecteerd uit mijn uitvoering van de 8ste cyclus van *72 Etudes Karnatiques*. De resultaten laten een significant verschil zien qua geluid en gebaren, tussen mijn aanvankelijke benadering en mijn nadien ontwikkelde benadering.

Hoofdstuk 5 bediscusseert de rol van technologie die wordt gebruikt als een *augmented mirror* in de muziekpraktijk. Na het illustreren van hoe performers in het verleden verschillende apparaten hebben aangewend om de efficiëntie van hun praktijk te verbeteren, verwijs ik naar de nieuwe geavanceerde technologieën als nuttige hulpmiddelen voor het monitoren van muziek uitvoeringen als artistiek onderzoek. Op basis van mijn ervaring leg ik uit hoe de toepassing van technologie een toegevoegde waarde kan hebben voor musici-onderzoekers die zich bezighouden met de systematische analyse van hun uitvoering.

Hoofdstuk 6 presenteert een narratieve documentatie in de vorm van een retrospectieve zelf-rapportage om alle activiteiten die inherent zijn aan mijn artistieke praktijk te kunnen reconstrueren. Ik schets mijn betrokkenheid bij de gesprekken die ik had met de componist, met de musici die getraind zijn in de West-Europese conservatorium traditie, met de kunstenaars en Indiase muziekexperts die hebben bijgedragen tot mijn artistieke groei. De documentatie van al mijn artistieke activiteiten werd verzameld via traditionele benaderingen (geschreven en verbale zelf-observatie en zelf-evaluatie) en via de nieuwe, met technologie versterkte spiegelmethode. Als getuigenis van mijn artistieke evolutie werden links naar mijn mediaportfolio en portfolio toegevoegd. Deze retrospectieve zelfrapportage volgt een triangulair samenspel tussen experiment, uitvoering en disseminatie. Het experimenteren bestaat uit mijn solo-oefeningen, ontmoetingen met de componist, de masterclasses en lessen met muzikanten en Indiase muziekexperts, maar ook de empirische studie die ik heb uitgevoerd om mijn uitvoeringspraktijk door middel van technologie in kaart te brengen. De uitvoeringen behelzen de solo-performances met de *72 Etudes Karnatiques* en het multidisciplinaire project *Re-Orient*. De disseminatie verwijst naar mijn uitvoeringen, projecten, opnamen en publicaties, voordracht-recitals en studentenbegeleiding, alsook besprekingen met andere professionele onderzoekers en musici die mijn artistieke ontwikkeling hebben beïnvloed en die hebben bijgedragen aan de verspreiding van mijn onderzoek. Als artistieke productie werd mijn solo-uitvoering van de *72 Etudes Karnatiques* live opgenomen tijdens het concert-evenement *Hommage à Jacques Charpentier* (Auditorium Francis Huster, Carcassonne 2016). Die live opname werd gepubliceerd op het Amerikaanse label Centaur Records in drie CD's (bijgevoegd bij dit proefschrift). Dit maakt deel uit van het artistieke resultaat van mijn onderzoek. Het multidisciplinaire project *Re-Orient* (de video werd gedeeltelijk gepubliceerd op

YouTube) bestaat uit een selectie van de *72 Etudes Karnatiques* voor piano, verrijkt met originele Karnatische vocale improvisaties, Hindostaanse percussie-begeleiding en Indiase dans. Deze voorstelling werd opgezet om op het podium te kunnen experimenteren met het proces van *embodiment* van Indiase muziek in een westerse context met een spiegelende interactie tussen de *gestures* van de muzikanten (een Karnatische zanger, twee percussionisten en ikzelf als pianist) en een danseres opgeleid in Indiase muziek. De visuele impact van de aanwezigheid van de danseres had de bedoeling om de conceptuele inhoud achter dit hedendaagse pianowerk van Charpentier en achter de theorie van 'embodiment' toegankelijker en begrijpelijker te maken, vooral voor een publiek van niet-specialisten.

Hoofdstuk 7 bevat de conclusie van dit proefschrift. Het onderzoeksproces, gebaseerd op het idee van het "spiegelen" van intentionaliteit en gesture/gebaar in een piano performance, wordt hier besproken in het kader van de relatie tussen kunst en wetenschap. De interdisciplinaire benadering toegepast op de exploratie van de evolutie van mijn uitvoering van de *72 Etudes Karnatiques* opent een debat over het gebruik van empirische methoden en objectieve metingen om de validiteit, credibiliteit en betrouwbaarheid van het artistiek onderzoek. Het gaat verder over de noodzaak om subjectieve artistieke perspectieven te integreren en wetenschappelijke bevindingen over muziek performance analyse te herbevestigen. Op die manier verschaffen de beide op uitvoering gebaseerde analysemethoden en het gebruik van een met technologie versterkte 'mirror', zoals voorgesteld in mijn artistieke onderzoek, mogelijkheden om te worden verfijnd en uitgebreid naar andere case-studies (bijvoorbeeld de monitoring van de praktijk van langere muziekstukken, naar andere genres toe, met andere uitvoerders, met verschillende instrumenten en ensembles). De artistieke drang om de spiegelende relatie tussen intentionaliteit en gesture/gebaar in mijn eigen ontwikkeling van *embodiment* van een piano performance te verkennen en te begrijpen, leidde tot deze baanbrekende studie. Door de combinatie van gevestigd artistiek onderzoek en een empirische analyse, bevorderde dit onderzoek een synergetische ontmoeting tussen kunst en wetenschap, met een nieuwe artistieke toepassing van technologie. Beide bevinden zich op de nieuwe grens voor muziek performance en onderzoek.

*Dutch translation by
Guy Van Belle*

List of Publications

Miscellaneous

Caruso, G. (2018). *Jacques Charpentier: 72 Etudes Karnatiques pour piano* (box of 3 CDS), Centaur Records, USA.

Articles

Caruso, G. (2017). L'approche scientifique et l'interprétation musicale: la technologie comme miroir. (C. LEJEUNE, Ed.). In *Cahiers internationaux de symbolisme*, 146-147-148 (Sciences et littérature), pp. 29-44.

*Caruso, G., Coorevits, E., Nijs, L. & Leman, M. (2016). Gestures in contemporary music performance: a method to assist the performer's artistic process. In *Contemporary Music Review*, Volume 35, Issue 4-5: Gesture-Technology Interactions in Contemporary Music.

Caruso, G. (2016). La femme au toucher ineffable: la pianiste, pédagogue et chercheuse Marie Trautmann, épouse Jaëll. In *Cahiers internationaux de symbolisme*, (C. LEJEUNE, Ed.) 143-144-145 (Genre), pp. 27-42.

*Caruso, G. & Leman, M. (2015). Le patrimoine musical indien dans le répertoire pour piano d'Olivier Messiaen et de Jacques Charpentier. In *Cahiers internationaux de symbolisme*, (C. LEJEUNE, Ed.) 140-142 (Patrimoines), pp. 23–56.

Conference Proceedings

Caruso, G. (2016). Experimenting with subjectivity instantiated into gestures: My soul at my fingertips : My Avatar and Me. *Proceedings of the International Codarts Artistic Research Festival (CRAFT 2016), Rotterdam Conservatorium, The Netherlands.*

Caruso, G. (2016). Gestures as an Interface of Cultural Identity in Musical Performance: Western Embodiment of Karnatic Music. *Proceedings of the International Conference "Musical Gestures as Creative Interface"*. Universidade Católica Portuguesa, Porto, Portugal, CITAR, pp. 91-92.

Caruso, G. (2016). Experimenting with subjectivity instantiated into gestures: My soul at my fingertips: My Avatar and Me. *Proceedings of the International Conference "Performance, Subjectivity and Experimentation in Artistic Research"*, Orpheus Instituut, Ghent, Belgium, pp. 15-16.

Caruso, G. (2013). Western embodiment of Carnatic Music: 72 Etudes Karnatiques by Jacques Charpentier (1933). *Proceedings of the International Piano Symposium, Royal College of Music, London*.

Caruso, G. (2013). Western embodiment of Carnatic Music: 72 Etudes Karnatiques by Jacques Charpentier (1933). *Proceedings of the International Conference "Experimental Affinities in Music - from Late Middle Ages"*, Orpheus Instituut, Ghent, Belgium.

**Articles included in the thesis.*

Table of Contents

Acknowledgements	v
Preface	vii
English Summary.....	ix
Nederlandse samenvatting	xiii
List of Publications.....	xvii
Table of Contents.....	xix
List of figures	xxiii
List of tables	xxvii

Chapter 1 Introduction: Approaching the interpretation of the 72 Etudes Karnatiques by J. Charpentier.....	1
1.1 Research topic and questions.....	1
1.2 Objective.....	5
1.3 Methodology	7
1.3.1 Theory	10
1.3.2 Practice: piano practicing, joint practice and empirical studies	11
1.3.3 Production	13
1.4 Outcomes and further investigations	14
1.5 Outline	15

Chapter 2 The Indian music heritage in Olivier Messiaen and Jacques Charpentier's piano works	19
2.1 Introduction	20
2.2 Indian music heritage in Olivier Messiaen's concept of musical time	21

2.3	Indian music and Messiaen's heritage in Jacques Charpentier's <i>72 Etudes Karnatiques pour piano</i>	27
2.4	Discussion and conclusion.....	39

Chapter 3 Gestures in contemporary music performance: a method to assist the performer's artistic process 41

3.1	Introduction	42
3.2	Music performance: embodied interactions in the performance space	43
3.2.1	The performance space-frame	44
3.2.2	Embodied interactions with music	45
3.3	Music Performance Analysis: bottom-up and top-down.....	46
3.3.1	Bottom-up approach: a third-person perspective on performance analysis.....	48
3.3.2	Top-down approach: a first-person perspective on the lived experience	49
3.4	Case study 1: Emphasizing the third-person perspective on performance.....	52
3.5	Case study 2: Emphasizing the first-person perspective on performance.....	59
3.6	Discussion and Conclusion.....	63

Chapter 4 Mirroring the intentionality and gesture of a piano performance 67

4.1	Introduction	68
4.2	The artistic process in music performance: interpretation, enactment and embodiment	72
4.2.1	Intentionality and music interpretation	72
4.2.2	The processes of enactment and embodiment in the performance space	73
4.3	A case study regarding interpretation and embodiment.....	75
4.3.1	Method.....	75
4.3.2	Procedure	78
4.3.3	Data Analysis.....	83
4.4	Results	89
4.5	Discussion.....	96
4.5.1	Intentionality and gesture.....	96
4.5.2	The artistic process and the gestural engagement.....	98
4.5.3	Method and analysis.....	99
4.5.4	The mirror technology.....	101
4.6	Conclusion	102

Chapter 5	The technology-enhanced mirror: a meta-perspective for music performance practice and research	105
5.1	Introduction	105
5.2	A meta-perspective for music performance analysis	110
5.2.1	Audio analysis: visual inspection and quantitative analysis	113
5.2.2	Gestural analysis for body awareness	116
5.2.3	Alignment of qualitative and quantitative analysis	121
5.3	General discussion	122
5.4	Conclusion	124
Chapter 6	Artistic process: experimenting, performing and disseminating.....	125
6.1	Introduction	125
6.2	Experimenting.....	129
6.2.1	Solo practicing	129
6.2.2	Joint practice with the composer and Indian music experts	130
6.2.2.1	Meetings with Jacques Charpentier	130
6.2.2.2	“Indian-inspired” practice	135
6.2.3	Empirical observation: application of technology and body awareness	143
6.3	Performing	146
6.3.1	Solo performances	146
6.3.2	The <i>Re-Orient</i> project.....	147
6.4	Disseminating	151
6.4.1	Performances, projects, lecture-recitals, recordings and publications.....	151
6.4.2	Guiding & Discussing	152
6.4.2.1	Experiences with students.....	153
6.4.2.2	Experiences with researchers and professional musicians	155
6.5	Conclusion	156
Chapter 7	Discussion and Conclusion: New frontiers for music performance practice and research.....	157
7.1	Introduction	157
7.2	New frontiers for music performance practice and research	159
7.2.1	The artistic-scientific entanglement	159
7.2.2	The technology-enhanced mirror for self-observation and dissemination of knowledge in the research on music performance	162
7.3	From artistic practice to artistic research and from artistic research to artistic practice.....	163
7.4	Conclusion	167

Bibliography 173

A.1 189

A.2 195

A.3 199

A.4 203

A.5 213

A.6 217

A.7 233

List of figures

Figure 1.1	The artistic research process is represented by five blue concentric circles linked by the idea of “producing through practice-based research” (the red circle).	6
Figure 1.2	TARS.	9
Figure 1.3	Structure of the chapters.	17
Figure 2.4	The original <i>râgavardhana</i> structure and the elaboration (augmentation) made by Olivier Messiaen.	23
Figure 2.5	Messiaen’s inversion (a) and transformation (b) of the <i>râgavardhana</i> rhythm.	23
Figure 2.6	Examples of Messiaen’s <i>valeur ajoutée</i> theory based on the principle of addition or interpolation of (1) a note, (2) a rest and (3) a dotted note to a regular rhythm.	24
Figure 2.7	An example of the <i>râgavardhana</i> rhythm from <i>Regards du Fils sur le Fils</i> (1944) (Ed. Durand Salabert).	24
Figure 2.8	The 72 Karnatic modes in Western notation from <i>Encyclopédie de la Musique</i> (1931) by Lavignac.	29
Figure 2.9	The pitches of the <i>swaras</i> in the correspondent Western well-tempered subdivision.	31
Figure 2.10	<i>Melakarta</i> chart.	32
Figure 2.11	The original Indian <i>tala simbanandana</i> n.35 from the <i>120 deçî-tâlas</i> by Sharngadeva and the elaboration made by Charpentier (Ed. Alphonse Leduc).	34
Figure 2.12	Extract from the 8 th cycle etude <i>Çadivedamangini</i> n. 46 (Ed. Alphonse Leduc).	35
Figure 2.13	Extract from 8 th cycle etude <i>Gavambodi</i> n. 43 (Ed. Alphonse Leduc).	36
Figure 2.14	Extract from 8 th cycle etude <i>Bhavaprya</i> n. 44 (Ed. Alphonse Leduc).	37
Figure 2.15	The original Indian structure <i>niççanka tala</i> and the elaboration made by Charpentier with one value omitted (Ed. Alphonse Leduc).	37
Figure 2.16	The music score of the etude <i>Râsikaprya</i> n. 72 from the 12 th cycle (Ed. Alphonse Leduc).	38
Figure 3.17	The performer-assistive method.	51

Figure 3.18	Multimodal framework for the analysis of <i>Austerity Measures I</i>	54
Figure 3.19	Visualization of different measurements in bars 30-49.	56
Figure 3.20	Stefan Österjö performs <i>Austerity Measures I</i> surrounded by sensors.	58
Figure 3.21	Giusy Caruso performs the 8 th cycle from the <i>72 Etudes Karnatiques</i> with markers attached to her upper body parts.	61
Figure 3.22	The alignment between a bar from the score annotation and the correspondent frame from the MoCap recording.	62
Figure 4.23	This scheme summarizes the concepts and the artistic context (“Indian-inspired” practice in this case) inherent to the performer-based analysis method.	71
Figure 4.24	The original Indian <i>niççanka tala</i> and the elaboration made by Charpentier.	76
Figure 4.25	The MoCap set up with 6 infrared cameras positioned on a fixed bridge.	77
Figure 4.26	The performance model.	79
Figure 4.27	The performer’s score annotation.	80
Figure 4.28	The MoCap avatar.	82
Figure 4.29	The performer’s analytical strategy.	86
Figure 4.30	Elan software.	87
Figure 4.31	Data collection.	88
Figure 4.32	A comparison between the vertical displacement (y) of the right hand, the right elbow and the head in the initial approach and in the developed approach according to the score above, taken as a point of reference.	91
Figure 5.33	Friedrich Kalkbrenner’s <i>guide-mains</i>	106
Figure 5.34	The <i>dactylion</i> by Henri Herz.	107
Figure 5.35	An example of the empirical analysis on piano touch made by Marie Trautmann Jaëlle.	112
Figure 5.36	An example of audio analysis from Sonic Visualiser by selecting the waveform and spectrogram views per 26 note onsets.	114
Figure 5.37	The lower panel shows a graphical representation of the energy (the root-mean-square, RMS) calculated by Sonic Visualiser.	115
Figure 5.38	My body as visualized by the Motion Capture System (QUALYSIS) in the tridimensional performance space.	117
Figure 5.39	My body seen in the virtual space through the MoCap Qualisys System from different perspectives.	118
Figure 5.40	An example of zooming in my <i>avatar</i> right elbow.	118
Figure 5.41	Elan project.	122
Figure 6.42	The artistic process, represented by a triangular configuration, shows the interplay between the acts of experimenting, performing and disseminating.	126
Figure 6.43	This timeline shows a prospect of my artistic process from 2012 to 2013.	127

Figure 6.44	This timeline shows a prospect of my artistic process from 2014 to 2015.....	128
Figure 6.45	This timeline shows a prospect of my artistic process from 2016 to 2017.....	128
Figure 6.46	The original <i>niççanka</i> rhythm form the 120 <i>deçî-tâlas</i>	131
Figure 6.47	Here there is the elaboration of the <i>niççanka</i> rhythm in mirror form made by the composer.	132
Figure 6.48	The accented notes of this passage from the 8 th cycle constitute the <i>Gavambodi</i> scale.....	133
Figure 6.49	This figure shows the passage from the 8 th cycle where the composer asked to maintain the sustain pedal to create the effect of resonance.	134
Figure 6.50	This figure shows how I applied the subdivision of the Indian rhythm <i>rangapradipaka</i> in Charpentier's <i>Chakavaka</i> etude n. 16.....	138
Figure 6.51	Examples of Indian <i>konnakol</i> taken from Reina's work.	139
Figure 6.52	The initial fragment of the <i>Varunaprya</i> etude n.24.....	140
Figure 6.53	The <i>konnakol</i> applied to a passage from the <i>Gavambodi</i> etude n.23.....	141
Figure 6.54	A moment from the rehearsal with the dancer.	143
Figure 6.55	The artistic and scientific entanglement in my artistic process. .	145
Figure 6.56	The <i>Re-Orient</i> project in Brussels (26 April 2014).	148
Figure 6.57	Some pictures from the <i>Re-Orient</i> project performed in the Miry Zaal at the Royal Conservatory of Ghent (8 March 2017).	150
Figure 6.58	Guiding and Reproducing approaches.	153
Figure 6.59	The performative experiment by Bart Lysens (16 October 2015).	154
Figure 7.60	The development of the artistic process from intuitive practice (instinctive research) to deliberate practice (conscious research) and then to artistic research (systematic research envisioned in the entanglement of art and science).	164
Figure 7.61	(1). Kolb's <i>learning model</i> ; (2) music performance learning model.....	166
Figure 7. 62	This figure shows how the entanglement of art and science augmented the prospect of possible new outlooks in music performance practice and research.	170
Figure A4.63	The cameras configuration on the bridge.	206
Figure A4.64	A moment of the Wand calibration procedure.	206
Figure A4.65	The final cameras configuration.....	207
Figure A4.66	This figure shows one of the results of my Wand calibration made by the Optitrack system in which the sketch of the keyboard is drawn.	208
Figure A4.67	This screen shot shows all the visible points blocked (white dots).....	208
Figure A4.68	This screen shot shows the position of the L-shaped reference structure.	209

Figure A4.69	This screen shot shows the capture volume of one of my calibration with excellent result.	209
Figure A4.70	A puppet used for the markers position.	210
Figure A4.71	First markers configuration.	210
Figure A4.72	Configuration of markers on my arms and forearms to draw the elbow.	211
Figure A4.73	First rigid body captured.	211
Figure A4.74	Final rigid body configuration	212

List of tables

Table 4.1	Codification made by the performer referring to the enactment of the fragment (see Figure 4.27).	80
Table 4.2	Integration of gestures labelled in Table 4.1	85
Table 4.3	Most occurring (mode) motor strategies in the head, right hand and right elbow.	89
Table 4.4	The table shows the significant increase ($p < .05$) in the developed approach for the duration and a significant decrease ($p < .05$) for the energy.	90
Table 4.5	The z value for the significant increase in the developed approach ($p < .05$)	93
Table 4.6	Correlations between the energy and the amplitude of all the notes in the initial approach.	94
Table 4.7	Correlations between duration, energy, amplitude, velocity and acceleration of all the notes in the developed approach.....	95
Table 5.8	A comparison between the first approach (1) and second approach (2) of the averages in the vertical displacement of right hand (RHy), right elbow (REy) and head (Hy).	120

Chapter 1

Introduction: Approaching the interpretation of the 72 Etudes Karnatiques by J. Charpentier

*I have to play this evening.
Will I have my soul at my fingertips?
I want to reach the depths of souls...
If I do not play well,
the beauty vanishes like a dream...
How can I make sure that
the beauty does not flee like a dream?¹*

Marie Trautmann Jaëll

1.1 Research topic and questions

In music performance, the performer experiences a subtle interplay between auditory feedback and tactile sensations in interpreting a score while “feeling” the music (Huang et al., 2013). During a music performance, sounds are skilfully produced with a musical instrument that itself imposes certain movements and postures. When the instrument becomes a “natural extension” of the body, the instrumental gestures become integrated with the musician’s bodily responses to

¹ Jaëll Trautmann, M., Journal (unpublished), in Guichard, C. (2004). *Marie Jaëll: The Magic Touch, Piano Music by Mind Training*. Algora Publishing, United States, p. 123.

the music and the musician's personal style of moving (Nijs, 2017). This results in an overall gestural involvement of the musician. Accordingly, gestures tend to show aspects of personal interpretation of music in relation to the emotional condition and intentionality, what Marie Trautmann Jaëll called "soul".

As a classical pianist, I tend to interpret the score by approaching the music as if it were a character. In that sense, my approach resembles that of actors who shape their character both by retrieving past artistic and practical experiences, sensations and emotional states (their "soul"), and by acting out their conscious decisions on the inflexion of the voice, breath, gestures and stage presence.

I believe that all classical musicians engaged in interpreting a score are involved in a similar physical and emotional commitment with music. Like actors, classical musicians shape the musical "character" of a music score in the phrasing, in the use of breath, movement and so on. All this decision-making constitutes, in a broad sense, the intentions of the performer.

Intentionality is a conscious state that has directedness - or "aboutness" - towards something². This conscious state derives from a process steered by a condition of satisfaction, which determines the intention. However, on the basis of the recent developments in neurophysiology, intentionality is considered not only a mental activity because it refers to an action-based understanding of the world (Leman, 2007).

In that sense, the performers' intentionality (the decision-making on a performance) appeals to specific artistic needs that imply:

- aesthetic concerns (what determines the intentions)
- performative strategies (how to execute the intentions)
- relational dimension (how to share the intentions through meaningful signs)

This explains why performers have this strong need to establish a connection between their intentionality and their performance gesture, as Trautmann Jaëll wondered: *Will I have my soul at my fingertips?*³. What she called "soul" concerns, indeed, musicians' intentionality, which comes from lived experiences, musical education, practices, specific studies and so on.

My research wants to focus on these specific aspects of musical intentionality, as they are manifested through the performance gesture.

² See Searle's general theory of intentionality (1983).

³ Jaëll Trautmann, M., Journal (unpublished), in Guichard, C. (2004). *Marie Jaëll: The Magic Touch, Piano Music by Mind Training*. Algora Publishing, United States.

Musical intentionality and performance gesture are an outcome of a process of conscious acquisition of a musical score, as determined by one's personal artistic practice. Therefore, at every stage of the artistic practice decisions on the musical style and structure are fixed as conscious musical intentions, translated, then, into executive/sensorimotor strategies. The subtle interplay between intended sound and gestures that emerges throughout practice and performance is grounded in a process of embodiment through which bodily experiences become the fruitful soil of musical interpretation (Leman, 2007, 2016).

In focusing on the "mirroring" relation between musical intentionality and gesture, I decided to study my own artistic practice by empirically exploring self-perception and body awareness in piano performance. I chose the *72 Etudes Karnatiques pour piano* by the composer Jacques Charpentier (1933-2017) as the repertoire of my research because their intriguing musical context (a Western application of Karnatic modes from South India) offered me new ideas for the interpretation, the practice and the execution of this work. The artistic goal was to establish an original performance of the *72 Etudes Karnatiques* and to explore new practice and methods useful for musicians in the challenge of interpreting and performing a musical score.

Composed between 1957 and 1985, Charpentier's *72 Etudes Karnatiques* are inscribed in the context of contemporary classical music tradition, which comprises music works from middle XX century up to now⁴. Since this piano work consists of 12 cycles of six etudes, which follow the 72 modes from the Karnatic *Melakarta Ragas* (the South India fixed system of 72 scales), its interpretation prompted me to explore the impact Karnatic music could have had on my performance practice. From this perspective, I wanted to study the evolution of my interpretative intentions, from an initial approach to a developed approach, in order to see whether this process is revealed in a different corporeal expression during my performance.

I started practicing and analysing the *72 Etudes Karnatiques* from its 8th cycle because it is written in the form of *Quasi Sonata*. This allowed me to have an initial proper overview of the six etudes constituting the 8th cycle, which are linked together in this *Quasi Sonata* form. Therefore, the 8th cycle performed in 2012 represents my initial approach to the entire piece. Since art in general is regarded as "a cultural practice" (Carroll, 2001) and the interpretation of a score requires

⁴Botstein, L. (2001). *Modernism. The New Grove Dictionary of Music and Musicians*, second edition, edited by Stanley Sadie and John Tyrrell. London: Macmillan Publishers.

specific competences (Danuser, 1992), I decided to initiate my research by first investigating on the sources of the *72 Etudes Karnatiques* available⁵.

I discovered that a historical interpretative tradition of this contemporary piano piece seems to be missing, apart from a few recordings⁶. Consequently, questions concerning its interpretation, practice and documentation/dissemination remained unanswered, namely:

- Which Indian musical elements were originally introduced in the score of the *72 Etudes Karnatiques* that I should learn as a Western performer in order to establish an original interpretation?
- Would a joint practice with the composer and with Indian music experts “reorient” my interpretation of the *72 Etudes Karnatiques*?
- How should I monitor, document and disseminate the evolution of my artistic process in practicing and performing this repertoire?

In addition to the questions related to my artistic practice and interpretation, other questions concerning the methodology based on self-perception and self-evaluation in music performance practice emerged:

- If bodily engagement in music performance is an outcome of an artistic practice, can gestures “mirror” aspects of the performer’s intentions? And, if so, can the performer’s artistic process be mapped through the lens of empirical studies on performance gesture?
- In this research, how can, musical structures and intentions (score interpretation) be linked to performance gesture?
- Can technology be used as a “mirroring” tool for the self-perception and self-investigation in artistic research on music performance practice?

⁵ Moreau, V. (1989). *Jacques Charpentier, l'homme et l'œuvre*, Université de Paris 4 Sorbonne. (private document); Charpentier, J. (1956). *Introduction à l'étude des lois de la Musique de l'Inde*, (private document)

⁶ At that time, a first recording by the pianist Ann Gaels (1996) and a more recent one made by the pianist Michael Schäfer (2012) were available to me.

1.2 Objective

This artistic research aimed at studying the process of my interpretation and practice of the *72 Etudes Karnatiques* by investigating the “mirroring” relation between intentionality and gesture of a piano performance. I planned to document and to empirically analyse this process by using technology to understand how my practice (after a joint practice with the composer and Indian music experts) could influence changes in my interpretation of the piece (musical intentionality) and, consequently, in my performance gesture.

In this way, this artistic research contributes to the established interpretative tradition on contemporary music while adding new perspectives on the methodological approach for contemporary music performers engaged in artistic research.

To sum up, the objectives of this study are:

- contributing to the interpretation and performance of an important contemporary piano work, still not well-known and as of now, not often performed;
- discovering new paths and methods useful for contemporary music performers engaged in the self-observation and self-evaluation of their performance practice;
- producing new artistic outcomes consisting of my solo performance of the entire *72 Etudes Karnatiques*, live recordings and the multidisciplinary project *Re-Orient*⁷ involving the presence of a Karnatic singer, two percussionists and a dancer trained in Indian music;
- proposing and encouraging a dialogue between art and science by introducing the creative use of technology in artistic research.

In this investigation, the objective of my artistic research is situated in the centrum of a number of concentric circles (recalling Maurice Cornelis Escher’s

⁷ The term “Re-Orient” was coined here to recall the sense of “re-orientation” I pursued during my artistic process. The intention was not to refer to the negative perception of *Orientalism* in music and art as Western “imitations” of other musical cultures (Said, 1978); rather, it seeks to propose a positive and constructive fusion of western and non-western music (Indian music in this case).

perspectives⁸, see Figure 1.1), which represent the different stages of my artistic research process.

Philosophical interpretation and inspiration, artistic practice and empirical observation are all elements of this blended art and science entanglement where producing through practice-based research is the leading goal. In other words, the aim is producing while doing research and doing research while producing.

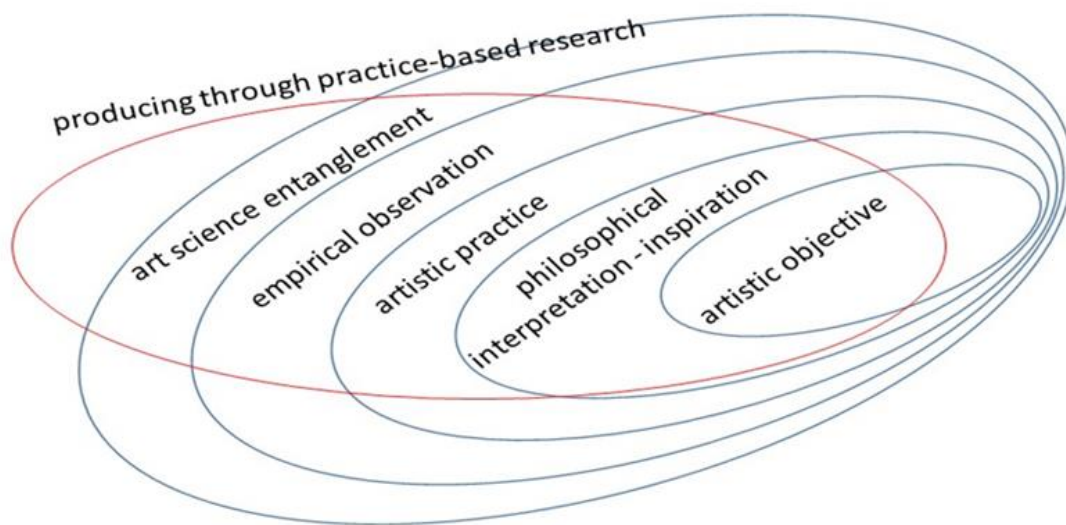


Figure 1.1 The artistic research process is represented by five blue concentric circles linked by the idea of “producing through practice-based research” (the red circle).

In short, the goal of this artistic research was to investigate my artistic practice «...not to rediscover the eternal or the universal, but to find the conditions under which something new is produced (creativity).»⁹.

⁸ The Dutch graphic artist Maurice Cornelis Escher (1898 – 1972) who made mathematically inspired woodcuts, lithographs and mezzotints.

⁹ Deleuze, G., & Parnet C. (2006). *Dialogues II*, new edition, trans. H. Tomlinson, B. Habberjam, and E. R. Albert (London: Continuum).

1.3 Methodology

One of the most problematic themes in artistic research concerns the methodological procedures needed to systematically elicit and scrutinize the different stages and developments of the artistic process (Klein, 2010). Based on my experience, I believe that artistic research needs a pluralistic approach, which comprises a balanced integration of various methodologies from different disciplines.

The different stages of the artistic process are rooted in the Aristotelian terms (see also Coessens, Crispin, & Douglas, 2009; Dos Santos & Hentschke, 2011):

- *theoria* (pure knowledge),
- *praxis* (intended here as the application of knowledge which determines a personal artistic growth, without referring specifically to the “ethical” implication of the term - *phronesis*)
- *poiesis* (creative technical skills, which implies music production - *techné*).

In designing the methodology of my artistic process, I applied an interdisciplinary approach, which points at an interaction between these different knowledges.

Theory (thinking) is the necessary knowledge gathered to inform personal decisions (interpretation and motor strategies) on a music performance and serves as a reference framework for reflecting, documenting and disseminating.

Praxis (reflecting while doing) implies all the necessary actions to build and develop a performance (experimenting / performing while documenting / disseminating).

Poiesis (doing/production) concerns the outcomes (performance, documentation and dissemination) obtained by the artistic process.

The interdisciplinary approach of my methodology is summarized in a triangular artistic research system (TARS, see Figure 1.2) where artistic research is placed in the middle of a process, which entails a synthesis, and not a hierarchy, of theory, practice and production.

The triangular configuration of my approach retraces the Hegelian idea of *synthesis of opposites* that combines different aspects while accepting their limits and contradictions because they are parts of an entire process¹⁰. The process of *synthesis of opposites* offered me a way to systematically shape the entanglement between art and science, theory and practice, mind and body. This idea of entanglement is borrowed from Schrödinger's concept in quantum mechanics¹¹. The quantum entanglement is a phenomenon in which the quantum state of two or more individual objects, spatially separated, cannot be described singularly but only as a part of a system where each refers to the other on having a mutual influence. Some studies reveal the relevance and applicability of Hegel's dialectical method within the modern physical theory of quantum¹². In the Hegelian triangular system, the Science of Logic is manifested through opposite elements, spirit-logos-nature, in a dynamic process of transformation where one is influenced by the other, reaching to a final synthesis.

The idea of entanglement from quantum mechanics and the concept of Hegelian *synthesis of opposites* inspired my triangular artistic research system (TARS). This system is based on a dynamical relation between theory, practice and production, synthesized within the artistic research. The artistic process is thus identified in this passage from theory, to practice, to production.

These are the premises of my interdisciplinary approach which enabled me to move from one field to the other as parts of my entire artistic research process:

- *theory* is envisioned in the fields of systematic musicology, embodied cognition and music analysis;
- *practice* comprises the actions of experimenting, performing while documenting and disseminating, approached through both qualitative and quantitative methods;
- *production* (outcomes) concerns performance, documentation and dissemination of my research by solo performances, artistic projects (*Re-Orient*), publications (articles and CDs), lectures and live recordings.

¹⁰ Hannula, M., Suoranta, J., & Vaden, T. (2005). *Artistic research: theories, methods and practices*. Published by Academy of Fine Arts, Helsinki, Finland and University of Gothenburg / ArtMonitor, Gothenburg, Sweden, p.153.

¹¹ Kumar, M. (2017). *Quantum*, Mondadori.

¹² Williamson, R. (2009). Hegel Among the Quantum Physicists, in *International Journal of Žižek Studies* 3 (1).

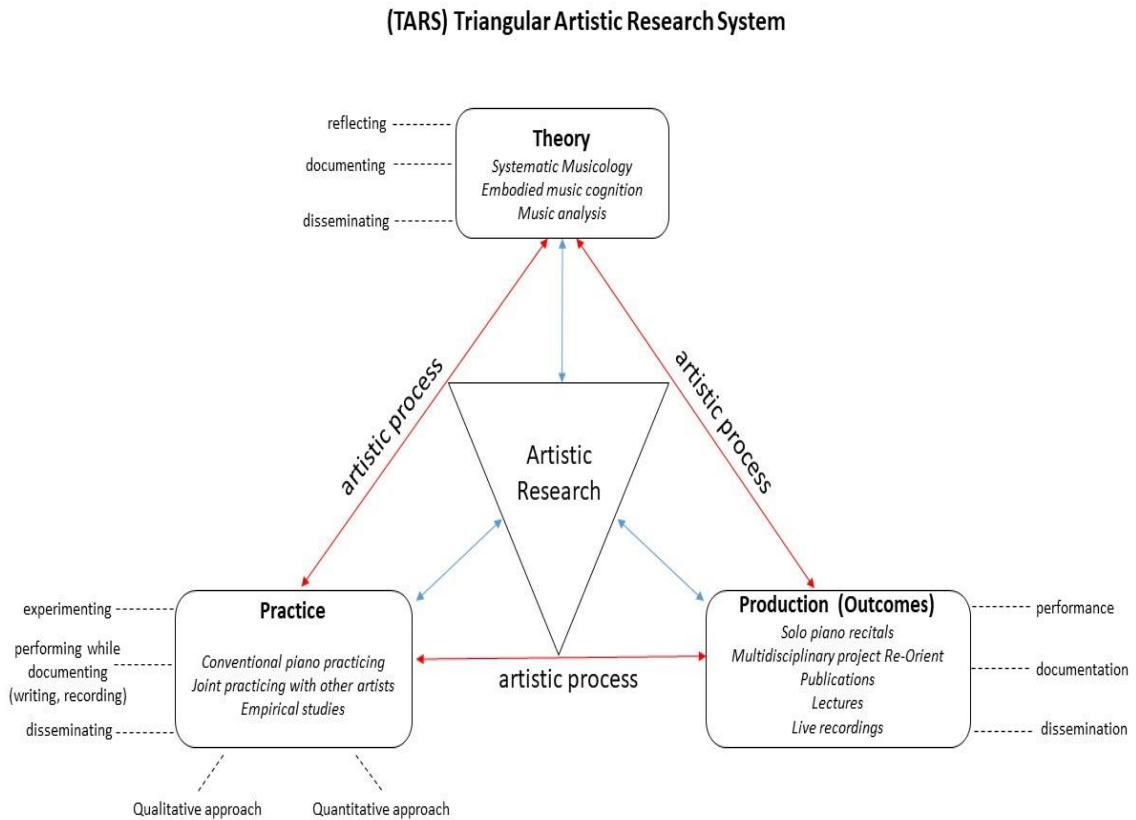


Figure 1.2 TARS.

In the triangular artistic research system, artistic research is placed in the middle as a synthesis (see the blue arrows) of the interplay between *theory*, *practice* and *production*, which are manifestations of the entire artistic process (see the red arrows). Practice and production furnish the concrete territory of experiences where theoretical concepts are applied. Vice versa, theory concerns the knowledge and the strategies for reflecting, documenting and disseminating the research through practice and production. A mutual influence happens also between practice and production because practice is finalized to production and production is used as a feedback for practice. All these three domains share a common objective of documenting and disseminating the artistic process as an artistic research.

1.3.1 Theory

Within the artistic research context, theory may assume different perspectives regarding practice (Borgdorff, 2012):

- *instrumental* to describe the artistic practice
- *interpretative* to reflect on the artistic practice
- *performative* to address the artistic practice
- *immanent* to be within the artistic practice

The theoretical approach, therefore, constitutes the knowledge on artistic practice, and, conversely, artistic practice reflects the theoretical approaches. Ultimately, artistic research can be identified in a fusion of the artistic practice and the theoretically informed approach¹³.

In light of this framework, the theoretical part of my doctoral investigation seeks to retrace an Indian music retrospective as a body of knowledge (*theoria*), needed to analyse and interpret the score. In interpreting or re-interpreting a composition, interpreters bring their personal “effective history” (Gadamer, 1960) based on a fusion of different theoretical and experiential horizons. To achieve a correct interpretation, performers need to define and refine specific knowledge and skills inherent to the text (score) and the context (style) (see Kivy, 1995; Danuser, 1996; Dreyfus, 2007).

These premises led me to apply the interdisciplinary approach from systematic musicology by referring to different theories and disciplines, in particular to music analysis and the theories on embodied music cognition (Leman, 2007, 2016).

The above theoretical framework constitutes the base of my artistic research. On one side the study of Indian music served to build my interpretation and performance of the *72 Etudes Karnatiques*. On the other side, the theories of systematic musicology and embodied music cognition gave me the keys to explore my performance practice of Charpentier’s piano etudes in light of the mirroring relation between intentionality and gesture. This theoretical part of my research also contributed to conceptually shape the artistic project *Re-Orient*, which was conceived to show and share on stage (social dimension) the process of embodiment through the gestural interaction between the musicians and a dancer, as happens in Indian music performances¹⁴.

¹³ Busch, K. (2009). Artistic Research and the Poetics of Knowledge. In *Art Research*, 2(2), pp.1-7. Retrieved from <http://www.artandresearch.org.uk/v2n2/busch.html>

¹⁴ Krishna, A. (2013). *Southern Music. The Karnatik Story*. HarperCollins Publisher, pp.224-225.

1.3.2 Practice: piano practicing, joint practice and empirical studies

The theoretical framework of my investigation (*theoria*) was integrated with my performative experiences (*praxis*). My practice entailed both solo performances and a joint practice with the composer himself and with some Indian music experts. The latter constitute the *Re-Orient* project group: Ayla Joncheere, a dancer trained in Indian music and a post-doctoral researcher at the Department of Indian Languages and Cultures at the University of Ghent; Sandeep Kalathimekkad, a Karnatic singer; Francesco Magarò and Carlo Strazzante, percussionists trained in Indian music¹⁵.

Given the lack of literature available on the *72 Etudes Karnatiques*, lessons, discussions and interviews with the composer and with Indian music experts were direct sources of information for my artistic practice¹⁶. A joint performance practice in Indian music helped to facilitate refinement of all the interpretative information collected through my musicological research (*theoria*).

To describe and analyse the development of my artistic process, I applied a phenomenological/qualitative approach (Bowman, 1998) to philosophically explain the essence and understand the meaning of my interpretation. To support this qualitative analysis, I also decided to integrate an empirical/quantitative approach by using technology in an experiment format. This experimental approach enabled me to make my subjective intuitions on my performance practice more explicit. Conversely, my perspective as a performer served to interpret the objective data provided by technology in light of my interpretation of the score.

Previous studies based on mere empirical observations of a piano performance are mostly conducted by musicologists in a laboratory and with performers who operate as participants in the experiments (Alon, Athistos, Yuan, & Sclaroff, 2009; Huang & Fu, 2009; Field, Gordon, Peterson, Robinson, Stahovich, & Alvarado 2009; Furuya & Altenmüller, 2013; Buck, MacRitchie, & Bailey, 2013; Jakubowski, Eerola, Alborn, Volpe, Camurri, & Clayton, 2017).

By contrast, I conceived at IPEM a *performative experiment* to be carried out by myself (both as the performer and the researcher) in an ecological environment of a concert hall and on a grand piano¹⁷.

¹⁵ From here on, I will refer to them as “the dancer”, “the singer” , “the percussionists” of the project.

¹⁶ See appendix A.1 and the media portfolio: <https://giusycaruso.wordpress.com/indian-inspired/>

¹⁷ At that time (2015), the IPEM Laboratory did not present a good ecological and viable natural environment for a piano performance experiment.

The performative experiment consisted of motion capturing, and audio and video recordings¹⁸. First, I performed the entire 8th cycle from the *72 Etudes Karnatiques*, which had been my first approach to the Charpentier's piece. Then, I explored in retrospective the evolution of my performance practice in the form of *lecture-recital* while performing some passages. I explained the changes in my "developed performance" (2015) - after my joint practice with the composer and Indian music experts - in respect to my "initial performance" (2012). For the *lecture-recital*, I applied the *thinking-aloud* protocol (Van den Haak & De Jong, 2003), which helped me to spontaneously express the motivations of my interpretative decisions (intentions) and to explain the gestural changes I intuitively felt in both my performances¹⁹.

The procedure of this experiment followed the co-developed performer-based analysis method (Caruso, Coorevits, Nijs, & Leman, 2016; see chapter 3). This methodology assists contemporary musicians-researcher in understanding and describing their artistic processes through a mixed qualitative and quantitative approach. In this way, musicians-researcher can benefit from an alternative method to the traditional self-observation based on phenomenological subjective reflections.

As a performer, I found in the quantitative measurements of sounds and gestures (bottom-up approach) useful references to reinforce my own qualitative observations and reflections on my artistic practice (top-down approach).

The combination of subjective and objective perspectives, mediated by technology as a "mirroring" tool for self-observation, permitted me to systematically map in retrospective the evolution and transformations of my performance in terms of gestures and sound. In designing this approach, I was inspired by the pioneering work of the pianist Marie Trautmann Jaëll²⁰, who was one of the first musicians to carry out a scientific study on gestures and intentionality in the history of piano performance²¹. Moreover, the idea of the "mirroring" practice was supported by the teachings of Claudio Arrau, who describes how he often performed in front of a mirror, or even in front of a camera to improve and be conscious of his piano technique²².

¹⁸ See appendix A.4. A video reportage of the experiment is available on my YouTube channel at this link: <https://www.youtube.com/watch?v=tOmF4YeBgvY>

¹⁹ See the verbatim in appendix A.5.

²⁰ Guichard, C. (2004). *Marie Jaëll: The Magic Touch. Piano Music by Mind Training*. Algora Publishing, United States.

²¹ Caruso, G. (2016). La femme au toucher ineffable : la pianiste, pédagogue et chercheuse Marie Trautmann, épouse Jaëll. In *Cahiers internationaux de symbolisme*, (C. LEJEUNE, Ed.)143-144-145 (Genre), pp.27-42.

²² Von Arx, V. A. (2014). *Piano Lessons with Claudio Arrau: A Guide to His Philosophy and Techniques*. New York: Oxford University Press.

The performance approaches of both these pianists suggested to me an experimental pathway that combines the artistic and the scientific domains and led me to this application of technology as a “mirroring” tool for monitoring one’s own performance practice.

1.3.3 Production

My research includes the production of artistic outcomes (such as my solo performances and the multidisciplinary project *Re-Orient*), lectures and published articles over a period of 5 years (2012-2017).

The program of my solo performances consisted of my interpretation of a selection from the *72 Etudes Karnatiques* and, ultimately, the performance and live recording of the entire three-hour work published by the label Centaur Records (USA).

The multidisciplinary performance project *Re-Orient* was based on the performance of a selection from the *72 Etudes Karnatiques*. This performance was accompanied by vocal improvisations, south Indian percussions (such as khanjira, udu, tabla, ghungroo, saggat etc.) and a dance choreography²³. The goal of this project was to experiment with a performance practice of Indian music²⁴ (Karnatic and Hindustani)²⁵ in order to grasp the composer’s “authentic” interpretative approach (Kivy, 1995) of the entire *72 Etudes Karnatiques*.

With the *Re-Orient* project, I also wanted to explore and to experiment with new directions and attractive formats in performing contemporary music for a non-expert audience.

²³ Brief examples of the performance are available on my media-portfolio:
<https://giusycaruso.wordpress.com/re-orientproject/>

²⁴ Narayan, R. & Sorrell, N. (1980). *Indian Music in Performance: A Practical Introduction*. Publisher, Manchester University Press.

²⁵ The musical analysis of the *72 Etudes Karnatiques* revealed an influence of both Indian music traditions: Karnatic in the scales and Hindustani in the rhythms.

1.4 Outcomes and further investigations

The outcomes of my research can be summarised as follow:

1. a historical and musicological analysis regarding the influence of Indian heritage in the contemporary French repertoire for piano from Olivier Meassiaen to Jacques Charpentier in order to refine my own performance of the *72 Etudes Karnatiques*;
2. knowledge useful for other pianists engaged in the interpretation and practice of this fairly unknown piece, contributing, thereby, to enrich its performance tradition;
3. a methodology (performer-*assistive* method that could be extended to different instruments, styles or genres) useful for contemporary musicians and researchers engaged in artistic research on music performance practice;
4. artistic production: a) my final interpretation of the entire *72 Etudes Karnatiques* (Carcassonne, 26 November 2016) in the presence of the late composer recorded live and published on 3 CDs by the Centaur Records; b) the multidisciplinary project *Re-Orient* aimed to stage my artistic process based on an interplay between Western and Indian music.

To sum up, this study wanted to trace a pathway of practicing while researching that may inspire other musicians in their practice-based research. Other possible investigations could complement my pioneering approach: e.g. the co-developed performer-*based* analysis method could be expanded to longer pieces of music, to different instruments or ensembles and could be used to better investigate the interaction and the entrainment between performers (including musicians and dancers). In the future, the integration of midi recordings for the analysis of sound could be included as complementary data to generate accurate results concerning sound and touch related to intentionality and gesture.

1.5 Outline

This doctoral dissertation presents and discusses my performance practice of the *72 Etudes Karnatiques* by Jacques Charpentier from both an artistic and empirical perspective with a particular focus on the “mirroring” relation between intentionality and gesture of a piano performance. Chapters 2 and 3 consist of two published articles and chapter 4 is under submission. These are the outcomes of my reflections and experimentations on my artistic practice.

Chapter 2 concerns a historical and musicological overview of the Indian music influence on the French contemporary piano repertoire, particularly in the piano compositions of Olivier Messiaen and his pupil Jacques Charpentier. This part of my research work provides the musicological basis for the interpretation and performance of the *72 Etudes Karnatiques*. Olivier Messiaen was an inevitable reference to retrace the development in Charpentier’s piano works (his pupil) and to outline the evolution of the French contemporary piano compositions linked to Indian music. This chapter is the result of my research on the existent literature and my practical collaboration with the composer and with Indian music experts. Indian music theory served primarily to give me a key with which to deliberately interpret, understand and perform some musical passages of the *72 Etudes Karnatiques*.

Chapter 3 explains the theoretical framework and the methodology conceived for the analysis of my music performance practice, referring specifically to the issue of gestures in contemporary music. In this chapter, my case study is presented alongside a case study from Coorevits designed to introduce a method to assist music performers in describing their artistic process. The first study illustrates the performer-*inspired* method, a case of music performance analysis that implies an interplay between researcher, composer and performer (Coorevits, Moelants, Östersjö, & Gorton, 2016). The second study, related to the experimentation on my artistic practice, presents the performer-*based* analysis method that compares self-analysis (made by myself as a musician-researcher) and empirical measurements. This chapter provides also a theoretical framework, which entails the theory of *enactment* and *embodiment* (Leman, 2016) and the concept of *performance space-frame* (Merleau Ponty, 1962; Bourgeau, 2006; Jensenius, 2007).

Chapter 4 outlines in detail the procedures and the results of my performative experiment by referring to the performer-*based* analysis method, which integrates the artistic practice (music interpretation and the enactment and embodiment processes) and empirical measurements. The video, audio and motion capture recordings of my performance of the 8th cycle from the *72 Etudes Karnatiques* constitute the data analysed to detect the effective developments and changes in my gestures related to my musical intentions from my initial interpretation to my

developed interpretation resulting from my informed artistic practice. This chapter describes my artistic process, systematized through a performance model and a score annotation, and outlines the protocol of my experiment conducted in a spontaneous performance condition in the Miry concert hall at the Royal Conservatory of Ghent (2015). The analysis of the data entails a creative application of technology as a mirror to examine one fragment from the piece recorded in the experiment. The “technology-enhanced mirror” generated a meta-perspective for the analysis of my performance, which supported me in eliciting the transformation of my interpretation and gestural approach to the instrument (Nijs, 2017).

Chapter 5 exposes and discusses in detail the technology-enhanced mirror implemented in my artistic research. A historical overview shows how performers have applied different means to improve their performance practice. Following the same approach, this research wants to propose the use of modern technologies as a tool for the self-observation of music performance practice in artistic research.

Chapter 6 reconstructs in the form of a retrospective self-report the development of my artistic practice from my initial approach to my developed approach. My artistic process included the act of experimenting, performing and disseminating. Experimenting consisted of my solo practicing, meetings with the composer, lessons with musicians trained in the West-European conservatory tradition and Indian music experts, as well as the empirical study for monitoring my performance practice with the implementation of technology. Performing entailed my solo performances and the multidisciplinary project *Re-Orient*, which wanted to represent on stage my process of embodiment of Indian music. Disseminating referred to my conference presentations, lecture-recitals, students’ guidance and interactions with other professional researchers and musicians who inspired and affected my artistic process and contributed to spread my research.

Chapter 7 constitutes the discussion and conclusion of this doctoral dissertation. In this final part, I problematize my research process focussing on my mixed methodology, which combines art and science. I also dedicated a reflection on the bi-directionality of artistic research and practice (from artistic practice to artistic research and vice versa from artistic research to artistic practice). In light of the artistic approach proposed here, the entanglement of art and science and the application of the “technology-enhanced mirror” contributed to open up new frontiers for the analysis of music performance practice in the context of artistic research. My doctoral dissertation is complemented by a series of appendices that document all my artistic activities including my portfolio and media-portfolio²⁶. My

²⁶ See the portfolio in appendix A.6.

live recording at Carcassonne, published in a box of three CDs by the Centaur Records, is attached as a part of the artistic outcomes of my research. The structure of my doctoral dissertation is synthesized in Figure 1. 3.

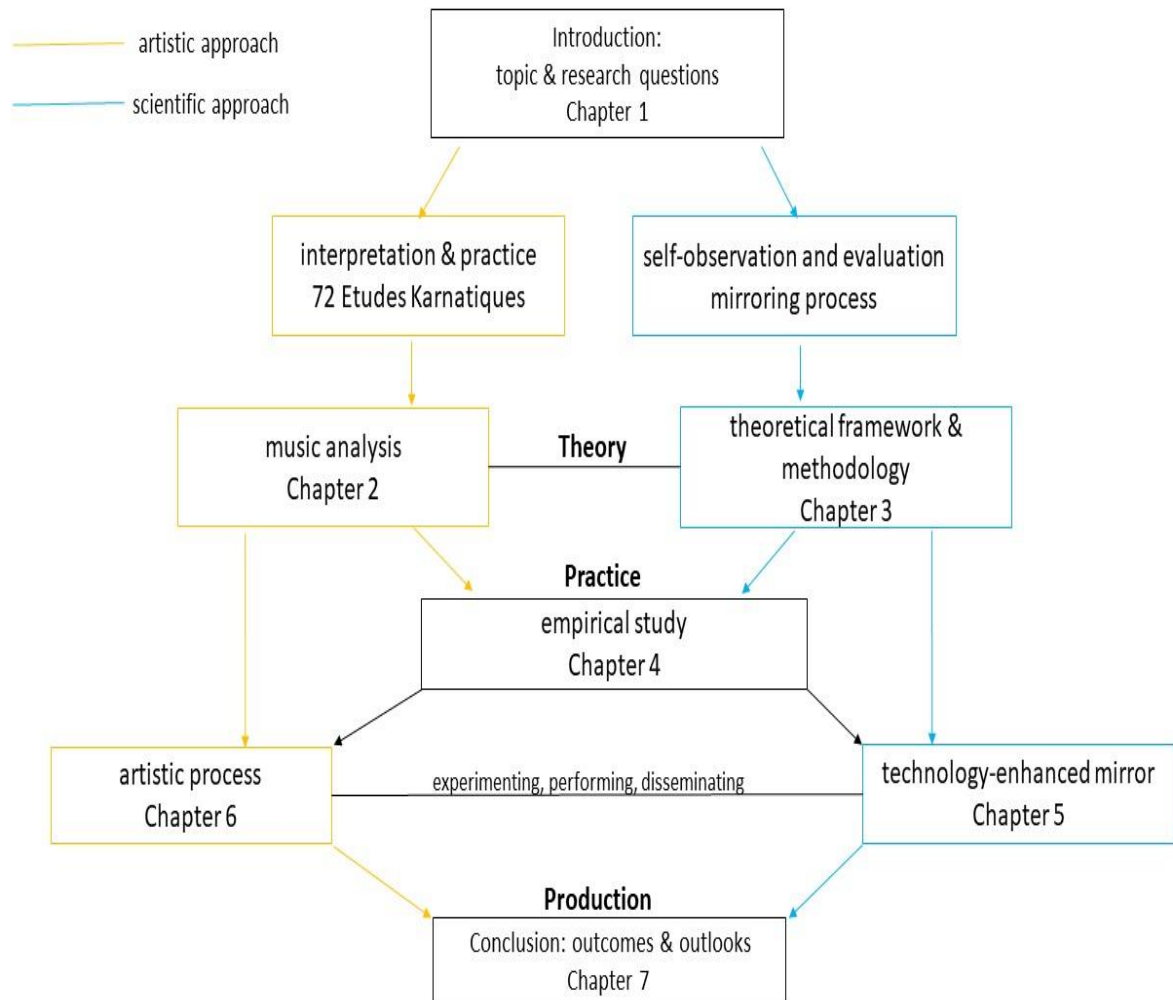


Figure 1.3 Structure of the chapters.

The topic and research questions of my artistic research are outlined in Chapter 1 (introduction) where a conjunction of art and science is proposed. The yellow path on the left represents the artistic approach (interpretation and practice) and the blue path on the right represents the scientific approach (self-observation and evaluation through a mirroring process). Following the triangular artistic system (see TARS, Figure 1.2), *theory*, exposed in Chapter 2 (music analysis) and in Chapter 3 (theoretical framework and methodology) converge into *practice*, Chapter 4 (empirical study) where methodology and artistic process are the themes of a detailed discussion in Chapter 5 and Chapter 6 (phases of experimenting, performing and disseminating). The conclusion in Chapter 7 shows the outcomes and outlooks of my artistic research conducted on the basis of an entanglement of art and science.

Chapter 2

The Indian music heritage in Olivier Messiaen and Jacques Charpentier's piano works

Abstract¹

The Indian music heritage constitutes a strong source of inspiration for western modern contemporary composers who want to expand their composing technique by fusing the Western and Eastern musical horizons. This study explores the influence Indian music had over two French composers with a kinship for being teacher and pupil: Olivier Messiaen (1908-1992) and Jacques Charpentier (1933-2017). The aim is to point out which are specifically the philosophy, aesthetics and musical structures both composers extrapolated from Indian music tradition and elaborated in their piano compositions. A musical analysis is conducted to retrace how Indian ragas and talas contributed to the development of Messiaen and Charpentier's conception of melody, harmony, rhythm, musical form and timbre. The Indian music retrospective retraced in this analysis is a useful knowledge for an original interpretation and performance of this French contemporary piano repertoire, especially the 72 Etudes Karnatiques by Charpentier, which is a fairly unknown piano piece.

¹ This chapter presents a we-form because it consists of a paper originally published in French: Caruso, G. & Leman, M. (2015). Le patrimoine musical indien dans le répertoire pour piano d'Olivier Messiaen et de Jacques Charpentier. In *Cahiers internationaux de symbolisme*, (C. LEJEUNE, Ed.) 140-142 (Patrimoines), 23–56.

My main contribution was in providing the content and in writing the paper.

2.1 Introduction

In his article, *The East in the West* (1946), John Cage underlined how Western composers have increased their interest in the Oriental classical philosophy and music as an aesthetic perspective able to renew their compositions². This phenomenon goes back to the end of the XIX century when the interest in music from far-off lands emerged especially in Paris, which became the capital for music and art during the *Exposition Universelle* in 1889. Cultural customs from diverse traditions converged in this event and, therefore, Western artists and composers experienced, probably for the first time, a tangible encounter with cultural inheritances alternative to their Western one. Among the curious visitors there was Claude Debussy, who first heard the gamelan music performed by a Javanese ensemble. This concrete impact with a non-western music tradition induced Debussy to overcome the common Western post-romantic style and to experiment new possible sonorities and timbres. Thus, exotic scales quite unusual for the Western composition of the time (like the pentatonic and the hexatonic scales) were copiously introduced in his works. Debussy's attraction to the Oriental cultural heritage is clearly retraced in his harmonic modal approach and in his research on timbre as "colour" of sound. His works, especially *Pelléas et Mélisande*, played a strong role on one of the major XX century French composer, Olivier Messiaen³. Differently from Debussy, Olivier Messiaen's research moved from a mere exoticism and an ideal Oriental music inspiration to a concrete use of the Indian rhythmical structures in Western composition. Later on, Jacques Charpentier, his pupil, developed this hybrid approach by applying in his works the South Indian Karnatic modes he learned during his stay in India.

The impact of the Oriental music heritage, especially Indian music, in the French XX century musical context opens up questions concerning the interpretation of the Indian rhythms and modes in Messiaen and Charpentier's piano works:

- Which are the Indian aesthetic and philosophical aspects absorbed by Messiaen and Charpentier that influenced their compositions?
- Which are the specific rhythmic and melodic Indian patterns both composers used in their Western musical language?
- How do the composers manipulate the original Indian musical structures?

² Cage, J. (1946) East in the West. In *Asian Music*, Vol. 1, N. 1 (Winter, 1968-1969), Published by: University of Texas Press, pp. 15-18.

³ Sherlaw, R. J. (1975). *Messiaen*. JM DENT & SONS LT, London, p.10.

- How much did the Indian music heritage contribute to the evolution of Messiaen and Charpentier's piano works?

The actual state-of-the-art of this specific issue comprises mainly essays on popular music, rock and jazz⁴. The primary sources of our investigation are Messiaen's theoretical treatises, *Technique de mon langage musical* (1944) and *Traité de Rythme, de Couleur, et d'Ornithologie* (1949-1992), and Charpentier's music philosophy thesis, *Introduction à l'étude des lois de la Musique de l'Inde* (1956) and personal interviews⁵.

This study furnishes useful perspectives for the interpretation and performance of this French contemporary piano repertoire, especially the *72 Etudes Karnatiques* by Charpentier, which is a fairly unknown piano piece.

2.2 Indian music heritage in Olivier Messiaen's concept of musical time

Olivier Messiaen's piano works present musical aspects taken from Western modern music (especially Debussy), avant-garde and Indian music⁶. His interest for the ancient Greek rhythms and the exotic cultures is strengthened even more when he completed his studies in composition under Maurice Emmanuel at the Paris Conservatoire. In 1936, Messiaen joins the composers Jolivet, Daniel-Lésur and Baudrier and forms *La Jeune France* whose function was to restore to music a more human and spiritual quality. During the Second World War, when he was taken prisoner at Gorlitz camp, in Silesia, Messiaen writes and performs the famous chamber music work for piano and strings *Quatuor pour la Fin du Temps* (1940). After his repatriation, in 1942, he is appointed Professor of Harmony at the Paris Conservatoire and, from then on, there ensued his most important formative years for composing. He meets the pianist Yvonne Loriod, his student and second wife, who prompts him to write his major works for piano.

⁴ Consult: Farrell, G. (1997). *Indian Music and the West*. Oxford University Press: Oxford; Lavezzoli, P. (2006). *The dawn of Indian music in the West: Bhairavi*. Continuum International Publishing Group; Rowell, L. (2000). Scale and Mode in the Music of the Early Tamils of South India. In *Music Theory Spectrum* Vol. 22, No. 2 p. 135-156, University California Press.

⁵ See appendix A.1 and media-portfolio <https://giusycaruso.wordpress.com/indian-inspired/>

⁶ Sherlaw, R. J. (1975). *Messiaen*. JM DENT & SONS LT, London, p.10.

Olivier Messiaen has the first impact with Indian music by consulting the *Encyclopédie de la Musique* (1931) by Lavignac where the Indian rhythmic system, called *deçî-tâlas*, was reproduced in Western notation⁷. Although Messiaen had never been in India, he discovers the cosmic and religious symbolic conceptions contained in each *deçî-tâlas* by the translations from Sanskrit made by a Hindu friend⁸. The *deçî-tâlas* - literally regional (*deçî*) rhythm (*tâlas*) – constitute of a table of 120 rhythmical patterns from the Hindustani North India tradition, as stated in the thirteenth century treatise *Samgîta-ratnâkara* by the Indian musician Sharngadeva⁹. In India, the conception of rhythm (*tâla*) is not a succession of regular isochronous beats like in the West. *Tâla* is a rhythmic cycle that consists of a fixed number of beats (*matras*). Each beat is defined by a combination of rhythmical sections growing into fixed patterns¹⁰. The most unfamiliar aspect of *tâla* to the Western ear is that the end of one cycle comes not on its last beat, but on the first beat of the following one in order to have a continuous endless overlapping. This peculiar absence of a metric definition in the Indian rhythmical structures led Messiaen to consider the *tala* system as a possible symbolic incarnation of his ideal of eternity in musical time¹¹. For this reason, Messiaen deepens the Indian system in order to apply some of its rhythms in his Western composition.

Messiaen himself clearly explains in his first theoretical treatise, *Technique de mon langage musical* (1944), how much the Indian rhythms generated a strong creative propulsion in his composing process he called *le charme de l'impossibilité*¹². In his composition, he mainly uses an elaboration of the *râgavardhana tala* taken from the 120 *deçî-tâlas* list¹³ (see Figure 2.4).

⁷ *ibid.* The list of the 120 *deçî-tâlas* is provided in appendix A.2.

⁸ Samuel, C. (1986). *Olivier Messiaen: Musique et couleur*. English translation by E. T. Glasow, 1994, Amadeus Press, Portland U. S. A, p.77.

⁹ Sherlaw, R. J. (1975). *Messiaen*. JM DENT & SONS LT, London, p.10. The table is provided in appendix A.2.

¹⁰ Perinu, R. (1982). *La Musica Indiana*. Zanibon, Milano, p.120.

¹¹ Tournemire, C. (2008). Messiaen as Improviser. In *Dutch Journal of music theory*. Vol. 13, N.2, 129.

¹² Caruso, G. (2006). Aspects and features of Western and Indian cultures in Olivier Messiaen's conception of music. In *Seminarium Stowarzyszenia De Musica*, pp.2-3; <http://seminarium.demusica.w.interia.pl/435/>

¹³ Messiaen, O. (1944). *Technique de mon langage musical*. Italian translation by L. Ronchetti, 1999, Leduc, Paris, p. 9. See the *deçî-tâlas* list in appendix A.2.

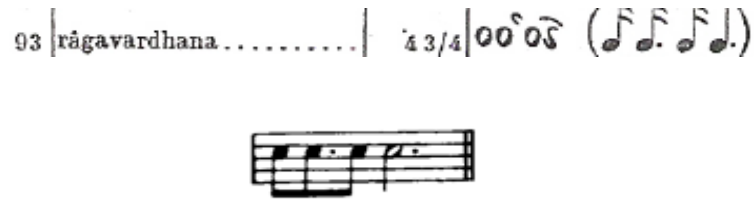


Figure 2.4 The original *rāgavardhana* structure and the elaboration (augmentation) made by Olivier Messiaen.

Messiaen focuses on the mirror-structure of the *rāgavardhana* rhythm to introduce the concept of palindrome-rhythms, or un-retrograde, due to its peculiarity of being read both backward and forward. Not having a well-defined starting or ending point, this rhythm embodies for Messiaen the symbol of eternity¹⁴. Fostered to deeply approach the Indian conception of rhythmic irregularities, Messiaen experiments new models of duration by implementing the Western conception of inversion form and transformation to the above Indian rhythmical pattern¹⁵ (see Figure 2.5):



Figure 2.5 Messiaen's inversion (a) and transformation (b) of the *rāgavardhana* rhythm.

Successively, Messiaen enforces his conception of irregularity in rhythm by focusing also on the Greek meter and by creating his personal *valeur ajoutée* theory based on the principle of addition or interpolation of short values like a note, a dotted note or a rest to a regular rhythm¹⁶ (see Figure 2.6).

¹⁴ *ibid.* p.17.

¹⁵ *ibid.* pp.9-10.

¹⁶ *ibid.*p.17.



Figure 2.6 Examples of Messiaen's *valeur ajoutée* theory based on the principle of addition or interpolation of (1) a note, (2) a rest and (3) a dotted note to a regular rhythm.

He applies the *râgavardhana* rhythm in his original and modified version (see Figure 2.7), followed by the *candrahala* and *lakskmica*, in the fifth piano piece, *Regards du Fils sur le Fils*, from the cyclic piano work *Vingt Regards sur L'Enfant Jésus* (1944) (Ed. Durand Salabert).

Figure 2.7 An example of the *râgavardhana* rhythm from *Regards du Fils sur le Fils* (1944) (Ed. Durand Salabert).

This piano work, divided into twenty movements, is a meditation on the childhood of Jesus. Messiaen applies musical themes as recurrent leitmotifs, such as the “Theme of God”, the “Theme of the Star and of the Cross”, the “Theme of Mystical Love”, the “Theme of Chords”, the “Theme of Oriental Dance and Plainsong”, the “Theme of Joy”. These themes are easily recognizable when they occur because they are based on the Indian *tala* mentioned above. While discussing on melody in Chapter VIII of his *Technique*, Messiaen refers to be fascinated also by the “refined”

melodic lines taken from the Indian *raga*¹⁷ other than from the Western folk songs and the Gregorian chant.

In the Indian music practice, each *raga* - the melodic structure - evokes to the listener a particular aesthetic reaction or feeling they call *rasa*.¹⁸ During an Indian performance, musicians choose to play one *raga* and improvise around it to evoke a particular *rasa* reaction or feeling to the listener. The relationship between music (*raga*) and feelings, seasons, time etc. has social and religious implications. This link between *raga* and *rasa* is the most important transcendent purpose Indian music theory perceives in relation to the ancient Vedic cosmology.

Messiaen, in his *Conversation with Claude Samuel* (1986), declares to be strongly attracted by the mystery and the magic symbolic and philosophical meaning of the Hindu rhythms and melody although he has never felt to convert to Buddhism, Hinduism or Shaivism¹⁹. Undoubtedly, Messiaen grasps symbolic meanings of music from the Indian metaphysics and aesthetic theory concerning the essence of *ragas*, while remaining devotee to his unfaltering catholic faith. Drawing his inspiration from the catholic doctrine, he considered music a means to bring the listeners into a spiritual dimension. Messiaen transposes these philosophical ideas into his compositions by evoking static atmospheres which are consequences of the parallel movement of melody and chords with sudden tonal changes without modulation²⁰. This composing procedure creates a static harmonic impression which John Cage considers as a clear Oriental music recall²¹.

In *Les visions de l'Amen* (1943) for two pianos, Messiaen wants to transmit in music a complete interpretation of the concept of *Amen* as the total submission of

¹⁷ Perinu, R. (1982). *La Musica Indiana*. Zanibon, Milano, p. 48. Actually, the *raga* is not a simple melodic line but it contains a symbolic meaning. Its essence is the expression of emotions, feelings, metaphysical ideas as well as the seasons, the weather or the time of the day. In fact, the word *raga* comes from the Sanskrit *ranj*, meaning "colouring"; and the term "colour" in Hinduism stands for the reaction of the soul to emotions.

¹⁸ *ibid.* p.181. In the Vedic cosmology, Music is considered the immediate and direct expression of the unspeakable primordial Sound -Verb (Logos) which is the creative energy (*shabda*, *nâda*) that vibrates in the universe from the very beginning of time in the *mantra* sound OM-AUM. This sound comprises all the harmonics and it is the first perceptible expression of the divine being (*Brahm*) whom all living beings are a part of. The very essence of the divine being (in a pure pantheistic sense) is manifested in music, as well as in poetry (chant).

¹⁹ Samuel, C. (1986). *Olivier Messiaen: Musique et couleur*. English translation by E. T. Glasow, 1994, Amadeus Press, Portland U. S. A, p.78.

²⁰ Caruso, G. (2006). Aspects and features of Western and Indian cultures in Olivier Messiaen's conception of music. In *Seminarium Stowarzyszenia De Musica*, p. 9; <http://seminarium.demusica.w.interia.pl/435/>

²¹ Cage, J. (1946). East in the West. In *Asian Music*, Vol. 1, N. 1 (Winter, 1968-1969), Published by: University of Texas Press, p.17.

all the living creatures to God²². This piece does not present structural links to Indian Music but the static proceeding it follows recalls Oriental spiritual moods. Messiaen introduces the theme of Creation (Genesis) by adopting long vibrating chords to achieve a solemn symbolic meaning and to confer a meditative and religious atmosphere.

Messiaen manifests a stronger Indian music heritage, instead, in his piano work for Orchestra and Ondes Martenot, *Turangalîla Symphonie*. Composed between 1946 and 1948 under commission of Serge Koussevitzky for the Boston Symphony Orchestra, the *Turangalîla Symphonie* is one of the symphonic masterpieces of the twentieth century. The word *Turangalîla* comes from Sanskrit and combines the word *Turanga* (time/movement/rhythm that flows like the gallop of horses) to the word *Lila* (game of the divine cosmos). The *Turangalîla* acts out the concepts of life and death (creation, destruction, reconstruction). It is divided into ten movements and has four cyclical themes that run throughout the entire piece. Four cyclical themes recur in the ten movements of the Symphony: the theme of the statue, the theme of the flower, the theme of love, the theme of agreements. The *Prelude – Introduction* - presents four rhythmic pedals two of which were taken from the Indian rhythms *Lakṣmīca* (4 times) combined with *rāgavardhana*. In the movement called *Chant d'Amour 1*, the initial tala is transformed with the subsequent addition of values in which the value 7 and 17 are again determinant. The *theme of love* is in ternary form and is performed by the strings along with the Ondes Martenot, while the piano accompanies with melodies taken from Messiaen's birdsong. In *Jardin du sommeil d'Amour*, there are *talas* rhythms in percussion, celesta and glockenspiel²³. In *Turangalîla 1 - 2 - 3* the theme of death is represented by important rhythmical structures made by percussive sounds.

Such examples taken from the above mentioned piano works by Messiaen show how Indian music elements are determinant in his composing technique. Messiaen creates an original *mélange* between Western and Indian music structures by extrapolating and elaborating original rhythmical structures from the *deçî-tâlas* written in Western notation. His hybrid approach to the composing process becomes a reference also to the younger generation of composers, like Jacques Charpentier.

²² See his notes in *Les visions de l'Amen* (1943), Edition Durand Salabert.

²³ The un-retrograde rhythm has the same structure whether it is read starting from right or left.

2.3 Indian music and Messiaen's heritage in Jacques Charpentier's *72 Etudes Karnatiques pour piano*

Jacques Charpentier spends two years in India (1953-1954) working as a classic pianist at the Grand Hotel of Calcutta²⁴. In the meantime, he comes in touch with Indian music beginning a correspondence with Alain Daniélou (1907-1994), the famous Indian scholar and musicologist, who gave him valuable advices. It was the early 1955 when the young composer, just back from his stay in Calcutta, is admitted to the Conservatory of Paris in the composition course by Tony Aubin as well as in the philosophy of music and musical analysis courses by Olivier Messiaen. At the end of his studies at the Conservatory, Charpentier receives the first Prize *Philosophie de la musique* for his thesis *Introduction à l'étude des lois de la Musique de l'Inde* (1956) and the first prize for his composition *Symphonie brève pour cordes* (1958). He becomes also choirmaster and organist at *La Chapelle St-Benoît d'Issy-les-Moulineaux* while continuing studying organ with Marcel Dupré (1886 – 1971). From July 1966, Charpentier holds diverse official positions. Introduced by Marcel Landowski and Olivier Messiaen, he is appointed by André Malraux, Minister of Cultural Affairs of the time, as Principal Inspector for Music, in particular for music education. In 1975, he is named General Inspector of Music by the Minister Michel Guy. Then, in 1979, introduced by Isabelle du Saillant, member of the Ministerial Cabinet, Charpentier becomes Director of Music, Art and Dance. Among his official posts, Jacques Charpentier refuses all except the engagement as organist and he continues composing. In October 1981, he leaves the Ministry of Culture and in 1989, he takes the positions as professor of orchestration and instrumentation and as professor of composition and musical civilizations at the National Conservatory of Paris. Between April 1957 and January 1985, Charpentier composes his extraordinary three-hour long work, *72 Etudes* for piano, based on the Karnatic Indian modes. His composing style is influenced by a mixed musical background acquired from his own studies in India and from Messiaen's teachings. While Messiaen implements structurally in his compositions mostly the Indian cyclic rhythms discovered in the *Encyclopédie de la Musique* (1931) by Lavignac,

²⁴ Most of the information on Charpentier comes from my personal discussions with the composers and private documents. See the interview in appendix A.1 and on the media-portfolio <https://giusycaruso.wordpress.com/indian-inspired/>

Charpentier introduces the scales from South India, called Karnatic, he learned directly during his stay in India²⁵. Charpentier has never thought to use Indian materials as mere exotic recalls or sound colours; on the contrary, he finds in the Indian music theory an unlimited source of musical creativeness²⁶. He declares to have turned his attention to Indian Music in reaction to the XX century Western aesthetic directions (like the atonal theory and serialism) he considered stagnated. In his thesis, *Introduction à l'étude des lois de la Musique de l'Inde*, he writes:

« India gives us one of the most amazing musical theories of all times »²⁷.

His aim is to find a systematic way, alternative to atonalism, to handle the 12 notes of the chromatic Western scale. Therefore, he dedicates his major piano work to the Karnatic modes extrapolated from an existent scheme of scales written in Western notation (see Figure 2. 8)²⁸.

²⁵ As Harold S. Power underlined in his book *An Historical and Comparative Approach to the Classification of ragas* - University of California, Los Angeles, Institute of Musicology, *Selected Reports*, Vol. I, n° 3, p.17. The South Indian system tends to classify systematically the *ragas* in scales respect to the Hindustani approach which is focused on *ragas* as melodic tunes.

²⁶ See the interview in appendix A.1 and on the media-portfolio
<https://www.youtube.com/watch?v=Dn7jJdwCFTY>

²⁷ Charpentier, J. (1956). *Introduction à l'étude des lois de la Musique de l'Inde*. p.23 (private document).

²⁸ The composer himself sent me this scheme by email (15/04/2015).

TABEAU DES 72 ÉCHELLES KARNATIQUES EN NOTATION EUROPÉENNE (clef de sol)

I. Classe Çuddha-madhyama				II. Classe prati-madhyama			
1. Kainkangi	2. Khatangi	37. Sālanāga	38. Sālanāva				
3. Cānamurti	4. Vānaspati	39. Jālavarāli	40. Nāvanita				
5. Mānavati	6. Tānarupi	41. Pavāni	42. Rāgonprya				
7. Sānapāli	8. Nānamatodi	43. Gavambōdi	44. Bhāvaprya				
9. Dānuka	10. Nāikaprya	45. Sābhapanlovarāli	46. Çatvedamanjini				
11. Kōkilaprya	12. Rūpavati	47. Suvarenāngi	48. Dāryamāni				
13. Cāikaprya	14. Vāktalabharna	49. Duvalāmbheri	50. Nānanāgini				
15. Māyamālavagāla	16. Çākrovaka	51. Kāmavārdini	52. Rāmaprya				
17. Suryakānta	18. Hatakambāri	53. Cāmanaprya	54. Viṣvambāri				
19. Çankarāvāni	20. Nātibhairavi	55. Syamalāngi	56. Çannuhaprya				
21. Kyravāni	22. Kārahāraprya	57. Çinhandra	58. Nānovasantha				
23. Çaurimanohāri	24. Vāranaprya	59. Dhārmavati	60. Nētimalki				
25. Mārarāngini	26. Çārukali	61. Kōntāmani	62. Rīshavaprya				
27. Sārasāngi	28. Hārikambogi	63. Lalāngi	64. Vachaspati				
29. Dehrazankāraharna	30. Nāganandini	65. Matsyahālāni	66. Çintāmani				
31. Yāgaprya	32. Rāgovārdani	67. Sūcharitra	68. Jōtivarāpēni				
33. Çangūyabhusāni	34. Vāgadesvāri	69. Dhāriovārdani	70. Nāçikabharna				
35. Sūlini	36. Çalanāia	71. Kosala	72. Rāsthaprya				

Figure 2.8 The 72 Karnatic modes in Western notation from *Encyclopédie de la Musique* (1931) by Lavignac.

The above scheme of the Karnatic scales is currently used in South India and differs from the North Indian ones (Hindustani tradition). This scheme is the elaboration made by Venkatamakhi, one of the major ancient Indian musicologist. Venkatamakhi classifies in his treatise *Caturdađi Prakaasikaa* (1660) the South Indian scales by assembling systematically 72 *ragas* in a system called *Melakarta*²⁹. The *ragas* are organized in twelve groups of scales; each group comprises six scales, *melas/ragas*, for a total of 72 *melas/ragas* (12 x 6). Each *mela/raga* is based on a lower tetrachord of fixed pitches and an upper one of different pitches. The octave is divided into two equal tetrachords; C-F and G-C arranged in accordance with the twelve chromatic degrees. This system produces 72 modes in the following way: the first class of these modes includes the perfect fourth, giving 36 modes to which correspond 36 relative modes that contain the augmented fourth (see Figure 2.8).

Venkatamakhi's classification is a theoretical mathematical expedient to organize the modes in a system useful for musicians. He declares:

« The 72 Melakartas I have suggested are doubtless the product of my creative urge. That is not their sole criterion. If it were so, it is a waste of ingenuity. Nor do I claim that the scheme as a whole is practicable here and now. True, it covers only a few ragas in circulation at present »³⁰.

The *Melakarta* is more a theoretical system than the Hindustani *raga* from North India, which comprises mostly a collection of the melodic lines used in the North Indian performance practice tradition. The South India Karnatic *melas/ragas* comprises 72 so-called *janaka ragas*, which are the generative structure (scale) of the melodic *ragas*. The pure scales form the *Melakarta* are called *janya* that in Sanskrit means "born or derived from". South Indian performance practice is based mostly in the use of the Karnatic modes in singing often enriched by ornamentations named *Gamaka*. Karnatic and Hindustani traditions differ in the scale system as well as in the articulation of the *Gamakas*³¹.

In the Karnatic musical system, the 12 notes of an octave are distributed among the 7 notes, called *swaras*, of a *raga*. The seven *swaras* are named SA-RE-GA-

²⁹ Vijayakrishnan, K. G. (2007). The Grammar of Carnatic Music. In *Phonology and Phonetics*. Vol.8, p.1.

³⁰ *ibid.* p.78.

³¹ Swift, G. (1990). South Indian "Gamaka" and the Violin. In *Asian Music* 21 (2): 71–89. University of Texas Press.

MA-PHA-DA-NI (abbreviation S-R-G-M-P-D-N)³². The notes Sa and Pa have the same function of the first and fifth notes of the Western scale. The other notes take two (M1-M2) or three (R1-R2-R3 / G1-G2-G3 / D1-D2-D3 / N1-N2-N3) different pitches are shown in the keyboard³³ here below in Figure 2.9:

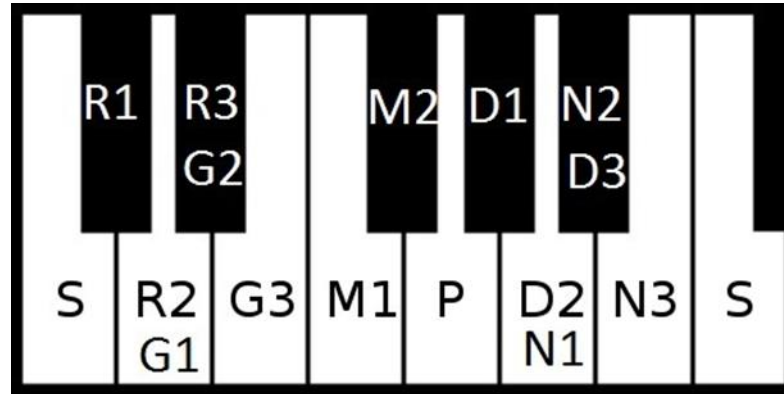


Figure 2.9 The pitches of the *swaras* in the correspondent Western well-tempered subdivision.

This division of an octave into twelve *swaras* (**S** / R1-R2-R3 / G1-G2-G3 / M1-M2 / **P** / D1-D2-D3 / N1-N2-N3) has evolved over a millennium. The ancient Vedic chants used only three *swaras* while later the scale arrived at seven *swaras*, as precursors of the actual *raga* system. While some ancient forms of music used fewer *swaras*, the current forms of many styles of classical music evolved independently, like the Hindustani and the Karnatic styles. The twelve *swaras* are generally considered to be the maximum number a normal human ear can perceive. Western music has a specific and absolute pitch of all the notes and thus, the frequencies of all the keys are fixed and are the same for all keyboards. Indian music, based on chant, has a relative position of pitches and thus, the notes are not fixed. The importance of the first note, SA, is that it provides the fixed foundation note upon which the rest of the music is built. Therefore, the *Melakarta* system was useful to fix the succession of the pitches in scales/*ragas* even if it is considered more a theoretical device. Each *raga* of the *Melakarta* has a particular symbolic name related to the Indian philosophy since each Karnatic mode represents a

³² The pitches correspond to the Western notes C-D-E-F-G-A-B.

³³ Bhairavi, S. The scales of Sindhu Bhairavi, <https://sujamusic.wordpress.com/sindhu-bhairavi/> (Accessed on February 2013)

Hindu divinity. The following chart (see Figure 2.10) reports the subdivision of the ragas with their correspondent Hindu name³⁴.

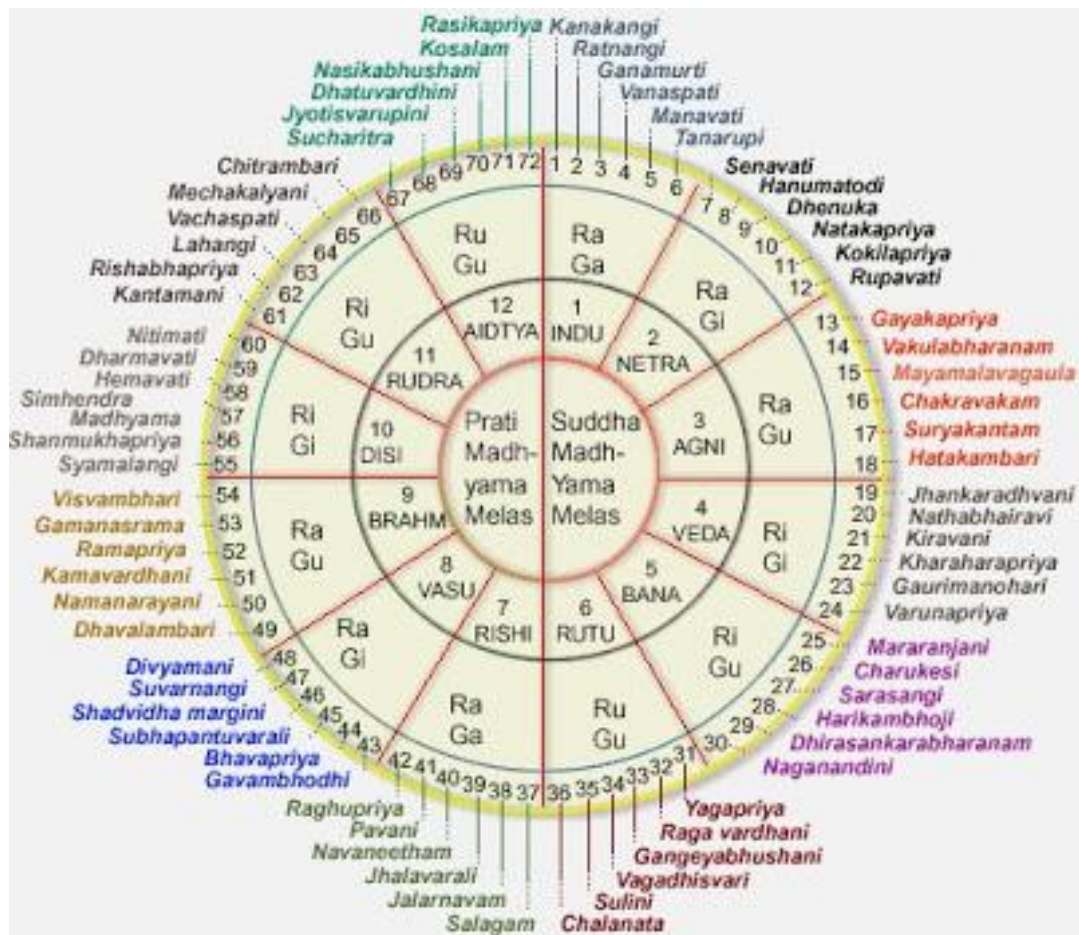


Figure 2.10 Melakarta chart³⁵.

³⁴ Sangeetha Kala Acharya, S. Rajam and Kallidaikurichi Veenai S. Venkatesan, *A Confluence of Art and Music on 72 Melakartha ragas*. Corporate Communications Dept of L&T, ECC division Chennai, p. 1, <http://www.indian-heritage.org/music/Melakartha%20Raga%20Booklet%20-%20new.pdf> (Accessed on 05/05/2015)

³⁵ Images retrieved form <https://en.wikipedia.org/wiki/Melakarta> (Accessed on May 2015)

The *Melakarta* chart shows the sequence of the twelve groups, named *chakra*. They are so-called to preserve the symbolic relation to the Vedic divinities. Here below is indicated the name, the meaning and the numerological correspondence of each *chakra/scale*³⁶:

1. Indu: Moon, as the earth has only ONE moon.
2. Netra: Eyes, as we have TWO eyes.
3. Agni: Fire, as there are THREE types of fires as stated in the Veda
4. Veda: Veda, as the FOUR original Hindu scriptures
5. Baana: Arrow, as Kama or cupid is believed to have arrows with FIVE flowers
6. Ritu: Seasons, as the SIX seasons in the Hindu calendar
7. Rishi: Sages, as the SEVEN Hindu sages (Rishis)
8. Vasu: Vasu, as the EIGHT celestial being in nature (sons of Ganga)
9. Brahma: Brahma, as the NINE cycles of the Universe
10. Disi: Directions, as the TEN directions
11. Rudra: Rudras, as the set of ELEVEN divine members of the class (Devas) headed by the Lord Shiva
12. Aditya: Aditya, as the TWELVE Suryas (sun divinities) in the cosmic Universe according to the Brâhmana sacred texts

Charpentier organizes his *72 Etudes Karnatiques* like the *Melakarta* chart, in 12 Cycles constituted of 6 etudes composed on the correspondent Karnatic mode. Each scale is presented at the beginning of each etude.

During the interview with Charpentier at Carcassonne in May 2012³⁷, the composer himself underlined how Indian Music is an amazing source of philosophic, metaphysical and ontological symbolism related to the Vedic cosmology. For example, the figure of Shiva Nataradja is an impressive and recurrent character in Charpentier's works to whom he dedicated in particular his third Symphony. Shiva, the Indian Lord (or King) of Dance, is considered the cosmic dancer who performs his divine ballet to destroy a weary universe in order to foster the process of re-creation by the God Brahma. Shiva and his divine dance embody

³⁶ Sangeetha Kala Acharya, S. Rajam and Kallidaikurichi Veenai S. Venkatesan, A Confluence of Art and Music on 72 Melakarta ragas. Corporate Communications Dept of L&T, ECC division Chennai, p. 1, <http://www.indian-heritage.org/music/Melakarta%20Raga%20Booklet%20-%20new.pdf> (Accessed on 05/05/2015).

³⁷ See appendix A.1 and media-portfolio <https://www.youtube.com/watch?v=Dn7jJdwCFTY>

the philosophical concept of creation, birth and death; the finite existence and immortality; time and eternity. Inspired by the Indian idea of Shiva's divine dance, Charpentier uses frequently in his compositions percussive sonorities and obstinate rhythms.

Even if Charpentier remains bound to his catholic faith, like Messiaen, the Hindi myth constitutes mostly a magic world from which he grasps his ideal of music. Moreover, Charpentier and Messiaen's compositions are full of symbols related to numerology. Both composers declared to have a particular attraction with the esoteric meaning of the odd numbers 7 – 5 – 13. Charpentier often applies, as Messiaen did, a metric section based on these odd numbers by elaborating Indian rhythms taken from the Hindustani *deçî-tâlas*. Although the *72 Etudes Karnatiques* are based on the South Indian modes, the rhythmic cycles are taken from the *deçî-tâlas*, the North India Hindustani rhythmical table. In his interview, Charpentier declared to have taken inspiration from the Sharngadeva's *deçî-tâlas* scheme, like Messiaen did. Consequently, the Karnatic etudes are a combination of Western and Indian tradition from both the South (concerning modes) and from the North (concerning rhythm).

The original Indian rhythms appear in their original cyclic sequence but often with one unit omitted, like in these sequences (Figure 2.11):

Figure 2.11 The original Indian *tala simbanandana* n.35 from the *120 deçî-tâlas* by Sharngadeva and the elaboration made by Charpentier (Ed. Alphonse Leduc).

By comparing the original Indian structure to the elaboration made by Charpentier, it is evident that the composer's structure missed one rhythmical value (the crotchet) to create a "mirroring" rhythmical pattern.

Concerning harmony, Charpentier in his etudes uses a strong melodic horizontal way of composing by interweaving different voices. Chords, mostly clusters, appear as agglomeration of the pitches taken from each Karnatic mode. The horizontal

melodic way of composing is related to the monodic feature of Indian music, typically based on one melodic line. Charpentier uses long pedals on the first note of the scale, the tonic, which represents in the Indian theory the Sun. The other notes turn around the tonic, like the planets turn around the Sun in the Universe³⁸. The melodic line is always shaped in large intervals and occur on all the register of the piano.

The twelve cycles of the etudes present different tempo, character and figuration and some passages strongly recall Messiaen's *Turangalila* Symphonie. Some etudes are very fast, percussive and violent, as the Shiva dance of destruction and reconstruction, while others are meditative with long-lined chant full of ornamentations (melismatic). Alternation of long chords and moments of silence is a recurrent feature in Charpentier's compositions as an expression of a specific mystic conception: the vibrating power of creation in the universe³⁹. Charpentier gives a vital importance to the concepts of resonance as the vibration of energy and silence as the breath of sound⁴⁰. In his thesis, he quotes the *Sangita-Makaranda's* treatise to underline the relation between the Indian philosophical idea of vibration as energy and the sound dimension⁴¹. For this reason, Charpentier sometimes uses only one note, or a few notes, followed by rests, to emphasize the timbre quality and the resonance of one pitch note (see Figure 2.12).

46. *Çadivedamangini*
soutenu, douce (dans la résonance)

The image shows two systems of musical notation for the piece 'Çadivedamangini'. The first system consists of two staves. The right-hand staff contains a melodic line with a long slur over it, starting with a piano (*p*) dynamic, followed by a *poco* marking and another *p* dynamic. The left-hand staff has a sustained bass note with a long slur. Above the right-hand staff, there is a rehearsal mark (13) and the word *simile*. The second system also has two staves. The right-hand staff continues the melodic line with a *p* dynamic and a long slur. The left-hand staff continues the sustained bass note. There are rehearsal marks (13) above the right-hand staff in both systems.

Figure 2.12 Extract from the 8th cycle etude *Çadivedamangini* n. 46 (Ed. Alphonse Leduc).

³⁸ Charpentier, J. (1956). *Introduction à l'étude des lois de la Musique de l'Inde*, p.6 (private document).

³⁹ See the interview in appendix A.1 and on the media-portfolio

<https://www.youtube.com/watch?v=9SodMRU5wqE>

⁴⁰ *ibid.*

⁴¹ Charpentier, J. (1956). *Introduction à l'étude des lois de la Musique de l'Inde*, p.7 (private document).

With this expedient, the piano timbre recalls alternatively the resonance of bell sounds and of percussive instruments to evoke, again, the deconstructive and reconstructive dance dimension of Shiva as well as the passion and resurrection of Christ.

In the twelve cycles of the *72 Etudes Karnatiques*, there are three groups of cycles 2-8 -12 to be played as a continuous movement without interruption. In these cyclic forms, the Karnatic modes/scales are treated as motives. The 8th cycle is conceived as a *Quasi una Sonata*. In the *Melakarta Chart*, this cycle corresponds to *VASU*, which represents the eight divine elements of nature in Hinduism. The Karnatic modes, *Gavambodi* and *Bhavaprya*⁴², are used in this cycle as a first and a second sonata theme.

The opening eight bars present the 7 notes of the *Gavambodi* mode as a melodic line structured in a very large position (from the bottom to the top crossing all the registers of the piano, see Figure 2.13).

43. Gavambodi
Presque vif ♩ = 126

The musical score for Gavambodi n. 43 is presented in two staves. The upper staff is the right hand, and the lower staff is the left hand. The piece is in 4/4 time with a tempo of 'Presque vif' (♩ = 126). The right hand begins with a melodic line starting on a low register and moving upwards, crossing all registers of the piano. The left hand provides a bass line with long intervals. Performance markings include *ff*, *ff sempre*, *loco*, and *m.d.* (mezzo-dolce). The bass line is labeled '8bassa'.

Figure 2.13 Extract from 8th cycle etude *Gavambodi* n. 43 (Ed. Alphonse Leduc).

This melodic theme/mode becomes the *leitmotiv* of each etude of the 8th cycle. The *Gavambodi* theme is transformed later into a scale of demisemi-quavers where every first accented note is the key tone of this mode. The shy melody, based on the descending tetrachord of the *Bhavaprya* mode (see Figure 2.14), could be considered the second theme of this cyclic *Quasi una Sonata* form.

⁴² I found different translations of the Karnatic modes from Sanskrit into some European languages. In this dissertation, I will refer specifically to the French translation used by Charpentier in his *72 Etudes Karnatiques* edited by Alphonse Leduc.

Figure 2.14 Extract from 8th cycle etude *Bhavaprya* n. 44 (Ed. Alphonse Leduc).

This motive contrasts with the heroic and strong *Gavambodi* theme, which appears again brutally in the rhythmic pattern based on an elaboration of the *niççanka tala* structure⁴³ (Figure 2.15).

Figure 2.15 The original Indian structure *niççanka tala* and the elaboration made by Charpentier with one value omitted (Ed. Alphonse Leduc).

The last cycle, the 12th, is conceived as an *Etoile*. Charpentier lets the interpreter free to mix in his performance all the sections of each etude of this twelfth cycle. Moreover, the last etude, the 72nd, sums up the chords and melodic pattern of the previous etudes in a star form (see Figure 2.16).

⁴³ Content of the interview available on the media-portfolio
<https://www.youtube.com/watch?v=9SodMRU5wqE>

72. RÂSIKAPRYA

The image displays a musical score for the etude 'Râsikaprya n. 72' from the 12th cycle, titled 'L'ETOILE'. The score is presented in a star-shaped layout with five vertices labeled 67, 68, 69, 70, and 71. Each vertex contains a musical staff with notes and rests. The central area of the star contains a larger musical staff with notes and rests, and the instruction *p ou f* below it. The key signature is one sharp (F#) and the time signature is 8/8. The title 'L'ETOILE' is centered at the bottom of the star.

Figure 2.16 The music score of the etude *Râsikaprya* n. 72 from the 12th cycle (Ed. Alphonse Leduc).

The performer has to play the five elements, located in the five spikes of the star, using his own combination. The final sound depends on the performer's assemblage and so it can change each time. In this last cycle, Charpentier applies an open form as in the Indian music performance practice where musicians are used to improvise on the fixed patterns of *ragas* and *talas* chosen at the beginning of the performance.

2.4 Discussion and conclusion

The historical and musical analysis proposed in this study wants to show how the Indian music heritage contributed to the evolution of the Western contemporary composition, especially in France, in the piano works by Olivier Messiaen and his pupil Jacques Charpentier. Olivier Messiaen was an inevitable reference to retrace the application of the Indian music in the French contemporary piano repertoire linked to the later contribution made by his pupil Jacques Charpentier. Both composers embraced Indian music not in terms of an ideal exoticism but through a concrete structural extrapolation and elaboration of the Indian musical patterns. To interpret some passages of Messiaen and Charpentier's piano work, a deep analysis on the Indian musical elements implemented in the Western parameters (such as rhythm, melody, harmony form and timbre) was deemed necessary.

The Indian music retrospective is an added value to deeply understand the original adaptations of the Indian *ragas* and *talas* to the Western piano composition by Messiaen and Charpentier and a useful tool to open up new perspectives concerning the interpretation and performance practice of this contemporary piano repertoire. This analysis contributes to highlight Charpentier's *72 Etudes Karnatiques*, a piano work still not well known, which reveals one of the most significant trace of the Indian music heritage in the Western piano contemporary repertoire.

Chapter 3

Gestures in contemporary music performance: a method to assist the performer's artistic process

Abstract¹

In this study, we propose a method to assist the performer in dealing with the challenges of contemporary music performance. Such a method aims at making a performer's artistic process (which is based on cognitive and sensorimotor schemes) more explicit, in order to better understand the relationship between goals, actions, and sounds. The method does not provide a heuristic that will automatically lead to a new performance model. Rather, it is meant to assist performers in (re)framing their interpretative outlooks while rendering their performative code explicit with the help of innovative mirror-like technologies. First we provide a general framework for understanding music performance, based on the notion of performance spaces and frames, and on recent insights in embodied interactions with music. Next we elaborate on how to approach the development of such understanding through performance research. Then we apply this framework to the performance of contemporary music, describing two complementary analysis approaches, in which we focus on analysis from a third-person perspective, and from a first-person perspective, respectively. The paper concludes with a discussion about the method and its value for both research and performance.

¹ This chapter presents a we-form because it consists of a published article: Caruso, G., Coorevits, E., Nijs, L. & Leman, M. (2016). Gestures in contemporary music performance: a method to assist the performer's artistic process. In *Contemporary Music Review*, Vol. 35, 4-5: Gesture-Technology Interactions in Contemporary Music.

My main contribution was in providing the content, the analysis of case study n. 2 and in writing the paper.

3.1 Introduction

Music performance implies a particular relationship between intended expressive goals, the way these goals are realized through musical actions, and the final sonic or musical outcome of the performance. Typically, a performance draws upon a performer's model for performing. Such a model is typically based on historical and established practices and conventions. Through education these practices and conventions got wired into the performer's cognitive and sensorimotor schemes that control the relationship between expressive goals, actions, and sounds. It is no exaggeration when we say that codified performance models form the backbone of almost every educated performer. However, contemporary music often challenges these models, requesting actions that go beyond existing codes and practices. Examples of such actions are: preparing instruments to obtain new instrumental sonorities, performing extremely complex rhythms, including theatre and acting, dealing with unconventional notations, including elements from other cultures, using unconventional playing techniques and so on. Arguably, such actions can be seen as opportunities for creativity, inviting the performer to engage in an artistic process of interpretative exploration and experimentation, and stimulating the development of performance models that better fit the challenges of contemporary music. Consequently, the artistic process should go beyond the confines of the codified performance model, addressing the cognitive and sensorimotor schemes that underlie such models. All this requires a particular mind-set that is based on a cognitive understanding of the expressive intentions behind the contemporary music score, and on a sensorimotor embodiment of these intentions as musical sounds. In other words, the artistic process of adaptation to renewed music aesthetics implies that the performers transform their practices, acquired from tradition, into a series of expressive concepts and motor strategies which are not yet well mapped and coded. Given the fact that contemporary music is not a single aesthetic concept, it may require the development of multiple performance models, perhaps even one for each composition. However, it is far from evident how to change cognitive and sensorimotor schemes. For that reason, it is worth considering a method that assists this change.

In this study, we consider the possibility of developing a method that assists the performer in dealing with the challenges of contemporary music performance. Such a method aims at making a performer's artistic process (which is based on cognitive and sensorimotor schemes) more explicit, in order to better understand the new relationship between goals, actions, and sounds. Ultimately, this may lead to a new performance model. However, it is important to understand from the outset that the method does not provide a heuristic that will automatically lead to a new

performance model. The method is meant to assist the performer with the help of innovative technologies. It allows performers to frame their new interpretative outlooks while rendering explicit their performative code implied in such an artistic process. The chapter is structured as follows. First we provide a general framework for understanding music performance, based on the notion of performance spaces and frames, and on recent insights in embodied interactions with music (section 3.2). Next we elaborate on how to approach the development of such understanding through performance research (section 3.3). Then we apply this framework to the performance of contemporary music, describing two complementary analysis approaches, called performer-*inspired* (section 3.4) and performer-*based* (section 3.5). This chapter concludes with a discussion on the approach and its value for both research and performance.

3.2 Music performance: embodied interactions in the performance space

The classical musician is a creative person whose task it is to interpret a musical composition through a (re-)definition of expressive goals, and through a particular realisation, the performance, of these goals by means of musical actions. The composition can be conceived of as a set of instructions that require an interpretation by the performers in order for them to perform the music. However, this interpretation draws upon prior cognitive and sensorimotor schemes of the performer. Therefore, performances will carry the mark of each individual performer. Moreover, each interpretation can be seen as the performer's estimation of the composer's intended musical state that led to the musical score.

The interpretation is managed by an *enactment* process, which Leman (2016) defines as a process by which intentions are transformed into patterns, and patterns into intentions. In the case of a performer who is confronted with a score of contemporary music, intentions are based on a cognitive interpretation of the composer's score. The *enactment* process then allows for the transformation of those intentions into sound patterns, using sensorimotor schemes that turn the intended actions into body movements that realise the sound patterns. This *enactment* process involves both an *encoding* and a *decoding* part. The *encoding* part is concerned with the transformation of intentions into sound patterns, through actions and gestures that make this encoding concrete. The *decoding* part is concerned with the transformation of sound patterns into intentions. According to Leman (2016) *decoding* already happens at the kinaesthetic level, which means

that performers, while playing, use their perceived motion already as a feedback for their intended actions. Apart from this proprioception, they also use the produced sound as a feedback for their intended actions. In short, performers are involved in both *encoding* and *decoding* activities of their own performance, and they engage sensorimotor schemes to deal with patterns at the intended level.

Overall, this *enactment* process is the outcome of a deliberate practice that involves the definition of expressive goals, on the basis of an analysis of the musical score. This involves self-reflection, thinking, and conscious monitoring of the performer's own performance. In addition, it involves sensorimotor schemes, which are dynamic, fast, and pre-reflective processes that draw upon intensive learning and conditioning. These sensorimotor schemes guarantee the realization of on-the-spot adaptations of practiced enactments. It is assumed that these schemes draw upon predictive mechanisms that control the motor system (Leman, 2016).

A codified performance model would typically consist of a cognitive convention for interpreting a score and defining appropriate intentions, and a well-trained sensorimotor scheme that allows a fluent transformation of these intentions into sound patterns. However, contemporary music may challenge this performance model in two ways. First, it may challenge the convention because the score may induce a rethinking of expressive strategies and intentions. Second, it may challenge the use of sensorimotor schemes that the performer has established during long and intensive years of training. The cognitive and sensorimotor aspects may influence each other. Cognition may impose new learning schemes but it also happens that cognition is influenced by sensorimotor-based outcomes. The method that we envision should contribute to a greater awareness of the intended expression and to a more robust refinement of sensorimotor schemes. It is a method that aims to assist the artistic process of a performer.

3.2.1 The performance space-frame

Our method takes into account that every performance implies a performance space. Different dimensions of a performance space can be identified (see also: Bourgeau, 2006; Jensenius, 2007). Each of these dimensions possibly has an impact on the *enactment* process by influencing the involved *encoding* and *decoding* processes. A first - objective - dimension is defined by the physical space in which a performance takes place (e.g. a practice room, a concert hall). For example, due to the physical condition of the instrument and the room acoustics, performers have to adapt their sensorimotor schemes in view of the intended sound result. A second - subjective - dimension is defined by the lived experience of the

performer within that physical space. For example, while playing, performers have to interpret the score by shaping their lived emotions and feelings, as a function of the enactments and challenging approaches to the instruments often deliberately required by contemporary composers. A third - social - dimension is defined by the relationships between players and audience. For example, performers, in approaching their instruments as a natural extension, enact musical gestures as an outcome of their subjective intentionality biased by the prevailing cultural conventions, which are also related to the emphatic responses of the audience.

Equally important for our method is that the performance space encompasses a set of conventions and cultural practices, which define a social frame that determines the nature and purpose of behaviours and how they should be interpreted (Goffman, 1974). This social frame sets an implicit agreement of performer and audience on the symbolic status of the performance, based on codified relationships that exist between players, instruments, musical composition (often a notated score) and audiences. Again, contemporary music may challenge the performance space and the associated social frame by using new types of spaces and unconventional approaches that can be in dissonance with the (conventional) space and frame. Consequently, when the performance space is new, and the social frame is unfamiliar, the question is how a new performance space-frame will emerge, and what it implies in terms of interpretative involvement from the part of the performer and the listener.

3.2.2 Embodied interactions with music

Our method focuses on the development of new cognitive and sensorimotor schemes that cope with the challenges of contemporary music. Central to this development is the performing body, which can be seen as the nexus of the enactment processes, through which intended expressions are transformed into musical sound patterns. Recent work in the domain of embodied musicology shows that the bodily gestures, which the performer uses during a performance, draw upon a complex web of different types of gestures, which recent research calls *sound-producing*, *sound-facilitating*, *interpretative*, and *communicative* (Godoy & Leman, 2010; Jensenius, 2007). These different gestures show both universal and idiosyncratic features (Buck et al., 2013). For example, sound-producing and facilitating gestures are determined by the postural and technical specificity of the musical instrument, while interpretative gestures are based on intentions and expressive goals (Leman, 2007). Overall, performance gestures are influenced by different sources, including musical structures (Wanderley et al., 2005), associated emotional states (e.g. Dahl & Friberg, 2004), and expressive targets within the

context of a performance (Davidson 2005, 2007). Being aware of these different gestures may be a first step towards the development of an adapted performance model.

Arguably, the features of the performer's gestures should be related to the different dimensions of the *performance space-frame*. For example, an intimate space will evoke a close relationship between performer and audience, where small gestures are clearly observable and will have an immediate effect. A large stage or concert hall endures much larger and overt gestures, without becoming grotesque. Furthermore, according to Goffman (1974), social frames are embodied and displayed in the way in which our bodies act physically, providing visual clues about roles, practices and activities that lead to the establishment of shared meanings. For example, in orchestral performance, the conductor leaves his baton and arms in the air, and the musicians hold their instrument in playing position to extend the tension that comes with the end of a piece. Only when the musicians lower their instrument and the conductor relaxes does the audience start applauding. But again, contemporary music tends to challenge these conventions. The musical structure and the associated expressive targets are less obvious than in repertoire music, where both the performer and the audience can rely on numerous, previous performances and recordings. This will evoke new ways of embodying and enacting the music on the side of the performer, which consequently challenges the social conventions that are part of the performance framework, as the bodily communication between performer and audience contains new and hence unconventional expressions.

In the next section we elaborate on how to approach music performance analysis to cope with the complexity of the enactment process as shaped by a challenging repertoire and the space-frames it opens up.

3.3 Music Performance Analysis: bottom-up and top-down

With our method we envision the possibility of making the enactment process more visible, for example through the recording and analysis of the corporeal involvement (gestures) in the performance, and through the visualisation of the relationship with sound patterns. However, this visualisation of relationships will only show gesture-sound performance patterns, rather than gesture-sound performance intentions. In order to comprehend the relationship between patterns and intentions, we will need to engage the performer in the entire process. For that reason, our method requires

the performer's participation: the performer plays an active role in making the enactment process more explicit, so that this process can be of help in changing the cognitive and sensorimotor schemes that operate within the performance space-frame. In addition, we should keep in mind that the subjective experience and social relations are important aspects of a performance, being reflected in the performing body as the nexus of decoding and coding musical intentionality.

Our method is based on the idea that certain aspects of the performance can be handled from a third-person perspective, while certain other aspects cannot be handled that way. For example, gestures and sounds can be registered, measured and analysed with the use of modern technologies. Yet, the intentional states that led to those gestures and sounds cannot, given the current state of the art, be approached straightforwardly from a third-person (or outsider) perspective. Instead, what we need is an account of the first-person (or insider) perspective, which is the perspective of the performer who had these intentions, and who transformed these intentions into gestures and sounds. For that reason we address those two perspectives. The third-person perspective can be used to monitor the enactment process by focusing on the analysis of auditory, visual, bodily and subjective aspects. The first-person perspective (which is that of the performer) can be used to develop an interpretation of the intentions, both the strategic intentions that are based on the analysis of the composition, as well as the intentions that draw upon the sensorimotor schemes related to the actual performance. We believe that the performer can gain a lot by combining an analysis of gesture-sound patterns with an analysis of intentions. This combination can reveal insight in the way in which pattern and intention are related to each other. Given the fact that the relationship between pattern and intention is a core element of the *enactment* process, we believe that clarification of this *enactment* process may provide an interesting feedback to the performer whose goal it is to establish a solid, new *enactment* process in relation to contemporary music.

In recent times, performance monitoring has undergone quite an evolution, due to technological advancements (e.g. motion sensors, software for observation and analysis) but also due to advancements in our understanding of the processes that underlie human interaction with music (Leman, 2007, 2016; Godoy & Leman, 2010; Fabian, Timmers & Schubert, 2014). The focus of performance research towards monitoring corporeal engagement in performance has been broadened. Performance research has led to the increased integration of advanced objective measurement and computational analysis (e.g. feature extraction, segmentation) of both music and movement. Technologies have been implemented to explore and experiment with new musical realms, and to develop new ways of corporeal involvement, possible with the aid of newly developed musical instruments, although technological applications that do address practice (e.g. iMaestro; Ng,

Larkin, Koerselmans, Ong, Schwartz, and Bevilacqua, 2007) often remain within the academic community instead of finding their way to the individual performer and to music educational institutions.

3.3.1 Bottom-up approach: a third-person perspective on performance analysis

A third-person perspective on performance analysis implies some kind of objective approach to measurement and analysis. “Objective” means here that the work can be done by any person, or perhaps even a machine, provided that the procedures for measurement and analysis are strictly followed. The overall procedure consists of a recording of movement and audio patterns (or signals) produced by the performer, the extraction of appropriate features from these patterns (such as movement speed, loudness, peaks, recurrent patterns, quantity of motion), and the comparison of patterns using computational analysis methods that extract salient features, structures, and so on.

The paradigm of embodied music cognition has led to many studies that investigate the role of body movement in the extraction and communication of musical meaning (Davidson, 2007; Thompson & Luck, 2008; Miranda, Kirke & Zhang, 2010; Repp & Keller, 2010). In most studies, musicians are instructed to perform a musical piece in a number of targeted expressive sensitivities, such as ‘light’, ‘heavy’, ‘expressive’, ‘immobile’ etc. The performances are then compared in order to catch objective features of expression. These features can then be correlated with movement and sound patterns. Other examples are studies on clarinet performances (Davidson, 1993; Dahl & Friberg, 2007; Nusseck & Wanderley, 2009; Wanderley, Vines, Middleton, McKay & Hatch, 2005), piano performance (Clarke & Davidson, 1998; Castellano, Mortillaro, Camurri, Volpe & Scherer, 2008), and marimba playing (Broughton & Stevens, 2009). The different studies on bodily involvement in music have led to various definitions and categorizations of movements (Cadoz & Wanderley, 2000; Godoy, 2010; Jensenius, 2007; Naveda & Leman, 2010; Wanderley, 1999), allowing a detailed description of the corporeal dimension in a performance.

However, the precise relationship between expressive sensitivities, musical intentions, and body movement still needs to be better clarified and investigated. Indeed, too often studies addressing movement through such a bottom-up approach do not take into account the role of the performer’s creative process. Movement is conceived of as a measurable phenomenon in the physical dimension of the performance space, describable in terms of different types of displacement (e.g. acceleration, velocity). But the performance space is not a “neutral” Euclidian

space. On the contrary, the performer whose lived experience shapes the corporeal dimension, subjectively embodies it. Accordingly, the different categorizations of gestures may give an objective description of the performers' motor strategies, but they do not necessarily supply information about the intrinsic interpretative and aesthetic signification the performers attributed to the music. Indeed, while movements may seem similar in the physical dimension, they may differ in the subject and the social dimension. Consequently, the voice of the performer is to be acknowledged as a crucial element in the interpretation of technology-generated observation data. From an insider's view, the performer can describe the lived experience and the social frames this experience is embedded in.

In short, the analysis from a third-person perspective on performance analysis does not guarantee the disentanglement of the enactment process. The reason is that the current tools and technologies are not sufficiently powerful for estimating intentions on the basis of patterns, and one may wonder whether they will ever become so powerful. In any case, the current state-of-the-art requires that the third-person perspective on performance analysis is supplemented with the help of a top-down approach (see next section). This is exactly the core idea behind our method.

3.3.2 Top-down approach: a first-person perspective on the lived experience

The top-down approach addresses the analysis of the performer's intentions and actions, both from the perspective of cognitive interpretation (of a score) as well as from the perspective of the performance (and the sensorimotor schemes involved). The core starting point here is the lived experience of the performer. It implies an insider view based on kinaesthetics (i.e. internal sense of movement, and comparison of action intention and actual movement), and perception (i.e. based on intended actions and realized action outcomes) as experienced by the performer (Leman, 2016). This experience is known to be an important aspect in shaping and fine-tuning one's musical intentions. However, it is less clear how this experience can be made explicit and turned into a feedback for developing a new performance model.

Moreover, prior to a performance, the artistic process of constructing an interpretation of the musical work unfolds through practice. An important part of practice is self-reflection about one's own intentions and performance outcomes, and about the performance space and associated social conventional frame (space-frame). That is, knowledge of performance (KP; internal or externalized post-action information about the outcome of one's own actions) and knowledge of

results (KR; internal or externalized post-action information about the nature of one's own actions) is evaluated against the background of technical, interpretative, stylistic and expressive considerations. These evaluations are embedded within a holistic framework of reference combining a personal interpretative framework (a set of cognitions that operates as a lens through which musicians look at their musicianship, give meaning to it and act accordingly; see also Kelchtermans, 2009) with socially and culturally determined opinions and beliefs. Note that both forms of knowledge (KP & KR) can be implicit or explicit and that the associated evaluation can be conscious or unconscious.

Our method addresses these issues and aims at making them more explicit. Ultimately, we believe that the above described combination of thinking in and on action – both in practice and performance – shapes the performers' musical ideas and intentions, as well as their knowledge about the executive strategies required to enact these ideas and intentions in the performance. Interestingly, new technologies offer new possibilities to broaden and deepen this thinking in and on action, and consequently to develop knowledge about the *enactment* process. On the basis of different sensors, new technologies may provide real-time feedback during practice, and as such augment natural processes of observation, analysis and evaluation. They may also provide post-hoc feedback based on visualization and computational analysis of digitally obtained observation data.

In the top-down approach, new technologies are used to allow the performer to observe and to analyse the enactment process in a more explicit, elaborate and detailed way. Using software for annotating scores, audio-video and sensor-based recordings, for example, the performer becomes more aware of the implicit (based on intuitive apprehension in performance) sensorimotor schemes that underlay the performance. By describing explicit (based on deliberate reflection in and on performance) knowledge about the enactment process, the performer becomes more aware of the entire performance space-frame. Importantly, this process of explication provides an elaborate – insider – view on obtained observation data. In addition, this process may support the development of a performer's knowledge not only about previously attended aspects but also about unaddressed elements of performance.

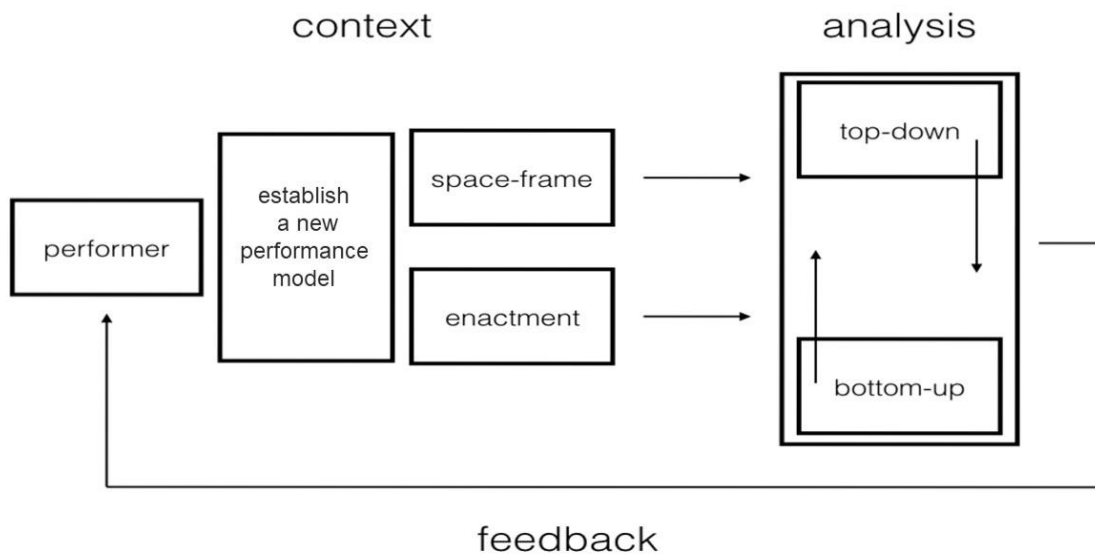


Figure 3.17 The performer-assistive method.

This method consists of three parts: context, analysis, and feedback. (i) The context is a performer who is challenged by contemporary music and wants to establish a new performance model based on intended expression supported by sensorimotor schemes. The performance is embedded in a particular performance space-frame, and it draws on the enactment of expressive intentions. (ii) The analysis envisions bottom-up and top-down analysis using modern technologies that measure movement and sound, extract proper patterns, find relationships among patterns, and connects these patterns with an analysis of artistic and performative intentions. (iii) The outcome of the analysis is provided as a feedback to the performer who uses this to refine the performance model. This method involves the performer in an active way because the top-down approach is based on the performer's lived experience.

As mentioned, the bottom-up and the top-down approaches are highly complementary features of our method. In our view, the combination of both approaches is crucial in developing a thorough understanding of the enactment process. This can easily be illustrated by the example of a performer's corporeal involvement during performance. The mere top-down or bottom-up approach will not be able to disentangle the bodily nexus of musical decoding and encoding processes. On the one hand, computational analysis and data interpretation (bottom-up) without the subjective dimension as elicited in the top-down approach may reveal interesting movement patterns, but might fail in ascribing the patterns adequately to the correct components of the enactment process. On the other hand, performers' top-down analysis might provide interesting insights about their own gestures, but fail to see some aspects that, for example, cannot be detected with the naked eye or ear. Instead, by combining both approaches, it becomes possible to enrich a computational analysis of gesture-audio patterns with the performers' inside view. Bottom-up and top-down are here conceived of as mutually influencing and enriching approaches. The ultimate goal of the method is to make the entire enactment process, and its embedding in the performance space-frame, more explicit, so that it can be used as a feedback for developing a new performance model. In this way research data (gestures and music) can fuel the artistic process of the performer. By addressing and trying to interpret and explain bottom-up generated information, the performers might gain a deeper self-knowledge about their corporeal involvement and its musical meaning.

In the next sections, we present two case studies in which the enactment process of two performers interpreting a contemporary music piece was studied. Each case study adopted a proper methodological approach. However, in both studies the aim was to interweave bottom-up and top-down approaches in the analysis of the performance. The performers' perspective was implemented in the analysis to different degrees. The studies illustrate particular ways of developing the method.

3.4 Case study 1: Emphasizing the third-person perspective on performance

In this section, we present a case study in which the enactment process of a contemporary music piece was studied by deconstructing the performance into different analytical layers, using sonic patterns (e.g. timing, phrasing) and gestural patterns (e.g. quantity of movement, recurrent gestures). The goal was to interpret

different pattern layers by integrating the perspectives of composer, performer and musicologist.

The composition used in this study was *Austerity Measures I* (2013) for ten-string guitar, written by David Gorton (b. 1978). It was performed by Stefan Österjö. The piece consists of 64 bars of music, each of which should be labelled by the performer, at will, with the numbers 1, 2, 3 or 4. Only the first and the last bars have a fixed label, 4. During performance, the piece should be played four times. The first time, it should be played as it is written. The second time, all bars labelled 1 should be replaced with rests. The third time, all the bars labelled 1 and 2 should be replaced with rests and so on. As a consequence, the piece is performed (and constructed) by deconstructing it. This compositional idea challenges the performer to develop a new performance model. The deliberate numbering of the bars requires a reflective process of constructing an interpretation of the piece, requiring an artistic decision-making process based on familiar decoding and encoding patterns. As more musical material is lost when proceeding through the piece, the musical material is combined in different ways for each run-through, and therefore the performer needs to adjust musical intentions and their technical realisation accordingly. Consequently, every run through implies a reconfiguration of instrumental and musical gestures, leading to changes in the bodily engagement within the performance space. In short, the performer has to develop a cognitive interpretation as well as a sensorimotor scheme for enacting that interpretation into a performance.

Due to the specific nature of the composition, the enactment has to be redefined throughout the process of constructing the interpretation of the work. To capture the impact of the performance space, four performances were recorded. Two of them took place in a concert hall (rehearsal vs. with a seated audience), and two in the main entrance of a conference building (without vs. with a standing audience). This created each time a different performance space and social framework in which the performer's bodily engagement with the music was altered.

To investigate the enactment process, the analysis focused on the temporal structure of the performance and on the gestural involvement of the performer. Both have been linked to musical intentionality in expressive performance (Fabian, Timmers & Schubert, 2014; Leman, 2016). The aim of the analysis was to detect performance targets and related strategies based on the aligned of information at different layers of analysis (see Figure 3.18).

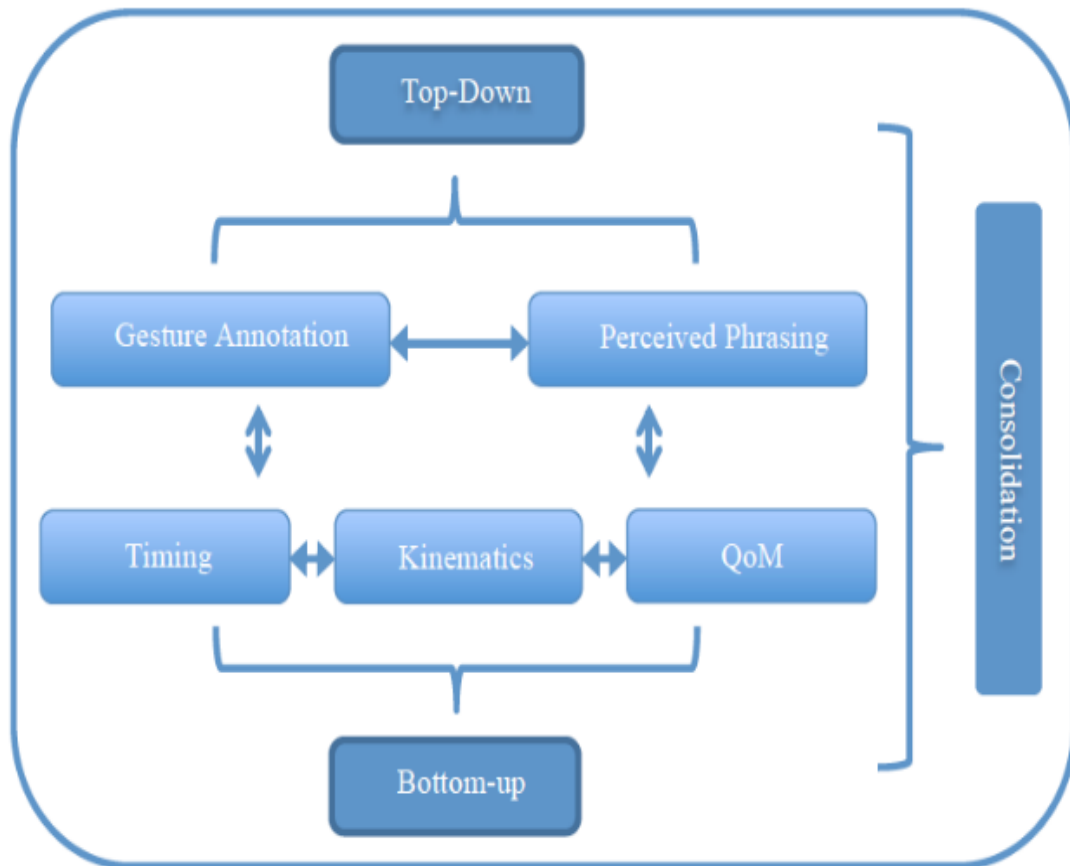


Figure 3.18 Multimodal framework for the analysis of *Austerity Measures I*. The bottom-up approach includes the timing (note onsets and duration) of the performance, the kinematics (velocity and acceleration) of the measured body parts and the QoM of the performer. The top-down approach comprises gesture annotations from the video recordings and perceived phrasing from the audio recordings. All these different layers can be mutually compared to contribute to the interpretation of data. In the end, the performer's intentions are crucial to consolidate the conclusions drawn out of the analysis.

A first layer concerns the objective measurement of sound and movement data. The temporal structure was measured by extracting onset times and durations from the dry guitar signal (recorded with a contact microphone). This was done per bar, and then calculated at the level of sections and run-throughs. In this way, it was possible to see how the timing deviates from a strictly isochronic rendering of the score, and how the process of compression and deconstruction in the score influences the timing over the different run-throughs. The gestural involvement of the performer was measured by extracting and calculating low-level kinematic variables (relative position, velocity, acceleration) from the movement of the head, shoulders and right wrist (recorded with active infrared markers and two Wii-motes). In addition, a platform with four pressures sensors placed under the performer's chair measured the executed pressure and displacement of weight, from which Quantity of Motion (QoM) was calculated.

A second layer concerned the measurement of sound and movement data, using the joint analysis of the recorded (audio & video) performances by the composer, the performer and the researchers. The temporal structure was measured by annotating the performances' audio recording with regard to perceived phrases (groups of measures) and super-phrases (groups of phrases). For the gestural involvement, the video-recordings of the different performances were annotated. Using the stimulated recall method (Bloom, 1953), a coding system of 18 descriptors was constructed as a frame of reference on what expression and related gestural involvement in the performance meant to composer, performer and researchers (see also Coorevits et al., 2016). These codes were applied to the jointly determined expressive moments in the performance. The time, and number of appearances of annotated gestures in the different run-throughs could be compared, which allows detection of where the changing musical material throughout the four run-throughs alters the performance gestures, and which gestures are used consistently (i.e. appearing at least in 3 of the 4 run-throughs at the same place in the score). These gestures could then be related to a specified musical structure.

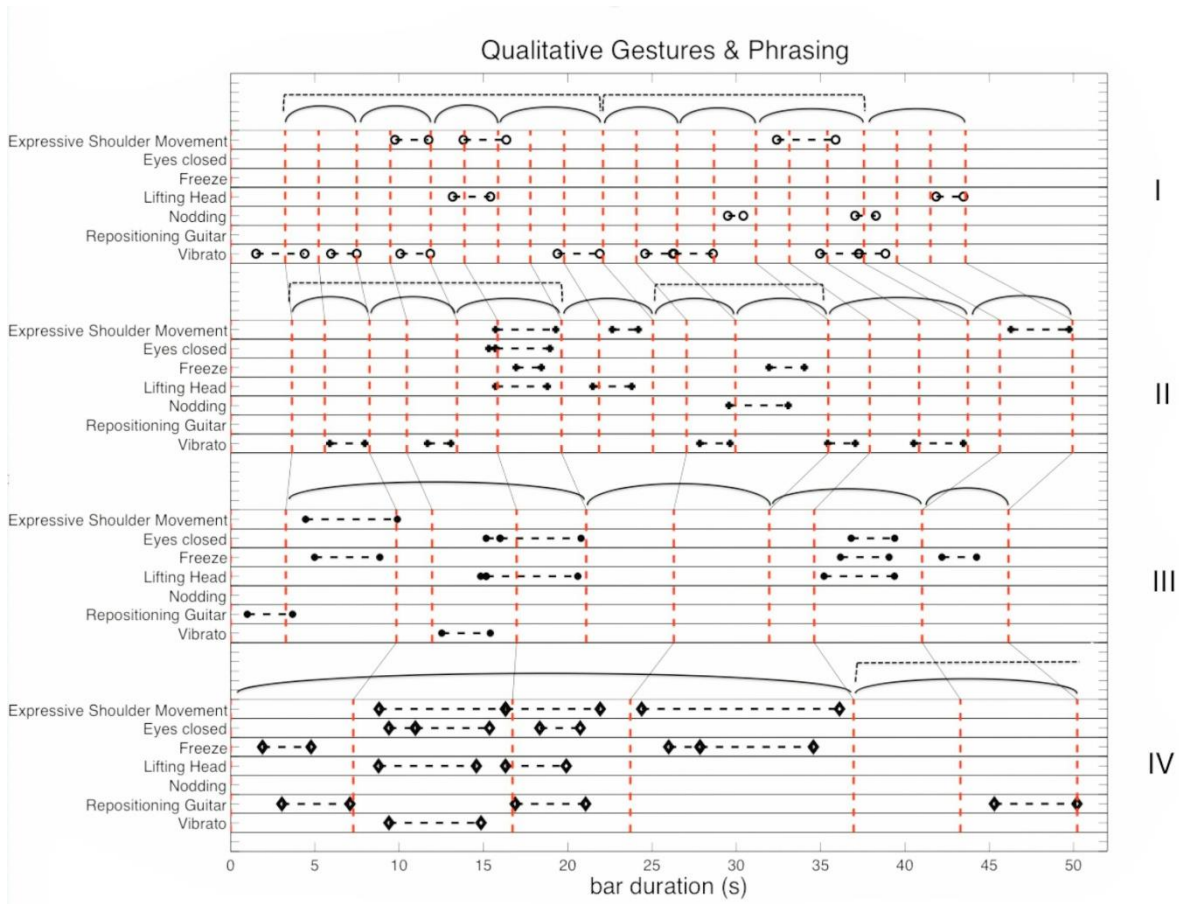


Figure 3.19 Visualization of different measurements in bars 30-49. The beginnings of each bar is represented by the dashed vertical red lines and perceived phrasing by the horizontal slurs (phrases) and dashed brackets (super-phrases) on top (horizontal axis). Gesture annotations and duration are indicated by the horizontal dashed lines in the tablature (left vertical axis). This way, the four run-troughs can be compared (right vertical axis).

A third layer concerned the consolidation of the first two layers. Here, the aim was to achieve a valid interpretation of the objectively and subjectively measured sound and movement data. First, a global evolution of timing, movement data and detected gestures throughout the run-throughs of the piece was used as a guideline to detect general performance strategies and musical goals. Next, the different sections within the score were compared over each run-through. Using the annotated gestures from the video recording as a reference point, the movement data was analysed in relation to the music. Here, data interpretation was supported by the visualisation of the different measurements, which helped to detect matches and mismatches between possible performance cues and musical goals (see Figure 3.19).

Finally, the annotated score of the performer, in which his musical goals and intentions are indicated, was used to interpret and consolidate the global results (see Figure 3.20). This step was particularly important to verify if the performance strategies detected in the different analytical layers corresponded with the intentions of the performer. For example, a particular point in the performance was first marked as expressive based on the results of the movement data and gesture analysis:

Researcher: «In that particular bar, you always seem to re-position yourself and your guitar, this might mark a boundary in the musical structure, isn't it?».

It was discarded afterwards, as it appeared to be just a technical difficulty in the score including a lot of position changes rather than a musical target in the performance:

Performer: «Well, in fact, in the section before I have to change to a higher position on the fret board with my left hand, but as this ten-string guitar is really heavy, it always falls down at that point, and that's why I have to re-position the guitar afterwards. I would not annotate that as an interesting or expressive gesture».

The outcome of the entire analysis is a visualisation of the *enactment* process, which the performer can use to refine the performance model.



Figure 3.20 Stefan Österjö performs *Austerity Measures I* surrounded by sensors.

Top-down analysis was based on interactions between the researcher and the performer. Here is reported an example of a dialogue between the researcher and the performer.

Researcher: « In that particular bar, you always seem to re-position yourself and your guitar, this might mark a boundary in the musical structure, isn't it? ».

Performer: « Well, in fact, in the section before I have to change to a higher position on the fret board with my left hand, but as this ten-string guitar is really heavy, it always falls down at that point, and that's why I have to re-position the guitar afterwards. I would not annotate that as an interesting or expressive gesture ».

Researcher: « Oh, Ok, but it might be good to annotate it anyway, as these movements will generate a lot of noise in the movement data »

Performer: « Actually I think this gesture in the left hand is not really expressive, I just lift it quickly from the fret board because I want to let the harmonics ring ».

Researcher: «I would code this as expressive, as you lift your hand from the fret board so quickly and energetic, with this big extended movement after you lift your hand. It evokes a feeling of power».

Performer: « Oh yes, this could be a good example of how a sound-producing gesture can be extended and thereby becomes expressive, as a kind of suffix».

3.5 Case study 2: Emphasizing the first-person perspective on performance

In this section, we describe a case study in which a performer's reflection is initiated by the challenge of a contemporary piano music composition to integrate elements of the Indian tradition. The goal is to come up with performance model that takes into account a re-orientation of the enactment towards this Indian musical tradition. The composition is the 8th cycle from the *72 Etudes Karnatiques* (1957-1984) by the French composer Jacques Charpentier (1933 - 2017). This piece is Western in orientation, but based on the South Indian *Melakarta Ragas System*. In this case, the performer, Giusy Caruso, is at the same time the researcher musicologist analysing her own performance.

Charpentier's composition challenged the performer to "re-orient" her initial approach to this specific 20th century piano music. In origin, this approach was a rather intuitive approach, based on a codified performance model of piano playing. Throughout practicing the piece, the performer realized that the interpretation of Charpentier's piano etudes required another, less conventional, perspective, based on Indian music competences that would reshape the musical intentions and expressive sensitivities. However, due to the limited sources on Indian music performance (these are only transmitted orally or written in the original languages Sanskrit/Hindi), the performer engaged a collaborative creative practice with the composer Charpentier, as well as with a Karnatic singer and a dancer trained in Indian music. In this way explicit knowledge was obtained about the Indian music tradition (*ragas, talas*) and its philosophical background. In addition, by playing together with Indian musicians and dancers, implicit knowledge was obtained about the enactment of that music.

To investigate the enactment process and, in particular, to trace the way this process was transformed by the process of acculturation (acquisition of implicit and explicit knowledge about the Indian tradition), several consecutive interpretations

of (selected fragments) of the piece were recorded. Due to the fact that the performer is in this case study at the same time the researcher/musicologist, a retrospective *thinking-aloud* procedure (Van den Haak & De Jong, 2003) was used in order to make the artistic reflection more explicit and systematic. The performer-researcher looked back at the development of the enactment process by verbally explaining and demonstrating at the piano the differences between the initial intuitive (codified) approach (implicit understanding of the musical intentionality based on a codified performance model) and the final conscious approach (explicit understanding of the score based on the deliberate acquisition of a new performance model). Verbal explanations were based on a protocol that was developed for the score annotation (see chapter 4). Before and after the performance and explanation of the fragments, the whole piece was played through as point of reference, allowing the detection of possible bias in the *thinking-aloud* procedure (i.e. whether the presupposed causal sequence of stimuli and expressive responses explained in the fragments biased the spontaneous performance of the piece). The performer-researcher asserted in her verbal explanations how her musical gestures changed from her initial intuitive approach in relation to the new intentions and expressive goals determined by her process of acculturation:

«My collaboration with the composer Jacques Charpentier brought me to interpret the piece respecting the Indian philosophical conception of sound intended as vibration and energy. Therefore, I started to increase the use of my body enlarging the sound-producing gestures in order to have a stronger and more vibrating piano timbre. For this reason, I changed some fingerings in both hands and I applied different technical gestures to my elbows for a more expressive enactment of some accents»².

Moreover, the performer-researcher declared how determinant has been her practicing and performing with a Karnatic singer and a dancer trained in Indian music:

«Working together with a Karnatic singer gave me the opportunity to catch the authentic style of Karnatic music. The interactive practice entrained my articulation and inflections of some musical phrases respecting much more the rests. Furthermore, the collaboration with a dancer trained in Indian music led me to really “act out” the piece by increasing the expressivity in my bodily articulation, such as punctuating movements with my head in some specific Indian rhythmical patterns»³.

² See the *verbatim* in appendix A.5

³ *ibid.*

The complete experiment, conducted in a concert hall on a grand piano to elicit an ecologically valid performance space, was recorded on audio and video (lateral & top view). In addition, the gestural involvement of the performer was captured with a motion capture system (six infrared camera's tracking markers on head, hands, back and elbows, and on keyboard).



Figure 3.21 Giusy Caruso performs the 8th cycle from the *72 Etudes Karnatiques* with markers attached to her upper body parts.

The analysis was carried out from the perspective of *musical intentions* which, in line with the above described model, were conceived of as states that cause gesture patterns. The aim was to make changes in the corporeal articulations, induced by the process of acculturation, more explicit, so that they could be used as a feedback for developing a performance model that fits this composition.

The top-down process comprised the multimodal analysis of music and movement through video annotation, on the basis of an elaborated score annotation. This score annotation, conducted by the performer, consisted of a *structural* analysis of the music (form, sub-phrases) combined with a collection of subjective observations on *interpretative* cues (tempo, phrasing, dynamics, timbre) and their *technical* implementation (e.g. fingerings) (see also: Chaffin & Imreh,

2002). In addition, a coding system was developed to indicate motor strategies in the score in order to link specific gestures to musical patterns. The codes were elaborated on the basis of video stimulated recall (Bloom, 1953), using archived video recordings of previous performances (solo and in ensemble with a Karnatic singer and a dancer trained in Indian music). On the basis of this coding system it was possible to differentiate performance related movements into sound-producing, technical and expressive gestures and, consequently, to relate structural, interpretative and technical aspects of the score to the different involved gestures. Furthermore, it enabled to detect and systematically describe changes in the performer's enactment as induced by the process of acculturation. Accordingly, this annotation framework also served as a protocol for the verbal description of the fragments performed during the actual experiment.

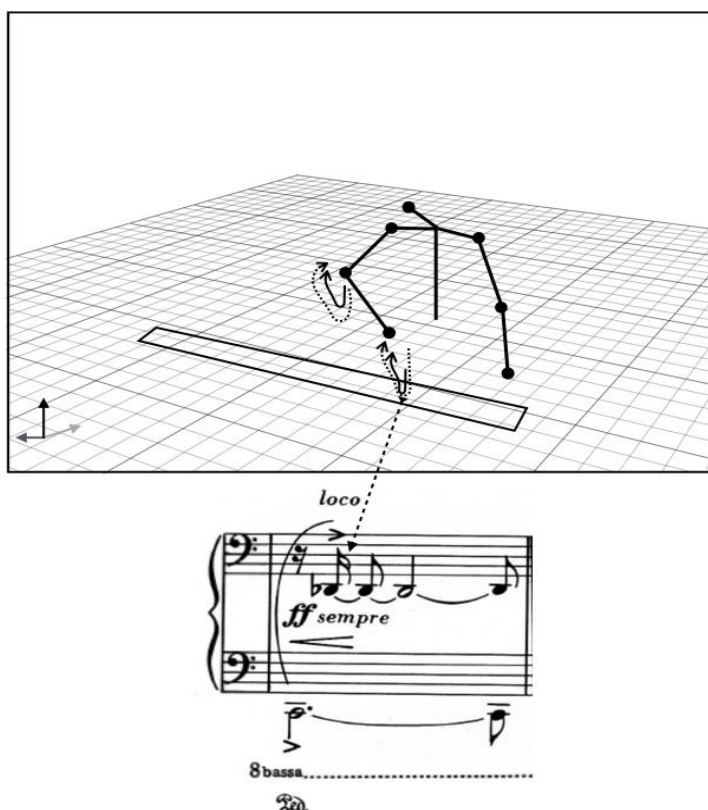


Figure 3.22 The alignment between a bar from the score annotation and the correspondent frame from the MoCap recording.

This figure shows two different motor trajectories in the attack of a target note (db) in function of the intended sound result. In the first – intuitive – interpretation (full line), the right hand starts closer to the keyboard and, after the key attack, leaves the keyboard with a small curved trajectory of the right elbow. In the second – deliberate – interpretation (dotted line), the right hand starts from a higher distance to the keyboard and, after the key attack, leaves the keyboard accompanied by a larger curved trajectory of the right elbow.

The bottom-up approach offered a way to segment the performance gestures automatically (see Desmet et al., 2012) and to extract kinematic variables (velocity and acceleration) that allow the comparison of the two performance models.

In this case study, the goal of the bottom-up approach was to fuel the performer's *first-person perspective*, based on reflection in and on action during practice and performance, with a *third-person perspective* elicited by the visualisation and analysis of the motion capture data. The aid of technology allows the performer-researcher to objectify her body image, supporting the self-investigation by mapping and measuring the corporeal, performative movements as an external reflection of the performer's deliberate and embodied musical intentions and expressiveness. The combination of the objectification of the gestural involvement with the subjective analysis, on the basis of score and video annotation, enabled the performer to investigate systematically how the gestural articulation in performance changes in relation to the expressive intentions embedded in the score through her deliberate practice. In particular, it provided insights on how the Indian music practice (inducing the process of acculturation) affects the final deliberate and spontaneous interpretation of the 8th cycle from *72 Etudes Karnatiques*.

3.6 Discussion and Conclusion

In this chapter we presented a method that can work as an assistive approach to artistic research in music performance. Our method focuses on the development of performance models that fit the challenges of contemporary music, such as unconventional practices and performance techniques taken from other cultures. Our method works as a traditional mirror, in the sense that it provides feedback to the performer, who uses this feedback to refine the performance model. However, the traditional mirror is here replaced by sophisticated technologies and analysis tools. An overview of the performance-*assistive* method is given in Figure 3.17. It is based on a theory of musical enactment (Leman, 2016), presented in the context of performance spaces and social frames.

Our method was then applied to two case studies that addressed the same challenge, namely how musical intentions can be reflected optimally in the performance. The studies are based on a combination of bottom-up and top-down analysis, and both involve the performer as provider of (i) a cognitive assessment of the interpretation of the composition, and (ii) a cognitive assessment of the lived experience during the performance. However, both studies differed in an important

way. The first case study adopted a performer-*informed* approach, in which the performer's intentions were used to consolidate the combination of the bottom-up quantitative analysis with the top-down qualitative analysis. Here, objective data were validated through subjective significations based on the joint - negotiated - perspective of the composer, performer and researcher. The second case study adopted a performer-*based* approach, in which the performer was at the same time researcher and participant, aiming to broaden and deepen the artistic process involved in practicing and performing a contemporary music composition. Here, subjective considerations about score and performance were complemented with insights retrieved from objectifying the body image through the quantification of the performer's gestural involvement. Overall, both approaches illustrate different aspects of the method.

The case studies are indicative of how artistic and academic research may join forces. With our method, we propose the integration of the performer's subjectivity into a scientific research context, such that it works as a driving force for artistic research. We believe that this rapprochement of artistic and academic perspective is an important step in the development of insights on the embodied nature of music performance (Coessens, Crispin & Douglas, 2009). In our model, the musical enactment process is handled as a multifarious phenomenon that depends on many subjective factors, as shaped by the specific performance space that constitutes the performance, such as anatomical differences and skills of the performers (Godøy et al., 2012), their different approaches to the instrument (Chadefaux, Wanderley, Le Carrou, Fabre & Daudet, 2012), or background and interpretation (Danuser, 1992).

We acknowledge that current, state-of-the-art, objective bottom-up methods cannot predict the intentions behind gesture-sound patterns, and we add the performer's insider knowledge to accomplish this. Obviously, the measurement of movement on the basis of sensor technologies, and the consequent computational analysis reveal aspects of performance that are not always part of the performer's experiential knowledge. However, performers do possess crucial knowledge about their own enactment of the music, and have particular opinions on the material they perform. Such knowledge is often vital in interpreting results from the computational analysis of movement. After all, the performer's reflection on action might provide important information to guide the analysis. For example, in the first case study, the close collaboration between composer, performer and researchers, based on dialogue and search for consensus on different aspects of music and movement, provided important information on the phrasing, and as such supported the interpretation of motion capture data. Moreover, the performers' inside view can shed light on the exact nature of the results obtained through objective measurement, and thereby support the validity and credibility of their interpretation,

or even steer the interpretation. For example, the performer's interpretative and expressive choices are important information to decide on the categorization of gestures (e.g. expressive vs. instrumental). Given the above, the role of performers in academic research ideally goes beyond merely being participants and extends into being research partners. In short, we believe that our method can offer valid perspectives on how to advance artistic research for performers.

Chapter 4

Mirroring the intentionality and gesture of a piano performance

Abstract¹

While musicians' gestures are often studied in terms of body movement and articulation, their gestures needed to be deeply understood in terms of musical intentions. In the performer-based analysis method, we reported the first step towards a technology-enhanced mirror that enables the analysis of gestures as an interface of the performer's own reflections on intentions (top-down), using measurements (bottom-up) of gestures and audio, as a reference basis. In this study, we accurately describe our performative experiment. The pianist's gestures were analysed with motion capture, video and audio recording in order to explore how, in the performance of a Western piano piece based on Indian music scales and rhythms, body articulations reflect different interpretative approaches. Two performance intentions of the same piano fragment were compared: initial and developed performance as outcomes of an artistic process in which the technology-enhanced mirror was used for monitoring artistic practice. The results reveal significant gestural and audio differences. Furthermore, we illustrate how technology can assist the artistic process, and how the artistic process can in turn enrich the science of musical performance. In this investigation, the approach to art and science is reminiscent to an entangled state that affects both the artistic and the scientific outcomes in a way that is not possible to realize from a purely artistic or purely scientific perspective.

¹ This chapter presents a we-form because it consists of an article in submission written in collaboration with Nijs, Coorevits, Leman. My main contribution was in providing the content, the data analysis and in writing the paper.

4.1 Introduction

In the past decades, research on music performance has become an important issue in empirical musicology. The strong corporeal dimension of music performance, involving different types of gestures, such as *sound-producing* gestures, *sound-facilitating* gestures, and *expressive* gestures, is in a specific way related to musical structure and its associated musical intentions (Cadoz, 1988; Delalande, 1988; Palmer, 1997, Godøy & Leman, 2010; Jensenius et al., 2010). Understanding how musical intention mirrors performance gesture is extremely complicated but there is a general agreement among scholars that progress in this domain has many consequences for innovation in the arts, and related to that: insight in the processes of human meaning formation and empowerment (Leman, 2016).

Research that contributed to the understanding of musical intentionality was based on laboratory studies using targeted expressive sensitivities (Davidson, 1993; Dahl & Friberg, 2007; Nusseck & Wanderley, 2009) and real concert studies (Wanderley et al., 2005). Other investigations have related music performance gestures to musical structures (Wanderley et al., 2005; Thompson & Luck, 2008), to emotions (Dahl & Friberg, 2004; Juslin, 2005; Hunter & Schellenberg, 2010; Cochrane et al., 2013) and to expressive targets (Davidson 2005, 2007; Miranda et al., 2010; Repp & Keller, 2010; Desmet et al., 2012). Often these studies tend to provide a categorization of gestures in relation to a specific instrument (clarinet, piano) or in relation to specific labelled emotions. Some studies also specify the causal relationship between the performers' action repertoire and gestural motor schemes on the one hand, and the musical structures in a spontaneous condition of practicing and performing on the other hand. For example, sensorimotor control theory has been used as a basis for explanation (Keller, 2012; Maes et al., 2015; Maes, 2016; Leman, 2016; Leman et al., 2017). The notion of inverse model offers a way to understand how perceived note structures in a score may trigger learned motor schemes from the action repertoire. The notion of a forward model offers a way to understand action execution in terms of an automated sequence of motoric activity that executes the musical action.

However, since a performance is the result of an intensive personal and deliberate practice that determines how to interpret the music and, accordingly, how to articulate the body in relation to this interpretation (Leman, 2016), eliciting the performer's artistic process may support and complement the interpretation of empirical data on sound and music in performance in line with the embodied music cognition theory (Leman, 2007). In that sense, sensorimotor control theory applied to musical actions may not provide alone a sufficient explanatory basis of the artistic

process and of the musical intentions. Next to control theory, we also need to take into account interpretation, and context. In short, the resources for action control are believed to be comprised in a larger container of resources, where all the things that exist, at least for the musician, are contained -- the so-called "action-oriented ontology" (Leman, 2007).

Despite the interest in gesture and in control theory, the musician's performance needed to be deepened in terms of musical intentions. Indeed, it is known that performers use gestures to transform a written score into live music. However, such a transformation is typically based on musical intentions that draw upon a previous compositional analysis. Seen from that perspective, a musical performance is the outcome of an artistic process during which knowledge (e.g. on musical style), education and training, experience and deliberate practice lead to decisions on how to play the musical structures, the articulation of phrases, the dynamics and tension arcs, the timbre, and so on. To realize these performance decisions - via real-time transformations into live music - the musicians have to adopt motor strategies to execute their action. Typically, this action repertoire has been established on the basis of traditional musical practices, that is, the learning of repertoire pieces that represent a good deal of different motor strategies. In that sense, the musicians' performance gesture is not merely a reflection of the executive strategies for turning a musical score into sound, but also a reflection of the musicians' personal style of moving and of their individual corporeal responses to the music. These responses emerge from the creative act of establishing and performing an interpretation (Nijs, 2017). This process implies a combination of an intuitive approach and deliberate considerations to music (Platz et al., 2014).

In previous studies, music performance has been conceived as a multimodal corporeal experience (e.g. Schacher, 2015). Up to recently, research on the corporeal dimension of music performance has only scarcely addressed the performers' artistic process of establishing an interpretation. However, first steps are being taken to acknowledge the voice of the performer in music performance studies. For example, Coorevits et al. (2016) proposed a specific approach called performer-*inspired* analysis that aims at guiding the artistic research process (see chapter 3). Basically, this method deconstructs the different layers of significance using technology that assists the exploration of different levels of expressiveness and musical meaning assignation. In performance studies that draw upon artistic exploration, there is a high need to further develop this approach in the direction of how and why some gestures occur when associated to particular musical intentions.

More specifically, if the performers' expressive gestures are the result of a personal and practical artistic work, can we map the subjective artistic experience through the lens of empirical studies, which, up to now, had a major focus on sensorimotor control?

And, how can the subjective basis of interpretation and artistic practice be integrated into an assistive technology for music performance?

Otherwise said, there is a need for better understanding the relationship between musical intentions (derived from artistic interpretations of musical structures), actions (especially expressive gestures based on learned repertoires) and sound (the live music aspect). Additionally, we want to address intentionality by exploring how a musician's expressive gestures relate to the artistic process.

We chose, as a case study, the performance of a contemporary Western piano piece based on an elaboration of non-western musical elements: Karnatic modes from South India and Hindustani rhythms from North India. The performer in question (the first author of this study) was quite new to this Indian music tradition. Therefore, the repertoire and its associated musical knowledge offered a way to investigate the artistic process development, in particular, differences in the interpretation and associated executive strategies from an initial approach to a developed approach. In our study, the artistic process was made explicit on the basis of a performative experiment that integrated the musician's description and explanation of her performance practice. Considering the difficulty to cope with this subjective component (Leman, 2007), we developed a multimodal analysis that aligns two different layers:

1. qualitative/phenomenological approach (Van Manen, 1990; Giorgi, 2009), i.e. a top-down approach based on the performer's reflections through verbal descriptions of her artistic process and through recalled lived experiences;
2. quantitative approach, i.e. a bottom-up approach based on the use of motion capture technology as a technology-enhanced mirror, i.e. augmenting the traditional mirror with objective measurement of body movement.

Both approaches are based on the performer-*based* analysis method (Caruso et al., 2016), in which the performer analyses the measurements in relation to the experienced (local, or score related) musical intentions. In this way, the performer proceeds from an intuitive analytical observation to a deliberate acquisition of knowledge (concrete level) and to a final systematic evaluation mediated by the technologically augmented mirror (meta-level).

The aim of this study is to go beyond the local musical score level by paying attention to the stylistic and artistic interpretations that the performer develops

during the artistic process. In this approach, the performer-based analysis is supported by technology as a "mirror" (technology-enhanced mirror) that provides top-down and bottom-up enhanced feedback regarding the performance. Obviously, the feedback is re-injected in the artistic process that defines and shapes the expressive intention of the performer. The mirror thus becomes a tool in a reinforcement dynamic within the artistic process. Our aim is to better understand this principle of artistic interaction that drives expressive performance intentions (Figure 4.23).

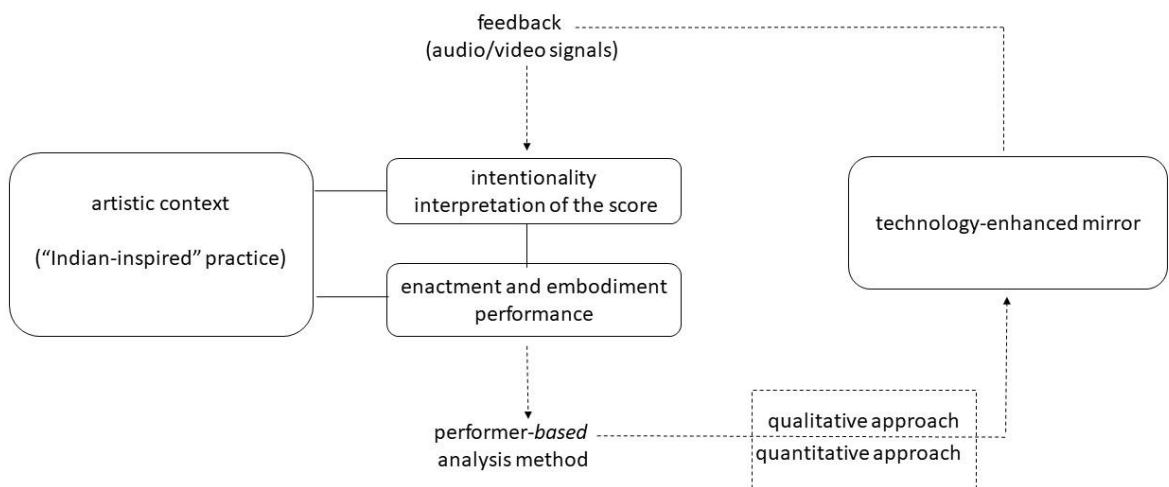


Figure 4.23 This scheme summarizes the concepts and the artistic context ("Indian-inspired" practice in this case) inherent to the performer-based analysis method.

To structure our ideas on this topic, we first frame the notion of intentionality and music interpretation within the artistic context of a music performance (section 4.1). We then situate this notion in the context of recent theories on enactment and embodied music cognition (section 4.2). Next, we introduce the method based on the use of technology as a mirror of music performance practice (section 4.3), and we show how this leads to specific results about gestures and intentions referring to the analysis of a short piano fragment (section 4.4). We conclude our study with a discussion section (section 4.5).

4.2 The artistic process in music performance: interpretation, enactment and embodiment

In classical written music, the artistic process can be conceived as a task in which a musical score is transformed into a live performance. This transformation involves a practice based on specific learning strategies of established interpretative models (Chaffin & Imreh, 2002). Typically, the practice consists of routine procedures. For example, in the initial stage the musician is engaged in a so-called *scouting-it-out* of the score (Neuhaus, 1973; Chaffin et al., 2003), which is an intuitive apprehension and interpretation of the score based on, for example, sight-reading. Then, in a later stage, the musician is engaged in a more deliberate heuristic approach that consists in analysing the score and practicing the piece in light of historical and conventional approaches or notions on a particular style, sometimes informed by listening to previous recordings. However, apart from routine procedures, the musician would also explore personal and creative expressive forms (Hubrich, 2016). For this reason, it is obvious that performances differ one from another by specific choices of expressive intentions in view of aesthetic or stylistic outcomes (Chaffin, 2007).

Overall, we believe that the artistic practice can be conceived as being based on music interpretation and the processes of enactment and embodiment. In the next section (4.2.1) we first define intentionality and music interpretation; then (section 4.2.2) we focus on the process of enactment (the way an interpretation is acted out) and on the process of embodiment (the way a performance is rooted in bodily processes). Furthermore, we take into account the importance of the performance space where performers shape and adapt their musical gestures in function of a specific cultural and emotional context, environment and acoustic (see also: Bourgeau, 2006; Jensenius, 2007).

4.2.1 Intentionality and music interpretation

According to the famous pianist Vladimir Horowitz, the composer's notation on a score is « *a mere skeleton that the performer must endow with flesh and blood*»². This view underlines the role of the performer as an interpreter of a "text" (Gadamer, 1989; Benson, 2003). In classical music, indeed, a musical interpretation refers to the musician's intentions, which are the result of the decision-making process about

² Schonberg, H. (1992). *Horowitz: His life and music*. New York: Simon & Schuster.

the content (aesthetic) and the way to perform the composition (performance gestures). Intentions involve musical concerns (how the music should sound) and executive decisions (how this should be realized) in relation to the shared meanings (social dimension). Music performance typically entails a dialogical interaction between playing what is written (executing) and performing (interpretation) (Sloboda et al., 1996). On the one hand, performers have to respect the composers' ideas and historical tradition (see "composer authenticity" in Kivy, 1995). On the other hand, performers are creative persons free to follow their own intentions and decisions on how to play a score (see "personal authenticity" in Kivy, 1995).

Performers shape their interpretation on the basis of their own artistic and performative intentions (collected through experience), which comprises both aesthetic concerns and performance practice approaches (Dreyfus, 2007; Cruz & Lourenço, 2010). Therefore, music interpretation requires a broad knowledge, gained from tradition and from other experiences. Such knowledge needs to be structured on a conceptual level and implemented as intentional choices in the performance practice. In this delicate interpretative challenge, performers need to acquire specific knowledge and skills inherent to the text (score) and the context using historical research to create, for example, new versions of extinct musical practices or to reinterpret older works in light of new interpretative insights (Danuser, 1992). This process is not a mere historical reconstruction but rather a creative act where performers often experiment with music material by applying different approaches with the intention of renewing traditional performative approaches and establishing their own performance model. Thus, interpretation constitutes an essential step that shapes the performers' intentional musical actions (Leman, 2016).

In short, the performers' musical actions are built on the intentions arisen from their process of interpretation and such musical intentions direct gestures on specific musical goals. In transferring those intentions into material form (music), the body can be conceived as a mediator between a mental level and physical energy (Leman, 2007).

4.2.2 The processes of enactment and embodiment in the performance space

The concept of interpretation is an important point of departure in any attempt to define the musicians' understanding of the music. The musicians' interpretation constitute the framework for transforming the musical intentions into the sounding music. This determines the musicians' gestural involvement in the performance. We assume that this transformation process can be conceived as an *enactment*

process (Leman, 2016). *Enactment* means that it involves corporeal action to realize it through the intertwining of the *decoding* and *encoding* processes. *Decoding* consists in the transformation of sound in musical intentional states, while encoding is concerned with acting out such established musical intentions. During practice, performers acquire a sensorimotor scheme that allows them to anticipate actions in function of the intended sound. Thus, in controlling and directing corporeal articulations towards specific musical goals, performers are guided by what they learn and embody throughout their artistic process. In addition, the *enactment* process involves on the spot responses to circumstantial contingencies such as different subjective and emotional circumstances and different situational components such as the concert hall and the audience (Nijs, 2017). As such, the performer's body, located in the space, engages in a *spatiality of sensations* or *spatiality of situations* (Merleau Ponty, 1962) which, during performance, may update the sensorimotor predictive model.

An important aspect of the enactment process is embodiment. Drawing on reflexes and acquired sensorimotor skills, embodiment involves certain corporeal states that assist the sensorimotor prediction that underlies enactment. Embodiment happens at different levels (Metzinger & Windt, 2015; Nijs, 2017) according to:

1. basic bodily reactions (e.g. reflexes) to the world (e.g. instrument and music) that are based on morphological features (e.g. tendon elasticity);
2. generation of an internal model of the body, the so-called *body schema* (Gallagher, 2005), on the basis of one's own morphological interactions with the world and on the acquisition of sensorimotor skills;
3. the way the body is subjectively perceived, seen and experienced.

Each of these levels plays a role in determining the musical gestures that realise the transformation of intended musical ideas into sound.

Focusing specifically on the processes of *enactment* and *embodiment*, our study wants to explore the intentional sensorimotor scheme of a musician, who experimented with different displacement of her gestures in the performance space in function of the deliberate interpretation acquired during her artistic process.

To sum up, interpretation and embodiment are two essential components of the artistic process. To better understand their role in the artistic process, we worked out a concrete case involving the analysis of a piano performance by using the feedback from the technology-enhanced mirror.

4.3 A case study regarding interpretation and embodiment

A performative experiment was set up in order to understand the relationship between interpretation (as action intentionality) and embodiment (as physical realization of the action). The goal of the study was to show how the performer-based analysis of expressive musical intentions and body movements contribute to frame a piano performance.

4.3.1 Method

Participant

The participant in this study is the first author, Giusy Caruso, who is a concert pianist trained in classical music performance. As a performer, she has a high-level expertise in contemporary music performance (she obtained a Post-Master in Contemporary Music at the Royal Conservatory of Ghent, Belgium). She has a basic theoretical background in Indian music acquired during a previous research project conducted at the CODARTS (Conservatory of Rotterdam, The Netherlands).

Music

The music used in this case study is the 8th cycle from the *72 Etudes Karnatiques pour piano* (1957-1984) by Jacques Charpentier (1933-2017) because the pianist started her practice in 2012 from this specific cycle (initial approach). This piece is a contemporary Western piano work based on the South Indian 72 Karnatic modes (*Melakarta Ragas*) and on an elaboration of one rhythmical pattern, *niççanka* tala, from the 120 Hindustani *deçî-tâlas*. The 8th cycle is a collection of six etudes conceived by the composer to be played in one movement as *Quasi una Sonata* where the Karnatic modes *Gavambodi* and *Bhavaprya* are used as a first and a second sonata theme (see chapter 2).

In this study, we referred, in particular, to the audio and gestural analysis of a short fragment from the *Gavambodi* theme, elaborated by the composer in a rhythmical pattern inspired by the Indian *niççanka tala* with one value omitted (see Figure 4.24).

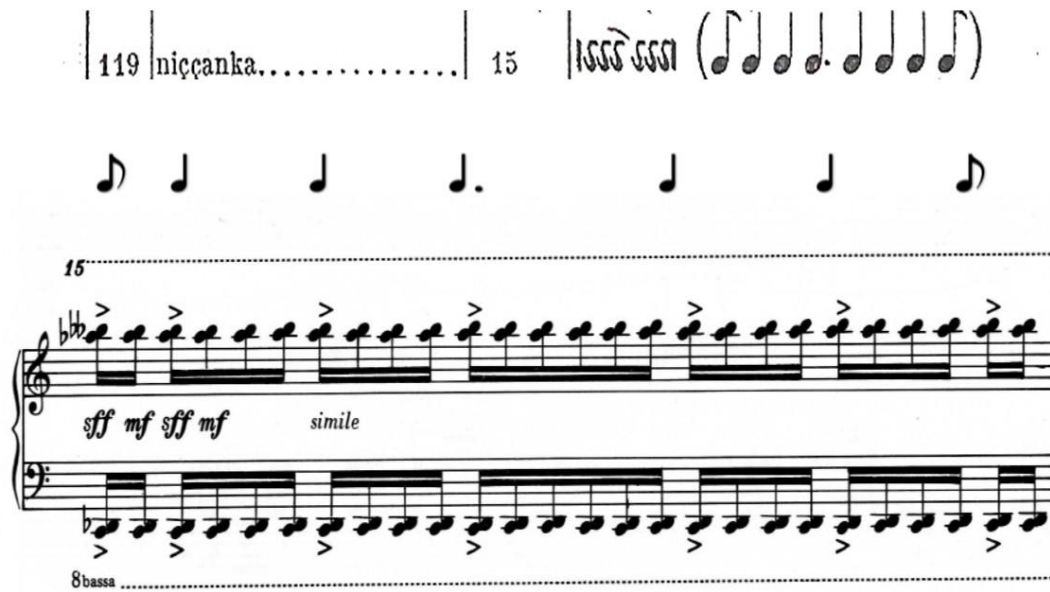


Figure 4.24 The original Indian *niççanka tala* and the elaboration made by Charpentier.

We decided to limit the analysis to this fragment in order to explore the procedure, to see how the methodology can be integrated in an artistic practice and research context and to investigate the value of the results.

Setting and equipment

To ensure the ecological validity of the performance space (see section 2.2), the performative experiment was conducted in a concert hall (the Miry Zaal at the Royal Conservatory of Ghent) using a grand piano Steinway. To provoke a spontaneous playing in the experiment, we used a video recording suggesting the natural feeling of a public concert, even if there was no audience really involved. The performative experiment was recorded with two video cameras (lateral & top view) and a microphone. Furthermore, the performer's movements were recorded with the OptiTrack Motion Capture System (<http://optitrack.com/>). Six infrared cameras were positioned in a hexagonal configuration on a fixed bridge, a setup that is sufficient to get a three-dimensional positional readout of infrared reflective markers at a sampling rate of 100 Hz (see Figure 4.25). Eighteen markers were placed on the pianist's upper part of the body (three on the head, three on each hand, three

on the back and three on each elbow), and four on the boundaries of the keyboard to have its reference in the visualization of the MoCap recording (see Figure 4.25).



Figure 4.25 The MoCap set up with 6 infrared cameras positioned on a fixed bridge.

4.3.2 Procedure

Preparation

The performative experiment required a period of practice and preparation. On the one hand, this concerned the performer's artistic process of establishing an interpretation of the piece. On the other hand, it entailed the performer-based analysis method in which top-down and bottom-up analysis of several video recordings of her piano performances allowed the performer-researcher to look back at her artistic process.

First, to prepare the performance of the 8th cycle from the *72 Etudes Karnatiques*, the pianist conducted a musicological research to enrich her cultural knowledge competences on Indian Music (see Caruso & Leman, 2015, chapter 2 of this dissertation). Furthermore, she had a collaborative three years practice with the composer Jacques Charpentier, and with experts in Indian music, a Karnatci singer and a dancer with whom she conceived an artistic project called *Re-Orient*. This artistic process led the performer to shape her musical interpretation, intentions and gestures on the basis of the explicit musical knowledge of and experiences with Indian music (Hindustani and Karnatic) she acquired by her artistic practice.

Second, the performer spent a period on observing and analysing video footages of her previous performances recorded in two years (2012-2014): two solo performances and an ensemble performance with a Karnatic singer and a dancer trained in Indian music. On the basis of an introspective and retrospective analysis (stimulated recall method; see Bloom, 1953), different types of gestures (see also: Delalande, 1988, 1995) were annotated referring to some specific movements of the upper part of the body (head, right hand and right elbow), which is considered the most expressive part of the pianist (Davidson, 2007). Focusing on one fragment from the score (see Figure 4.24), she referred in particular to three categories of gestures and relative symbols (see Table 4.1). In this way, it became possible to reconstruct gestural changes. Furthermore, a video observation was done using the ELAN package, a software dedicated to multimodal video observation and analysis (Wittenburg et al., 2006). This software served as a technology-enhanced mirror, offering the possibility to systematically observe and categorize gestures.

Third, the performer elaborated a performance model to systematically explain the relation between her musical intentions and gestures (see also: Chaffin & Imreh, 2002). All that information is summarized in the performance model and reported in the score by a specific score annotation (Figure 4.26).

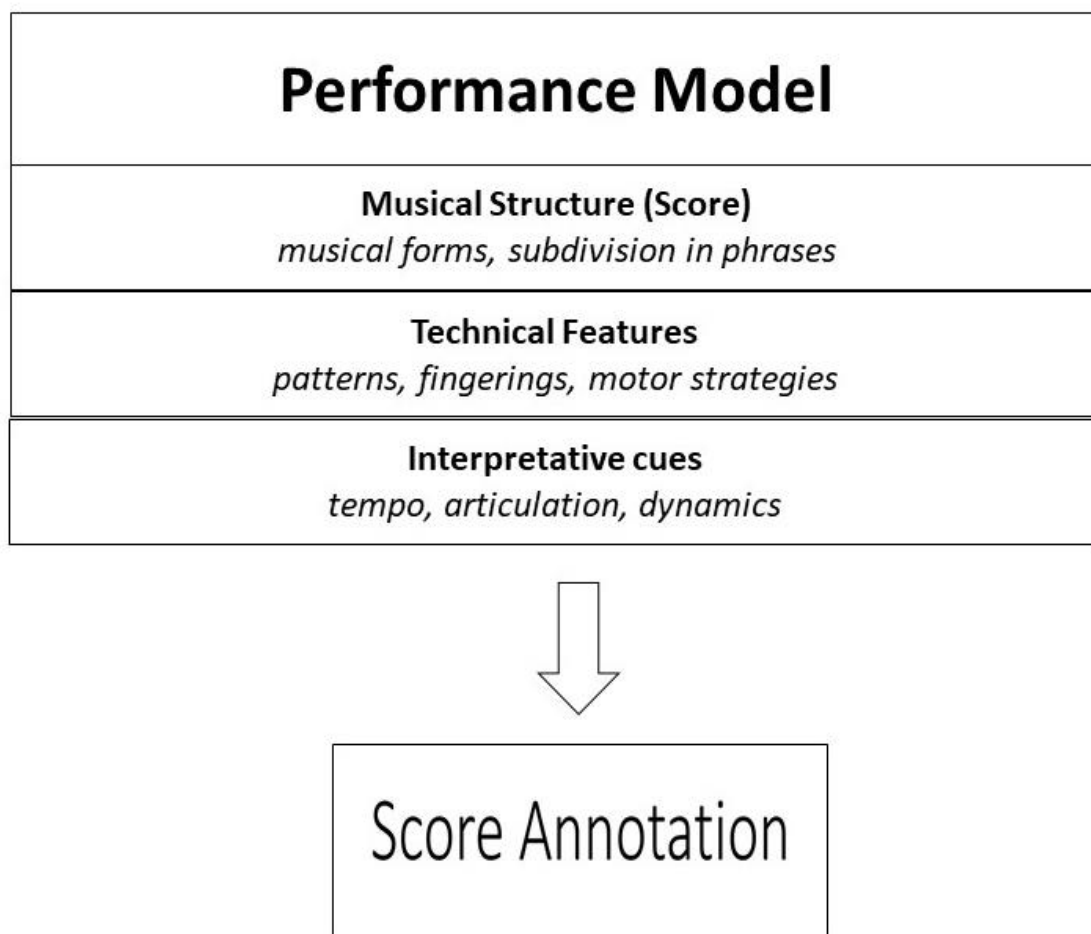








Figure 4.26 The performance model. It consists of a systematic structural analysis of the score (musical form, subdivision of phrases) combined with a collection of subjective observations on the technical structures (e.g. patterns, fingerings, motor strategies) and the interpretative cues (e.g. tempo, articulation, dynamics).

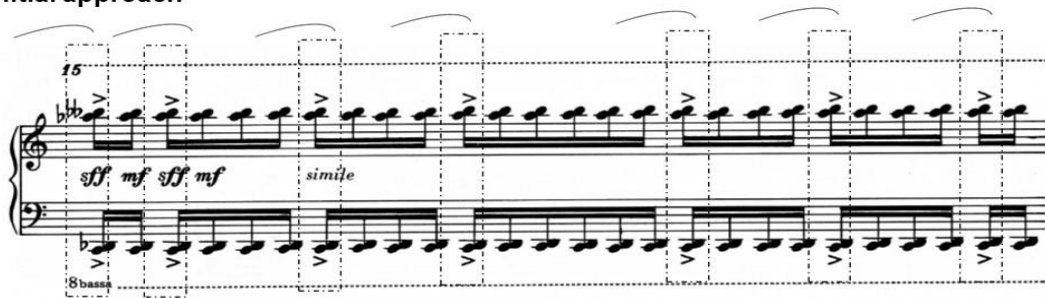
To report and annotate on the score the changes from the initial approach to the developed approach, the pianist edited her performance model by codifying her motor strategies (specifically the gestures of the head, the elbows and the hands) through the symbols in Table 4.1.

The symbols in Table 4.1 refer to the gestural approach in playing the accented notes of one fragment from the score as in her initial approach and in her developed performance affected by her joint practice with the composer and Indian music experts (see Figure 4.27).

Table 4.1 Codification made by the performer referring to the enactment of the fragment (see Figure 4.27).

Gestures	Meaning	Symbols		
		head	hands	Elbows
composed	almost fixed in a certain position			
wavy	down-up-down movement			
punctuating	evident accentuation of the down-up-down movement			

1) Initial approach



2) Developed approach

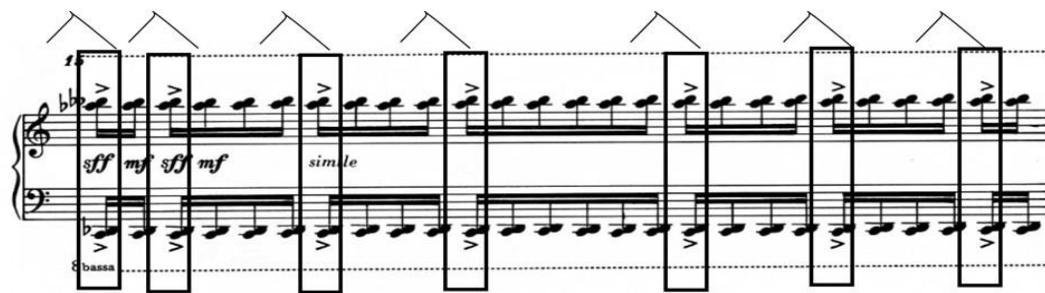


Figure 4.27 The performer’s score annotation. This figure shows the performer’s score annotation applied on the same fragment (Charpentier’s elaboration of the Indian *niççanka* rhythm, see Figure 4.24) performed during the experiment. These two examples illustrate the different motor strategies in playing the accented notes of the same fragment by using the symbols in Table 4.1. The head moves from a composed position in the initial approach to a punctuating movement in the developed approach. Both elbows and hands shift from a wavy movement in the initial approach to a punctuating movement in the developed approach.

The performance model and score annotation lead the performer to systematically reflect on her artistic process by following these points:

- “what” is the piece in term of its musical structures, i.e. analytical description of the piece,
- “how” to transform these musical structures into technical features i.e. the description of her intentional motor strategies (*process of enactment*),
- “why” confer specific aesthetic significations to the musical patterns, i.e. description regarding the intentional decision-making over the *interpretative cues*.

This procedure served for three purposes, namely, to:

1. systematically document the artistic process (how the performer shapes her musical intentions during the artistic process);
2. structure the subjective self-report in relation to the sensorimotor-based descriptions;
3. organize the final analysis and correlation between score – intentions – gestures.

The performance model was also used, indeed, in the performative experiment as a protocol for the verbal descriptions (*verbatim* in appendix A.5) and as a structure to correlate the artistic outcome from the score with the gestures annotations in the final analysis in Elan.

Performative experiment

The Performative Experiment was structured as follows:

1. Performative Section 1: spontaneous performance of the entire piece;
2. Fragment Sections 1, 2 & 3: performance and performer-based analysis of three fragments extracted from the piece using a retrospective *thinking-aloud procedure* (Van den Haak & De Jong, 2003);
3. Performative Section 2: spontaneous performance of the entire piece.

The retrospective *thinking-aloud procedure* allowed the performer to render explicit and systematic her artistic reflections on her performance practice. By referring to the music performance model and the score annotation elaborated during the period of preparation, the performer verbally elicited her progresses of learning and enacting while demonstrating some passages at the piano. She performed two

versions of each fragment, which represent the initial approach (implicit understanding of the music) and her developed approach (founded on the deliberate explicit knowledge acquired during the artistic process).

The two spontaneous performances (Performative Sections 1 and 2) were used to induce a natural execution in the Fragment Sections 1 and 2. They are also used as a point of reference in order to detect possible biases during the *thinking-aloud* procedure, i.e. whether the supposed causal sequence of stimuli and expressive responses influence the natural performance. They were examined by two of the researchers (1st and 2nd author, both professional musicians) to verify the consistency of the interpretation in both performances.

Data Acquisition

The data obtained from the experiment consist of: (1) the performer's subjective reflections retrieved during the *thinking-aloud* procedure by following the performance model (see the *verbatim* in appendix A.5); (2) motion data retrieved from the MoCap system recording; (3) video and audio data.

The MoCap recording provided raw data in the form of Euclidean positions of the markers in the performance space and, most important for musicians, the visualization of the *avatar* as their "mirrored" image (see Figure 4.28).

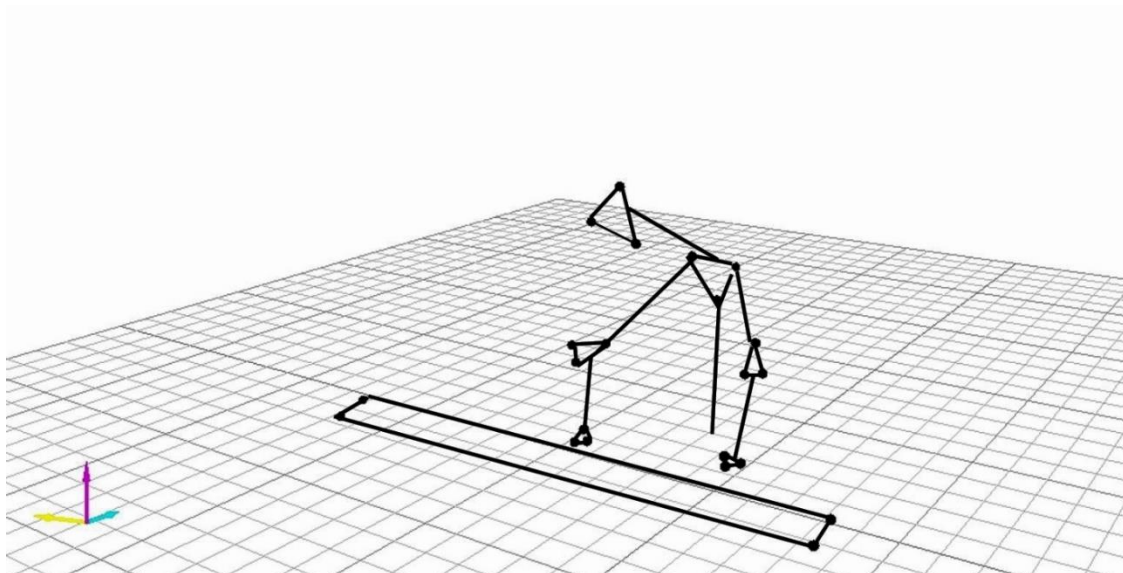


Figure 4.28 The MoCap avatar.

In contrast to other experiments based on motion capturing (e.g. Wanderley et al., 2005; Goebel & Palmer, 2008, 2009, 2013; Schoonderwaldt, 2009; Dalla Bella & Palmer, 2011), in our study the performer, being at the same time the researcher, decided to focus on the video analysis of the MoCap recording as a “mirror” where she could verify her approach. For this purpose, the MoCap video was captured in three perspectives (up, lateral and side view) by OBS Studio video processing software. Then, the tracks were imported in PhysMo2 (Barraclough, 2011), a software for frame-by-frame video analysis of motion (see appendix A.4 for a description of this procedure). By using PhysMo2, the X- Y- displacement (in pixels) against time (s) were extracted. The analysis in Physmo2 considers the displacement of only one marker per body part. The audio waveforms were extracted from the video recording by using the software Audacity (Mazzoni & Dannenberg, 1999).

4.3.3 Data Analysis

In line with the performer-*based* analysis method (Caruso et al., 2016), the data analysis involves a quantitative exploration of the video, audio and motion measurements (bottom-up) and a qualitative interpretation of these measurements (top-down). Both approaches (quantitative and qualitative) were aligned and synthesized using the Elan software, which served as a mediator between the observer (the performer) and the observed (her performance).

Quantitative Analysis.

Audio Analysis. The audio waveforms of the initial and the developed performance were analysed with Sonic Visualiser 1.9 (Cannam et al., 2010) in order to export the data concerning the parameters indicated in the performance model: tempo and dynamics. A note-by-note audio analysis was done by dividing the fragment of each version into 26 windows (26 notes) with the use of Aubio vamp plug-ins for the notes onset. This subdivision enabled calculating the duration of each note. Second, BBC vamp plug-ins for the spectral analysis was used to calculate the root-mean-square (RMS) of the notes in each fragment in order to obtain the energy values (sound intensity). From all the energy values, we calculated the mean to obtain one value for each note.

Motion Analysis. The data from Physmo2 consisted of the horizontal (x) and vertical (y) displacements in pixels against time. We analysed the vertical displacement (y) of the head, the right hand and the right elbow in the lateral camera view. From the vertical displacement data (y), we calculated two kinematic variables, namely relative velocity (V) and acceleration (A):

$$V = \Delta y / t$$

$$A = \Delta V / t$$

Furthermore, we used the notes onsets extracted with Sonic Visualiser to subdivide the data concerning the vertical displacement (y) into 26 windows (26 notes).

From this subdivision, we calculated for each note the absolute difference in amplitude, of the movement of the head, the right hand and the right elbow, by subtracting the maximum vertical displacement value (Max) and minimum vertical displacement value (Min):

$$\text{Max}(y) - \text{Min}(y)$$

Qualitative Analysis

The qualitative analysis consisted of the performer's observation and annotation analysis of her playing the initial and the developed performance using the audio and video recordings obtained from the experiment. After having synchronized the video and audio recordings (see appendix A.4), the audio and the MoCap data were imported in the Elan software. Next, to precisely annotate the gestures (see the labels in Table 4.2) and to see the exact correspondence between the movements and the accented notes, the video was segmented on the basis of the note onset detector, as retrieved from the audio analysis in Sonic Visualiser. At this point, the performer needed to integrate her gestural categorization, intuitively segmented as in Table 4.1 (top-down approach).

Table 4.2 Integration of gestures labelled in Table 4.1

Gestures	Meaning
<i>rotating</i>	turn around
<i>transition 1 (T1)</i>	down-up movement
<i>transition 2 (T2)</i>	up-down movement
<i>flowing</i>	smoothly oscillation of the down-up-down movement

Alignment

Qualitative and quantitative data were aligned using the score as a point of reference, as shown in the following scheme (see Figure 4.29):

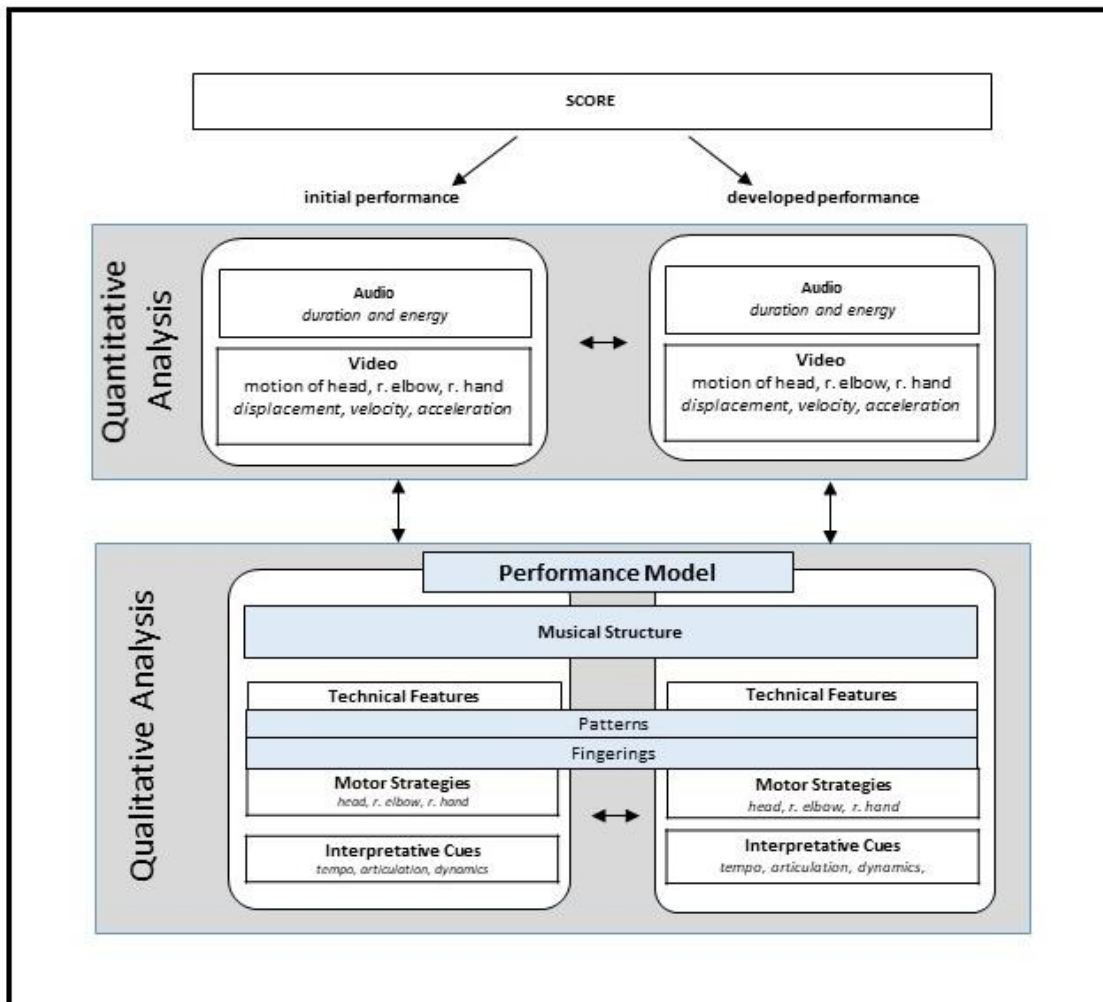


Figure 4.29 The performer's analytical strategy.

This figure represents a summary of the performer's analytical strategy. The score, which in this case study is the rhythmical pattern in Figure 4.24, was used as a point of reference. With regard to the quantitative analysis, the performer expected differences between the results of initial and the developed performance concerning the audio (duration and energy) and the video (motion, displacement, velocity and acceleration). In respect to the qualitative analysis, as indicated in the *verbatim* (see appendix A.5), the performer reported similarities only in the musical structure and technical features (patterns and fingerings). The alignment of both approaches should reveal in the results an association of these assumptions.

To compare the subjective analysis, based on the performance model, with all the objective analysis (audio, video and the kinematics displacement, velocity and acceleration) of the two performances (initial and developed), the pianist used again the Elan software as media browsers. By integrating all those data (qualitative and quantitative) in Elan, the performer could look at a complete dataset and start comparing and interpreting all the data and the graphs obtained (see Figure 4.30).

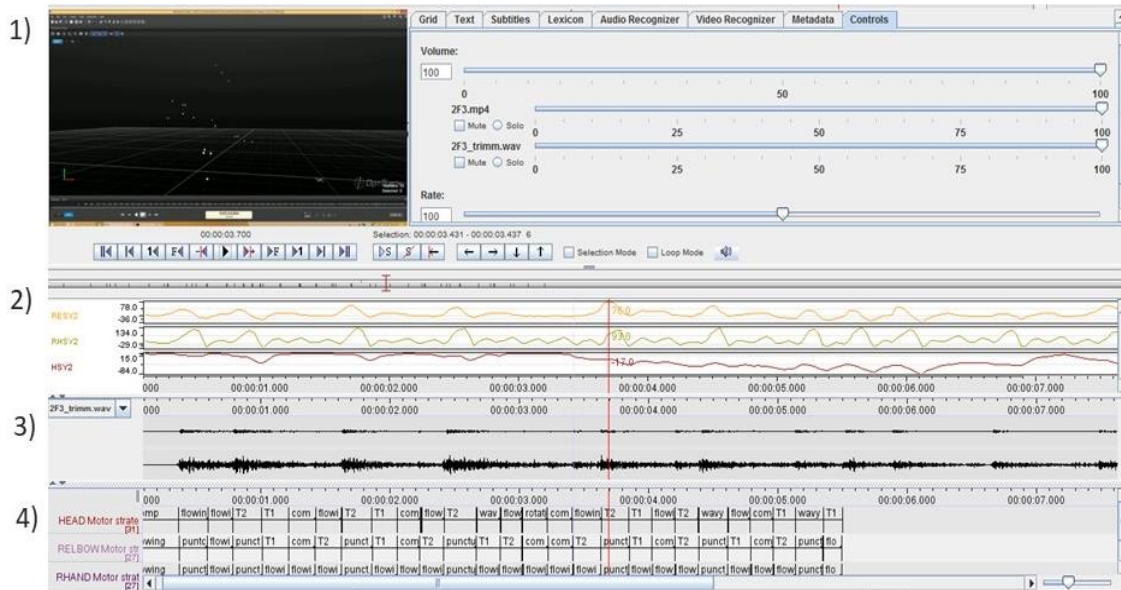


Figure 4.30 Elan software.

This screen shot, taken from one of the Elan projects, shows the parallel configuration of four layers in analysing the developed performance of the piano fragment in Figure 4.24. The quantitative measurements are displayed in the following order from up downward (1) the video, (2) the motion tracks of head, right hand, and right elbow, (3) the audio waveforms, while the qualitative descriptions (4) are shown below in the segmented annotations made by the performer by following the structure of the performance model (musical structure, technical features and interpretative cues, see Figure 4.26).

Finally, to detect the precise occurrence of gestures and the correlation between movements and sound, the performer proceeded with a statistical analysis made in SPSS (Pallant, 2010) using the analysis of the frequencies, *t*-test, Wilcoxon Signed-Ranks's test and Spearman's Rank-Order Correlation as summarized in the following scheme. The qualitative and quantitative data, taken from the performance of the fragment in Figure 4.24, were analysed according to these specific cases: all the notes, accented notes and non-accented notes (see Figure 4.31).

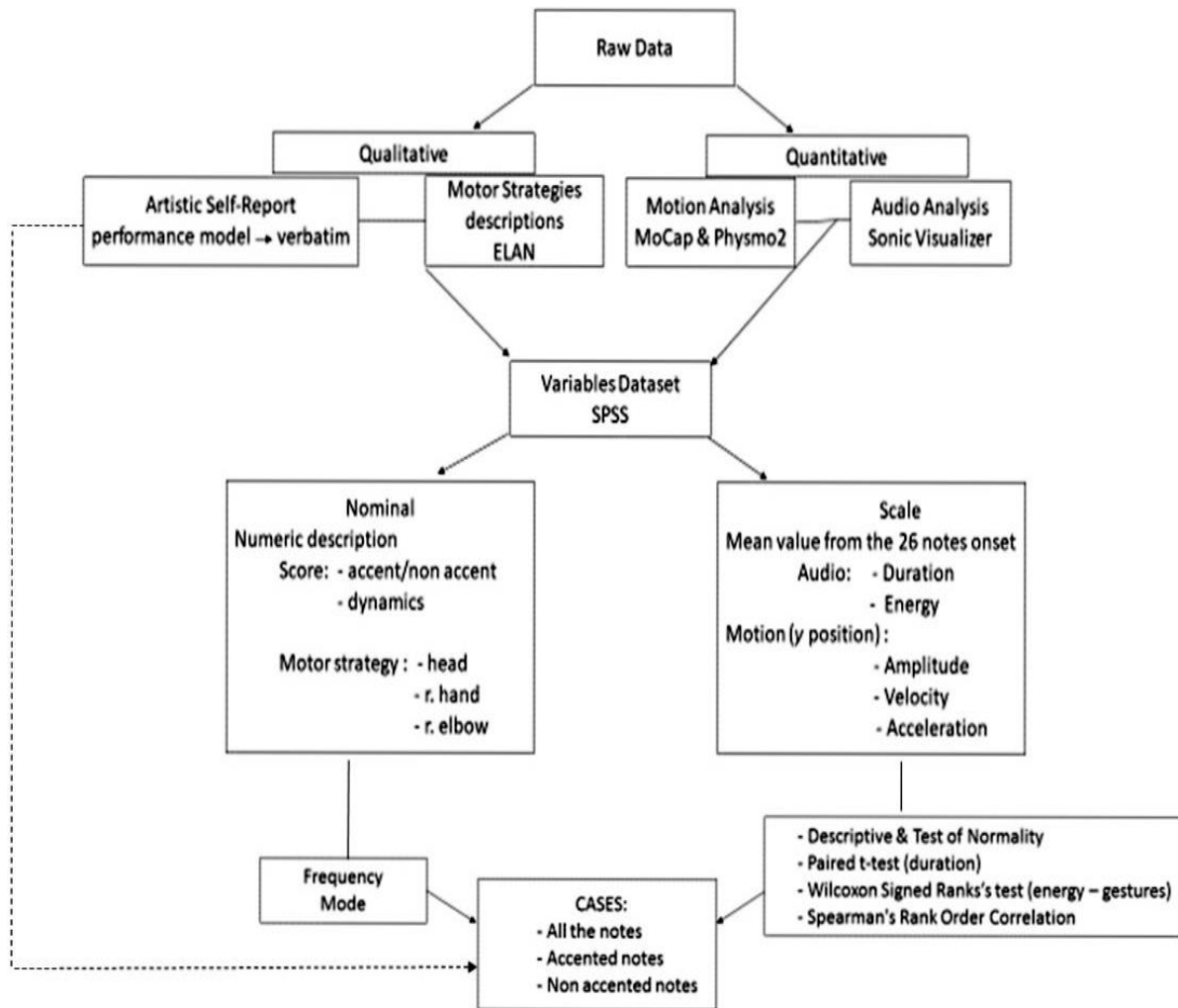


Figure 4.31 Data collection. Summary of the organization of the data using the technology-enhanced mirror (Motion Capture, Physmo2, Sonic Visualiser, Elan software) and SPSS. The performer refers to her artistic self-report (the verbatim of the experiment organized according to the performance model) in order to interpret all the audio and motion data in function of her musical intentions related to all the above cases.

4.4 Results

Top-down analysis

To determine what kind of gestures occurred most frequently in each version, the mode of the motor strategies was calculated. The results showed changes in motor strategies between the two versions for the right hand, the right elbow and the head.

The general “flowing/wavy” strategies in the initial approach changed into a systematic “flowing/punctuating” strategy in the developed approach. With regard to the accented notes, results indicated that the right hand and right elbow used much more the “punctuating” strategy in the developed approach and the “wavy” strategy in the initial approach, while the head progressed from a recurrent use of the “flowing” strategy in the initial approach to an “up-down” strategy in the developed approach. With regard to the non-accented notes, the right hand moved from a “wavy” strategy in the initial approach to a “flowing” strategy in the developed approach while the right elbow from a “flowing” strategy in the initial approach to a mix of “composed” and “down-up” strategy in the developed approach. The head presented a “composed” strategy in the initial approach and a major use of the “flowing” strategy in the developed approach. These results are summarized in Table 4.3.

Table 4.3 Most occurring (mode) motor strategies in the head, right hand and right elbow.

Motor strategies	Initial approach		Developed approach	
	accented	non acc.	accented	non acc.
head	flowing	composed	up-down	flowing
r. hand	wavy	wavy	punctuating	flowing
r. elbow	wavy	flowing	punctuating	composed/down-up

Bottom-up analysis

Audio Analysis. The note-by-note audio analysis in Sonic Visualizer focused on the parameters taken from the interpretative cues of the performance model, namely tempo and dynamics.

Concerning tempo, a *t*-test was conducted in SPSS to compare the duration of the accented notes in the initial approach ($M = .20$, $SD = .01$) vs the developed approach ($M = .22$, $SD = .01$). The results show a significant increase in the duration for the accented notes of the developed approach ($t = -3.344$, $p < .05$).

Concerning dynamics (energy), visual inspection (histograms, normal Q-Q plots and box plots) and a Shapiro-Wilk's test (Shapiro & Wilk, 1965) revealed that the data were not normally distributed in the initial approach ($W = .931$, $p < .05$) and in the developed approach ($W = .865$, $p < .05$). Therefore, we applied the Wilcoxon Signed-Ranks's test.

The results indicated a significant decrease of energy for all the notes in the developed approach ($Mdn = .04$, $p < .05$) compared to the initial approach

($Mdn = .07$, $p < .05$); a significant decrease of energy for the accented notes in the developed approach ($Mdn = .07$, $p < .05$) compared to the initial approach ($Mdn = .10$, $p < .05$); and, a significant decrease of energy for non-accented notes in the developed approach ($Mdn = .03$, $p < .05$) compared to the initial approach ($Mdn = .06$, $p < .05$).

The *t* and *z* values of the significant differences are reported in the Table 4.4.

Table 4.4 The table shows the significant increase ($p < .05$) in the developed approach for the duration and a significant decrease ($p < .05$) for the energy.

Variables	All notes	Accent. notes	Non-accent. Notes
Duration		$t = -3.344$	
Energy	$z = -4.457$	$z = -2.366$	$z = -3.823$

Motion analysis. Figure 4.32 shows the vertical displacement of the right hand, the right elbow and the head (y) data from Physmo2, the motor strategies of the developed approach appear wider and more coordinated.

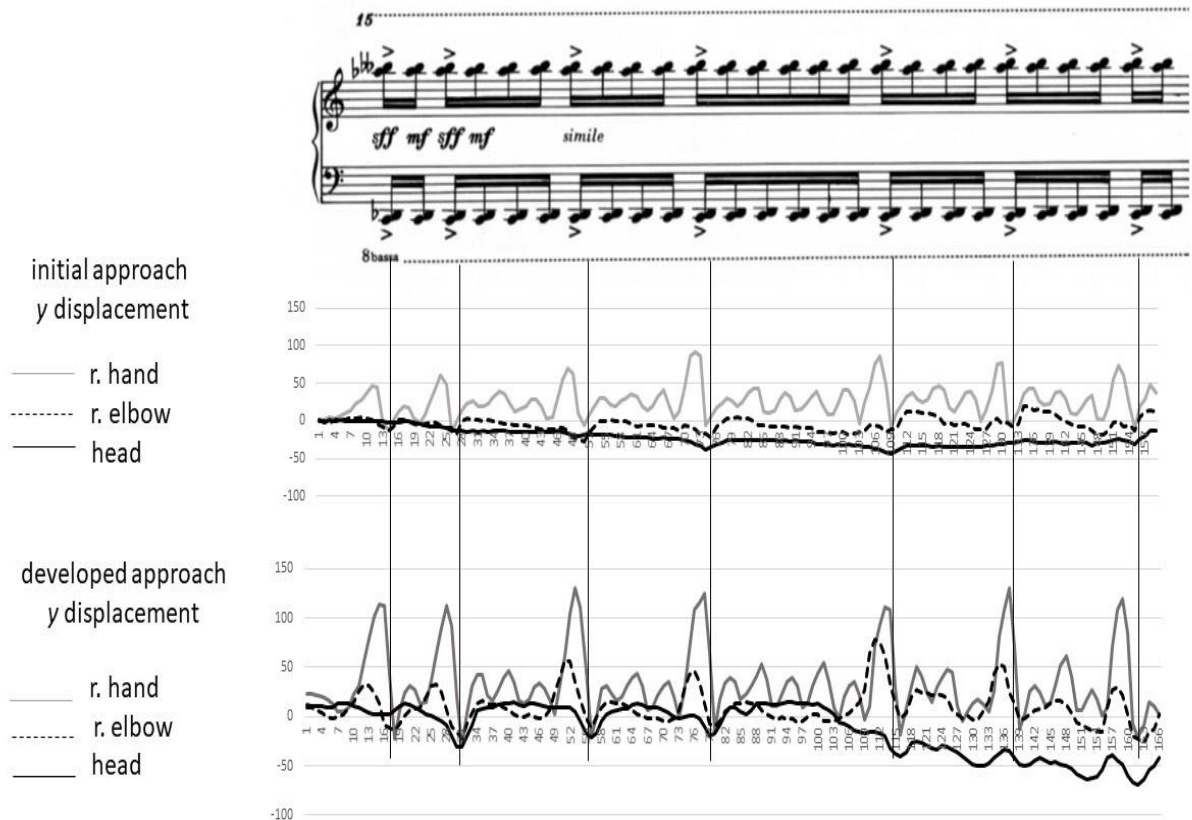


Figure 4.32 A comparison between the vertical displacement (y) of the right hand, the right elbow and the head in the initial approach and in the developed approach according to the score above, taken as a point of reference. The graph of the developed approach shows similar trajectories in the right hand, right elbow and head, concerning the “punctuating” strategy, as preparation to playing the accents. We can notice how the graph of the developed approach is more pronounced clearly replicating the musical shape in the three parts of the body analysed.

To check a significant difference in the gestures of the initial approach and the developed approach, the Wilcoxon Signed-Ranks’s test was used for not normally distributed data.

The results present:

1) for all the notes a significant increase in:

a) the amplitude of:

- the right hand in the developed approach ($Mdn = 51.0$) compared to the initial approach ($Mdn = 34.0$)
- the right elbow in the developed approach ($Mdn = 26.0$) compared to the initial approach ($Mdn = 11.0$)
- the head in the developed approach ($Mdn = 12.0$) compared to the initial approach ($Mdn = 3.0$)

b) the velocity of :

- the right hand in the developed approach ($Mdn = 516.0$) compared to the initial approach ($Mdn = 285.0$)
- the right elbow in the developed approach ($Mdn = 150.0$) compared to the initial approach ($Mdn = 94.2$)
- the head in the developed approach ($Mdn = 94.2$) compared to the initial approach ($Mdn = 30.0$)

c) the acceleration of:

- the right hand in the developed approach ($Mdn = 14914.2$) compared to the initial approach ($Mdn = 13371.4$)
- the right elbow in the developed approach ($Mdn = 4275.0$) compared to the initial approach ($Mdn = 3375.0$)
- the head in the developed approach ($Mdn = 2400.0$) compared to the initial approach ($Mdn = 1350.0$)

2) for the accented notes a significant increase in:

a) the amplitude of:

- the right hand in the developed approach ($Mdn = 141.0$) compared to the initial approach ($Mdn = 79.0$)
- the right elbow in the developed approach ($Mdn = 56.0$) compared to the initial approach ($Mdn = 15.0$)
- the head in the developed approach ($Mdn = 25.0$) compared to the initial approach ($Mdn = 7.0$)

b) the velocity of³:

- the right elbow in the developed approach ($Mdn = 137.1$) compared to the initial approach ($Mdn = 55.7$)
- the head in the developed approach ($Mdn = 25,71$) compared to the initial approach ($Mdn = 78.0$)

³ The right hand did not present a significant increase in the velocity.

3) for the non-accented notes a significant increase in

a) the amplitude of:

- the right hand in the developed approach (*Mdn* = 39.0) compared to the initial approach (*Mdn* = 28.0)
- the right elbow in the developed approach (*Mdn* = 19.0) compared to the initial approach (*Mdn* = 11.0)
- the head in the developed approach (*Mdn* = 11.0) compared to the initial approach (*Mdn* = 2.0)

b) the velocity of:

- the right hand in the developed approach (*Mdn* = 630.0) compared to the initial approach (*Mdn* = 280.0)
- the right elbow in the developed approach (*Mdn* = 183.7) compared to the initial approach (*Mdn* = 107.1)
- the head in the developed approach (*Mdn* = 107.1) compared to the initial approach (*Mdn* = 30.0)

c) the acceleration of:

- the right hand in the developed approach (*Mdn* = 19542.8) compared to the initial approach (*Mdn* = 13371.42)
- the right elbow in the developed approach (*Mdn* = 4757.1) compared to the initial approach (*Mdn* = 3857.1)
- the head in the developed approach (*Mdn* = 2700.0) compared to the initial approach (*Mdn* = 1285.7)

The z values of the significant differences are summarized in Table 4.5.

Table 4.5 The z value for the significant increase in the developed approach ($p < .05$)

Variables	All notes			Accent. notes			Non-accent. notes		
	R. hand	R. elbow	Head	R. hand	R. elbow	Head	R. hand	R. elbow	Head
Amplitude	z= -3.604	z= -3.570	z= -4.459	z= -2.366	z= -2.371	z= -2.371	z= -2.295	z= -2.201	z= -3.726
Velocity	z= -3.820	z= -4.349	z= -4.469		z= -2.371	z= -2.197	z= -3.823	z= -3.542	z= -3.783
Acceleration	z= -1,994	z= -2.475	z= -3,916				z= -2.133	z= -2.374	z= -3.622

Correlation analysis

To determine the relationship between sound and gestures, specifically in the right hand and the right elbow, we used the Spearman's Rank-Order correlation analysis for non-normally distributed but monotonic data. In the initial approach, we found only a strong correlation in all the notes between the amplitude of the right hand and the energy.

Table 4.6 Correlations between the energy and the amplitude of all the notes in the initial approach.

Variables		Mean Energy	R. hand Amplitude
Mean Energy	Correlation		,702**
	Coefficient		
R. hand Amplitude	Correlation	,702**	
	Coefficient		

*. Correlation is significant at the 0.05 level (2-tailed).

** . Correlation is significant at the 0.01 level (2-tailed).

The results regarding all the notes of the developed approach show a significant positive correlation between the duration and the amplitude of right hand and right elbow with the energy. A significant negative correlation was detected between the duration and the velocity of right hand and the acceleration of right hand and right elbow. Concerning the movements, a significant positive correlation was found between the amplitude of right hand and right elbow. With regard to the velocity, right hand and right elbow present a significant positive correlation as well as for the acceleration. These results are summarized in Table 4.7.

Table 4.7 Correlations between duration, energy, amplitude, velocity and acceleration of all the notes in the developed approach.

Variables		Duration	Mean Energy	R. hand Amplitude	R. elbow Amplitude	R. hand Mean Velocity	R. elbow Mean Velocity	R. hand Mean Acceleration	R. elbow Mean Acceleration
Duration	Correlation Coefficient		,690**	,545**	,614**	-,496**	-0.336	-,618**	-,399*
Mean Energy	Correlation Coefficient	,690**		,687**	,802**	-0.130	0.104	-0.225	0.006
R. hand Amplitude	Correlation Coefficient	,545**	,687**		,804**	-0.190	0.148	-0.164	0.007
R. elbow Amplitude	Correlation Coefficient	,614**	,802**	,804**		-0.175	0.061	-0.252	-0.043
R. hand Mean Velocity	Correlation Coefficient	-,496**	-0.130	-0.190	-0.175		,743**	,788**	,653**
R. elbow Mean Velocity	Correlation Coefficient	-0.336	0.104	0.148	0.061	,743**		,782**	,876**
R. hand Mean Acceleration	Correlation Coefficient	-,618**	-0.225	-0.164	-0.252	,788**	,782**		,756**
R. elbow Mean Acceleration	Correlation Coefficient	-,399*	0.006	0.007	-0.043	,653**	,876**	,756**	

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

4.5 Discussion

In this study, we explored the intentional process of a piano performance in relation to musical gestures, score interpretation and stylistic/artistic decisions. In order to access the intended initial and developed way of expression, we combined a top-down analysis (performer's subjective perspective) with a bottom-up analysis (objective measurement on movement and audio). However, this approach formed part of an artistic process that leads here to a final performer-*based* analysis method (Caruso et al., 2016). In the course of the artistic process, the results were actually used to refine the artistic interpretation, that is, to sharpen the expressive intentions, using performative gestures that optimally support these intentions.

4.5.1 Intentionality and gesture

Although accents are conventional signs in music notation, they can be performed in many different ways depending on the musical style, the context, the type of pulse or rhythmical pattern (Drake & Palmer, 1993; Friberg & Battel, 2002), and on performance posture (from a certain height or closer to the keyboard, with or even without a deep pressure, using only arms or the entire body; Lourenço, 2010). The short rhythmical fragment chosen for our analysis is Charpentier's elaboration of the Indian rhythm *niççanka* (♩ ♪ ♩ ♩ ♩ ♩ ♩, see Figure 4.24). The composer has marked this rhythmical pattern in the score with dynamic accents (*sff*). As the pianist referred during the experiment, the most obvious way to perform an accent is to stress it and play it louder (see also Parncutt, 1997):

«My first interpretative approach to this fragment was to emphasize the bi-chords where one has to play the accent very loud just by pressing the keys harder, feeling sometimes pain in my hands and fingers»⁴.

The audio analysis of the initial performance shows, indeed, higher energy values when playing the accented notes. However, after the experience with the dancer and the collaboration with the composer, the pianist decided to change her motor strategies in respect to new music intentions acquired:

⁴See the verbatim in appendix A.5

« During my performance practice, I conceived an artistic project called “Re-Orient” involving a Karnatic singer and an Indian dancer. The Indian dancer made a particular choreography to accompany this percussive part. It happened that, when we practiced together this section, watching her movements, I started feeling and articulating differently this rhythmical pattern synchronizing the music with her choreography. Therefore, I played this part not simply by emphasizing the accents but also by articulating and “acting out” the accents with my body. During the collaborative practice with the composer, I realized that this rhythm is also inspired to an Indian rhythm called *niççanka*»⁵.

The developed pianist’s motor strategy caused a different gestural articulation of the rhythmical groups. It was based on a new intentional way of considering and feeling those accents, and thus a new intentional way of enacting this rhythm. The developed performance reveals a significant increase of duration and amplitude of the gestures, especially in the phase when the playing of the accented notes is prepared (see Figure 4.32). Previous research pointed to the fact that the performance of accents depends on the melodic contour (Thomassen, 1982; Lerdahl & Jackendoff, 1983), duration or tempo (Deliège, 1987; Sundberg, 1988; Sloboda, 1991) and timbre (Parncutt, 1994a; Huron & Royal, 1996; Pfordresher, 2003). However, in our approach, we want to add that gestures play a fundamental role in understanding the performance of accents, i.e. the intentional way to perform. Gestures require a preparatory phase and an executive phase. The extra time needed to prepare the execution of the accents is particularly relevant for enacting expressive sound effects (Repp, 1992; Kurkela, 1995; Parncutt, 1997, 2003; Palmer, 1997; Gabrielsson & Juslin, 2003; Widmer & Goebel, 2004; Leman, 2007, 2016). This enactment of expression was reflected in the significant correlation between duration, energy, and right hand and right elbow amplitude of the developed expression: the wider movements increase the duration of the accented notes but decrease the energy of sound. Furthermore, the significant negative correlation between the velocity of the right hand and the acceleration of the right hand and the right elbow with the duration means that the duration decreased when the velocity and acceleration of the right hand and the right elbow increased. These changes are crucial, especially in piano playing, where the enactment of expression on the instrument is translated into the velocity of the piano key that affects the way a string is touched and, subsequently, generates the sound energy and consequently the loudness and timbre (Parncutt, 1997; Bisesi & Parncutt, 2010).

⁵ *ibid.*

Through a major corporeal involvement, based on the enactment of the intended expression arc, the pianist can manipulate duration and dynamics. Accordingly, it is possible to create a variety of subtle effects of accentuation embraced in phrasing and prolonged individual notes. By comparing the pianist's self-report and the motion capture data, we saw how the collaborative practice with the composer and Indian experts, changed her enactment of this fragment.

Other analyses can be undertaken in the future by mapping a performance practice in real time and not in a retrospective view, as in the present case study. This method could be extended to a longer piece of music (instead of a short fragment) deepening the study on the accented notes in piano playing and calculating specifically the differences in the attack, or rise time, steady state, and decay portions of sounds, as well as the correlation between gestures and touch (timbre).

4.5.2 The artistic process and the gestural engagement

The performative experiment was set up to better understand the performers' expressive intentions as part of the artistic process. Evidently, long-term piano practicing brings about differences in organization and coordination of movements. Studies show that the flexibility of the nervous system through extensive piano practice allows for an optimization and coordination of the movements and, consequently, a refined control of loudness and sound energy (Furuya & Altenmüller, 2013). In our present study, the motor coordination obtained after a period of practicing (also with the dancer) turned out to affect the performance model of the pianist and accordingly, her enactment in function of the sound she wants to produce, changed. Such a dynamic is obviously crucial for the development of the artistic process. After all, the artistic process is a development process that leads to gestural solutions for intended expressive strategies. Expressive gestures thereby affect the intended expressive character of the sounds and the perceived sounds (enhanced by the technological mirror) work as a feedback for expressive gesturing. The dynamic can be seen as part of the encoding and decoding processes of enactment (Leman, 2016), which govern the mutual relationship between patterns and intentions. The awareness of the enactment process is here improved by the performer-based analysis method that conceives the use of technology as an "augmented mirror" (technology-enhanced mirror). Overall, these processes govern the relationship between gesture and sound, and its encapsulation within later expressive arcs, which in turn relate to intended expressions in the artistic process.

The analysis of the audio data showed a difference in dynamics, and a significant decrease of energy in the developed expression. In addition, a graphical representation of the displacement of the analysed body parts (head, right hand and right elbow) illustrated how the corporeal articulation became more coordinated in the developed expression. The graphical representations of the initial and developed expressions show in Figure 4.32 similar trajectories of the musical shape, where the developed approach is more pronounced. This resonates with the pianist's self-report about the change in her motor strategy after a period of collaboration with the dancer. Furthermore, the results of the frequency analysis indicated that the motor strategies classified by the performer as "punctuating" or "flowing" occur mostly in the developed approach. Indeed, the results of correlation analysis of the developed approach show a positive association between energy and the right hand and the right elbow amplitude of the gestures. This means that the amplitude of the gestures affected the sound energy in the developed approach. Additionally, in the initial approach, there was a strong correlation between the amplitude of the right hand (which was smaller than the developed approach) and the energy in playing all the notes. The smaller amplitude of the right hand of the initial approach caused, indeed, major energy, e.g. a hard sound.

4.5.3 Method and analysis

In contrast to studies that focus on predefined and limited conditions in music performance (Alon et al., 2009; Huang & Fu, 2009; Field et al., 2009) or conducting on a digital piano in a laboratory (Furuya & Altenmüller, 2013; Buck et al., 2013; Jakubowsky et al., 2017), our performative experiment aimed at covering a realistic artistic process with a focus on spontaneous playing in an ecological environment (a grand piano in a proper concert hall). However, our set-up implied other practical challenges. For example, the stage lights and its reflections on the grand piano complicated the calibration of the MoCap cameras and the continuous measurement of the movements. In the future, this might be solved by using, for example, a piano with case in matte black or other non-reflective surface. Furthermore, in contrast to a digital piano, the shape of a grand piano (e.g. the rim case) introduces a problem of camera occlusion. Further explorations with setup and number of cameras are needed, as well as the application of more sophisticated cameras in respect to the Natural Optitrack used in our study. However, one should take into account that in an experimental context it is necessary to find a good balance between the ecological validity and the risk to lose a correct data collection.

Despite other studies on musical gestures (Clarke & Davidson, 1998; Castellano et al., 2008), our approach aimed at combining a phenomenological approach (subjective reflections/top-down) with an empirical approach (quantitative measurements/bottom-up) using the performer-based analysis method (Caruso et al., 2016). The effectiveness of the performer-based analysis method inside the performers' artistic process (Cervino et al., 2011) was enhanced by applying the thinking-aloud procedure. The content of the talk was based on the annotations which the pianist made by analysing her video archive in order to elaborate her performance model. Those annotations consist in a systematic analysis of the entire artistic process (three years of practice). The video-stimulated recall method helped the performer to make her artistic progress explicit and to simulate, during the experiment, her explanation of the transformation from her initial to her developed expression.

Since the performer is subjectively involved in this procedure, there is a risk that the results are biased. For this reason, the experiment integrated two spontaneous performances (Performative Section 1 and 2). This was done to stimulate the natural execution of the fragments sections.

The analysis of the quantitative data was conducted and experimented here on one short fragment in view of the performer's perspective and analysis of her artistic process and intentionality. The rationale behind this approach is that the performer can give important inside information about her artistic experience and decision-making on the score related to musical gestures. The goal of the analysis is to assist her in explicating the intentionality of the artistic process and the performance. Additionally, we believe that quantitative data (the measurements of gestures and sound) offer to performers a tangible and detailed view on their own gestural strategy related to music. The use of Physmo2 revealed to be an intuitive tool for musicians useful in the motion analysis even in case of occlusions of some markers (it requires the use of only one marker for tracing the displacement of gestures, instead of three from the rigid body).

In conclusion, the study of musical intentionality necessitates a mixed methodology that needs further elaboration. We are convinced that a mixed methodology offers the performer/researcher a way to associate the quantitative results with her musical artistic intentions. Aesthetic meanings and empirical observations become complementary and this complementarity contributes to creating a transdisciplinary artistic experience for the performer (Klein, 2010). This kind of technology-enhanced mirror helps performers to look from an outsider perspective at their own gestures as an outcome of their artistic process and as an interface of their own music intentionality (Caruso et al., 2016).

4.5.4 The mirror technology

According to Sutil (2015), the representation of human motion can be mediated by a written record (notation), a visual record (animation), and a computational record (motion capture). In this study, these three types of representation were used. The musical score was annotated with symbols (notation) and the pianist's performance was videotaped and recorded with MoCap. Our technology-mediated approach aimed at a transformative effect in the artistic awareness, as it may happen when studying in front of a traditional mirror. But in contrast to a normal mirror or a simple video recording, the MoCap data enables the visualization of an avatar-like representation based on quantitative movement data. The 3d perspective in combination with the data analysis provides musicians with the exclusive advantage to look at and analyse their body image by jumping from a first-person perspective of the lived performance to a third-person perspective of that same performance (Himonides, 2012; Pitozzi, 2014). Such data-based mirroring gave the performer an opportunity to study her subjective gestural involvement from a more objective perspective, allowing a detailed investigation and heightening of self-awareness concerning the relationship between her decision-making (intentionality) and gestural involvement in performing.

In the present study, the performer analysed her performance with an easy-to-use software (like Elan or Physmo2) in which MoCap and video recordings were combined with sound and subjective annotations. This provided her with a technology-enhanced mirror that:

1. enables an intuitive and graspable way to empirically analyse music performance by focusing on the video analysis;
2. offers the possibility to visualize the avatar on different angulations by rotating the figure;
3. allows zooming in and out on particular body joints in order to better understand, for example, the displacement and amplitude of gestures.

In addition to working with data and visualizations, the pianist had to elaborate the set-up and she had to learn how to work with camera setting and calibration. This included studying and exploring the morphology of her body to decide where to put the markers and to define the rigid bodies. It also included a pilot test performing repertoires other than the piece selected for the experiment in order to have a spontaneous playing in the real experiment with the material of the markers attached. Body awareness was achieved by scrutinizing the performance through a quantitative approach to see how the body reacts and accomplishes specific

musical patterns. The self-monitoring was conducted on three levels: 1) the technology supports the global availability of the sensorimotor information that 2) by mediation of the “body schema”, serves 3) to reach the awareness of the “body image” (Gallagher, 1986).

The artistic interpretation of the score was used as a point of reference for understanding artistic intentions. The performer stated, for example, that she was inspired by the graphical representation of her movements in labelling her gestures. The third-person perspective to her own gestural expression provided in turn a source for creative exploration and technology-enhanced learning that fostered the artistic interpretation and in particular also the expressive intention (Bransford et al., 2000). This combination of “artistic” and “scientific” insights can be conceived as a way to reinforce the debate on artistic research on music performance (Borgdorff, 2007; Coessens et al., 2009). In this way, the present study offers a further perspective and methodology to explore and design new pathways within the field of artistic research (Hubrich, 2016).

4.6 Conclusion

In this study, we looked at body articulations (gestures) as interfaces of the performer’s artistic process and the intended expression that is realized in sound by comparing her initial interpretation and her developed interpretation of a same short fragment executed in the performative experiment (see Figure 4.32). The application of the performer-*based* analysis method (Caruso et al., 2016) involved both subjective reflections (top-down approach) and objective measurements (bottom-up approach). We proceeded from subjective descriptions (qualitative/top-down approach) to objective measurements and graphical representations (quantitative/bottom-up approach) and vice versa (from quantitative to qualitative). This process of synthesis of the two approaches is well represented in what the application of Elan software can offer, for example. The results from those two perspectives reveal a “mirroring” relationship between musical intentions and physical movements. This study provides preliminary information to be deepened in further investigation, which can involve other performers and instruments and the analysis of longer pieces of music.

The use of technology as an “augmented mirror” is a promising method that gives access to some morphological aspects of the performance that cannot be achieved in other ways. The performer can verify her work by moving from her concrete experience to another dimension (meta-level), i.e. from an intuitive approach to a

deliberate acquisition and a final systematic consolidation supported by the quantitative data gathered from the “mirroring” method. This creative use of technology would open new insights to the artistic research in music performance by offering to musicians/researchers a meta-perspective for the music performance analysis. We believe that the “technology-enhanced mirror”, which integrates “scientific” approach and artistic insights, offers a mutual opportunity because, on the one hand, it provides a meta-level of analysis to musicians and, on the other hand, it gives a possible access to the subjective sphere of the artistic process and intentionality to scientists.

To sum up, our study aimed at exploring the “mirroring” relation between intentionality and gesture of a piano performance during the artistic process. The combination of an “artistic” and “scientific” approach to performance resulted in a mutual reinforcement model suggesting an entanglement of the artistic and scientific domain. While scientific methods offer to the performer, a possibility to jump from a first-person perspective to a third-person perspective on gestural and musical expression, this jump also affects the artistic process in the sense that it changes the particular intended expression. This type of relationship between the artistic and the scientific world may be characteristic for the dual role of the performers who are at the same time the observer of their own actions. The relationship suggests an artistic-scientific entanglement implying that observations in the scientific domain immediately affect observations in the artistic domain and vice versa. The artistic-scientific entanglement of our study seems to suggest a very specific state of being that affects both the artistic and the scientific domain in a way it would not be possible from a purely artistic or purely scientific perspective.

Chapter 5

The technology-enhanced mirror: a meta-perspective for music performance practice and research

5.1 Introduction

For centuries, musicians have searched for means to enhance their practice and make it more effective and efficient. These means were not only based on innovative methods in practicing, but they also implied the use of different tools to assist practicing. Some of these tools aimed at training the muscles involved in instrumental gestures. For example, as early as 1814, a new aid, patented as *chioplast*, was devised by Johann Bernhard Logier (1777-1846). Directed to musicians, especially to amateurs, the *chioplast* allowed to practice on the keyboard with a correct position of hands and fingers¹. It consisted of a board on which the pianists placed their arms so that they could give the right position to their fingers. This device was later improved by Kalkbrenner in 1830 and fittingly called *guide-mains* (Figure 5.33).

¹ Rattalino, P. (1982). *Storia del Pianoforte*. Il Saggiatore, Milano, p. 20

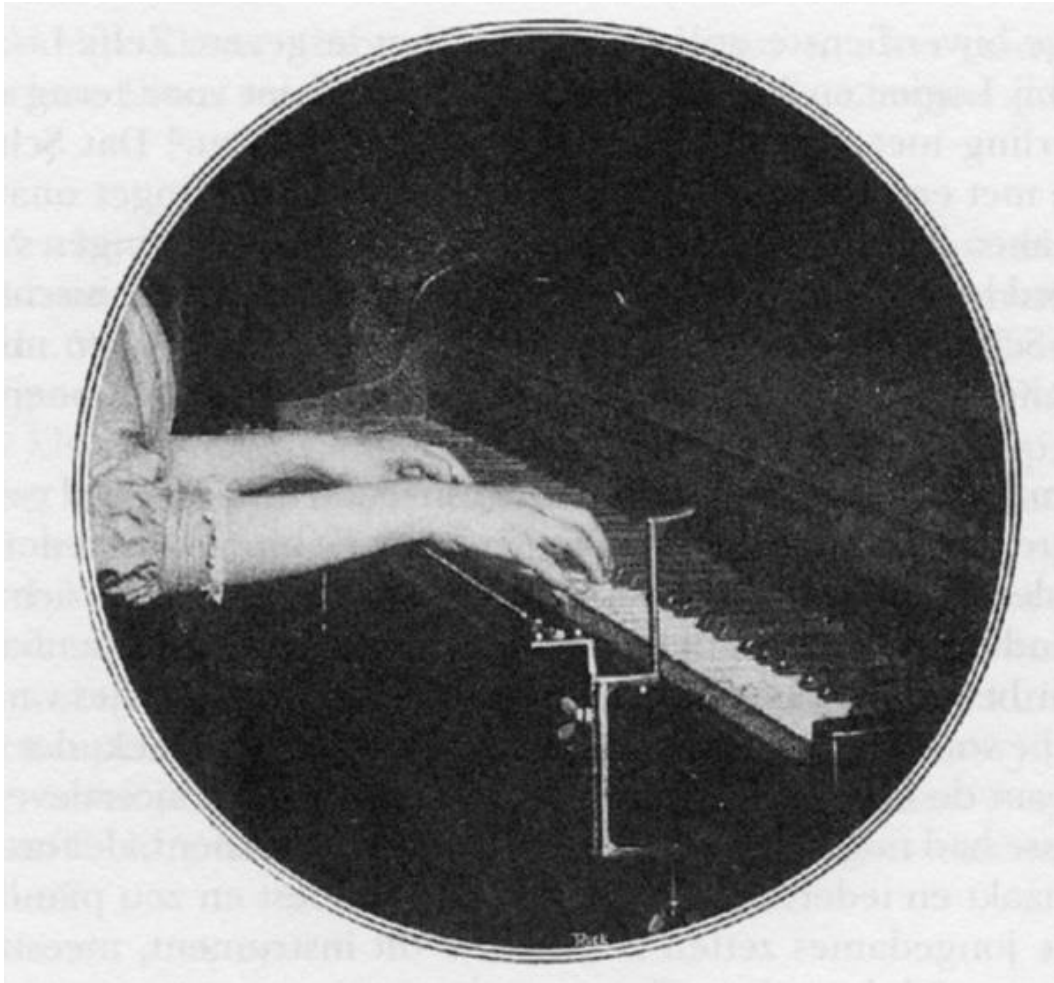
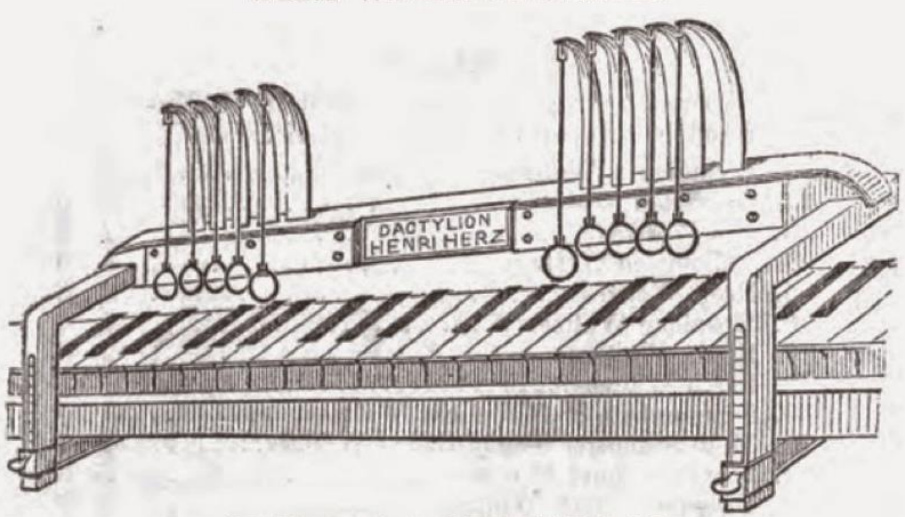


Figure 5.33 Friedrich Kalkbrenner's *guide-mains*.
This picture shows the rail on the front side of the piano on which the arms are placed.

Another example is the device called *dactylion* (Figure 5.34) invented by Henri Herz (1806-1888). It is well known that Robert Schumann, in order to achieve more independence of his fourth finger, ruined his right hand with a similar device.²

² Edler, A. (1991). *Schumann e il suo tempo* (Robert Schumann und Sein Zeit), Italian traslation by Laura Dallapiccola, E.D.T. Torino.

**NEW METHOD OF STUDYING
THE PIANOFORTE.**



THE DACTYLION,

An instrument calculated to give strength and flexibility to the fingers ; to render them independent of each other ; and to communicate that equality of touch so essential to correct and brilliant execution on the pianoforte,

INVENTED BY HENRI HERZ.

PIANO DACTYLION.

A new invention of great practical value and real benefit to the Piano Player.

- To strengthen the fingers.
- To improve the touch.
- To ensure flexibility and rapidity.
- To give correct position of the hand.
- To save time and a vast amount of labor.

Used, endorsed, and highly recommended by the best of Pianists and Teachers, among whom—

MAD. JULIE RIVE-KING.	MR. S. B. MILLS.
MR. CHAS. KUNDEL.	MR. H. G. ANDRES.
MR. ARMIN DOERNER,	MR. OTTO SINGER.
MR. GEO. SCHNEIDER.	

Introduced at, and used by, the different Colleges of Music in Cincinnati.

AGENTS WANTED EVERYWHERE. Send for Circulars.

L. E. LEVISSOR, Manufacturer,
153 W. Fourth St., Cincinnati, O.

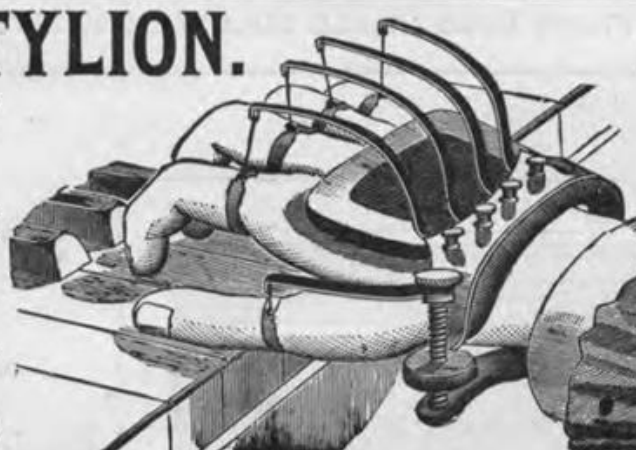


Figure 5.34 The *dactylion* by Henri Herz. It was constituted ten strings hanging above the keys, with a spring on top of it and rings on the bottom. The fingers would be inserted in the rings and after striking the key, they were pulled up again by the simultaneously tightened spring.

Other devices aim at enhancing body awareness in order to optimize body posture and specific gestures. The simplest example par excellence for monitoring music performance is a mirror. Mirrors were used by musicians to observe and evaluate the way they play, to adjust their gestures and posture, and to find alternative modes of execution. This is nicely illustrated by the acclaimed pianist Claudio Arrau, who stated:

«I put a mirror next to my piano [...] I began to notice the rotation, the vibration, the use of arm weight, and so on.»³

As Arrau suggests, the awareness of gestural involvement during practice plays a fundamental role in the development of music performance skills. However, the image of a mirror is linked to one moment and, above all, it is difficult to grasp due to the fact that musicians have to watch and interpret what happens in the mirror while playing.

Later on, other more advanced tools, which we nowadays tend to call "technologies", have emerged. They typically use a form of registration in order to be able to mirror one's performance in a more precise way. For example, musicians could watch to a sequence of photographs while performing, as the pianist Marie Trautmann Jaëlle did for her studies on gestures in piano performance⁴. The invention of the film and video gave the opportunity to see and hear a complete performance after the execution. However, when considered from the perspective of enhancing piano practice, both film and video, up to recently, perhaps, were immature technologies.

First of all, the captured images are typically visualized from one perspective (frontal, lateral, or whatever prospective used) and the resulting 2Dimensional-image does not allow from a viewpoint from different perspectives in 3D. Secondly, the analysis of the 2D-images was until recently based on subjective inspection, rather than on computational tools. However, advances in the analysis of video-recorded gestures offer ways to handle recorded performances (Castellano et al., 2008).

Overall, 2D-video recordings have shortcomings and therefore, their use as a tool to enhance piano practice is limited when compared to the 3D camera technologies. Recent developments in technology offer the most promising approach by providing a 3D-visualization of the body in performance, together with techniques for objective analysis about displacement, velocity, quantity of motion on a 3D-body posture and movement (Goebel et al., 2014).

³ Von Arx, V. A. (2014). *Piano Lessons with Claudio Arrau: A Guide to His Philosophy and Techniques*. New York: Oxford University Press, p.18.

⁴ Jaëlle Trautmann, M. (1897). *Le mécanisme du toucher*. Armand Colin.

Inspired by the possibility offered by new technologies to augment and, as such, enhance the traditional mirror in performance practice, my goal was to experiment with tools that could help me in the learning and analysing processes of piano performance. The application of technology as an “augmented mirror” (Ng et al., 2007) offers a way to support the evaluation of my piano practice.

Using 3D-video recording equipment, I decided to conduct an empirical study and apply a performer-*based* analysis method (Caruso et al., 2016). The goal was two-fold. On the one hand, this study helps me to refine my own artistic interpretation of a musical piece in relation to my gesture. On the other hand, this study would offer other performers a way to develop their own artistic process (Cook, 1999; Yih, 2013) using this approach as a model for “mirroring” intentionality and performance gesture. The first goal is more artistically oriented and aimed at sharpening my own feelings and intuitions. The second goal is more scientifically oriented and aimed at sharpening my understanding a piano performance. This scientific approach would ultimately lead to more general knowledge that could be useful for other musicians’ artistic development, if not immediately then as a step towards the achievement of a future mirroring technology.

In artistic research, traditional music performance practice models are predominantly based on phenomenology. Traditional methods are written/narrative self- reflections (Schön, 1983), subjective observations on video and audio recordings; but objective references are missing.

In scientific research, scientific models are based on the analysis of raw data that cannot provide meaningful explanation in relation to the subjective musical interpretation.

The current state-of-the art technology opens up many new possibilities for analysing performance from multiple perspectives and for providing musicians with detailed real-time visual knowledge of performance and multimodal knowledge of results (Wanderley, et al., 2005, Davidson 2005, 2007; Repp & Keller, 2010). Musicians could implement quantitative data from technology to reinforce their self-reflective approach and, conversely, scientists could consider musicians’ qualitative interpretation crucial information to give an artistic meaning to raw empirical data. My own research project turned out to be a mix of artistic and scientific approaches, as it was based on connecting objective results and artistic findings through the technology-enhanced mirror.

In this chapter, I specify how I implemented in my artistic research the use of technology (3D motion capture, Physmo2, Sonic Visualiser and ELAN) as means to investigate my personal approach and the gestural and intentional development (process of embodiment) in the interpretation and performance of the *72 Etudes Karnatiques*.

5.2 A meta-perspective for music performance analysis

The goal of artistic research is to look at one's own practice and production by self-questioning and self-reflecting on inspiration, approach and method (Borgdorff, 2012; Coessens et al., 2009). An engagement in this kind of “reflective practice method” (Schön, 1983) implies that musicians have to document and evaluate the different stages of their artistic process (including practice and performance). Most importantly, such documentation is a fundamental meta-perspective in the artistic process because it elicits knowledge concerning the process itself and its outcomes. Documenting has always a strong impact on the artistic process as a whole. Being a practice associated with other practices (e.g. practicing on the instrument or analysing), documenting may precede or follow a public performance. Examples are the way musicians adjust their interpretation (music intentions and gestures) while watching their video recordings or listening to their audio recordings during their practice or after their public performances.

One way of documenting one's artistic practice is by written narrative description (Bruner, 1986). The act of “writing” implies simultaneity of thinking and doing, i.e. observing the world and immediately (re)creating it⁵. Great musicians often write down their reflections on their practicing and interpretation, presented to a wider public in the form of essays and treatises or books. Famous examples are the treatises of Carl Philipp Emanuel Bach's on the harpsichord technique and Carl Flesch's on the violin technique⁶. With regard to piano performance, several great pianists have shared their views on practicing and performing. For example, Alfred Cortot wrote on interpreting Chopin and provided associated practice exercises⁷; Paul Badura Skoda shared his vision on analysing and interpreting Mozart⁸; Charles Rosen wrote an essay on the performance practice of the romantic piano repertoire⁹. These acclaimed artists shared their own interpretive approaches, practice and technique (including corporeal strategies and exercises), which

⁵ Hannula, M., Suoranta, J., & Vaden, T. (2005). *Artistic research: theories, methods and practices*. Published by Academy of Fine Arts, Helsinki, Finland and University of Gothenburg / ArtMonitor, Gothenburg, Sweden, p.40.

⁶ Some of the essays by Carl Flesch are: the art of violin playing vol. 1-2 (1928), Problems of Tone Production in Violin Playing (1931), Violin Fingering: Its Theory and Practice (1943).

⁷ Cortot, A. (1950). *Aspects de Chopin*. Italian translation by A. Curci. Edizioni Curci, Milano.

⁸ Badura Skoda, P. (1962). *L'art de jouer Mozart au piano*. Buchet-Chastel, 1974.

⁹ Rosen, C. (1995). *The Romantic generation*, Harvard University Press, 1998.

contributed to training following generations of musicians. Next to their “pedagogical” value, these treatises are also valuable examples on how to subjectively articulate one’s “artistic narrative reflection” on music performance.

Another way of documenting the artistic process is based on scientific methods and their application in the field of music performance. Among the post-romantic performers, who wanted to understand more systematically their corporeal engagement in music performance, there is the renowned pianist, pedagogue and composer, Marie Trautmann Jaëlle. Her works are seminal due to the way she integrated scientific research in her studies on piano technique¹⁰. Marie Trautmann Jaëlle said that the methods to study piano performance should be based on a systematic investigation on gestures:

« ...dans l'exécution d'une œuvre musicale, la beauté idéale est acquise par le perfectionnement physiologique des mouvements... »¹¹.

With the aim to explore and study the physiology of the body, and more specifically the physiology of the pianist’s hands, she started, between 1896 and 1907, collaboration with the French physiologist Charles Samson Féré (1852-1907). Supported by Féré, Marie Trautmann Jaëlle developed various experimental procedures to empirically analyse her intuitions on the relationship between brain, body and piano touch, anticipating the development of the empirical observations in music performance analysis¹². For example, she blacked the pianist’s fingers to collect fingerprints on the keys (see Figure 5.35) and she studied the pianist’s body movements by observing and analysing the sequential photography shots of a performance. Marie Trautmann Jaëlle represents one of the first testimonials of a research, done by a musician that entangles the domains of art and science. She wrote and published a series of treatises¹³ reflecting on her scientific experimentations in order to analyse and to understand piano performance from a gestural point of view and to develop strategies regarding specific connections between sound and touch.

¹⁰ Caruso, G. (2016). La femme au toucher ineffable : la pianiste, pédagogue et chercheuse Marie Trautmann, épouse Jaëll. In Cahiers internationaux de symbolisme, (C. LEJEUNE, Ed.)143-144-145 (Genre), 27–42.

¹¹ Jaëlle Trautmann, M. (1897). *Le mécanisme du toucher*. Armand Colin, p.1.

¹² Guichard, C. (2004). *Marie Jaëll: The Magic Touch*. Piano Music by Mind Training. Algora Publishing, United States.

¹³ *ibid.*

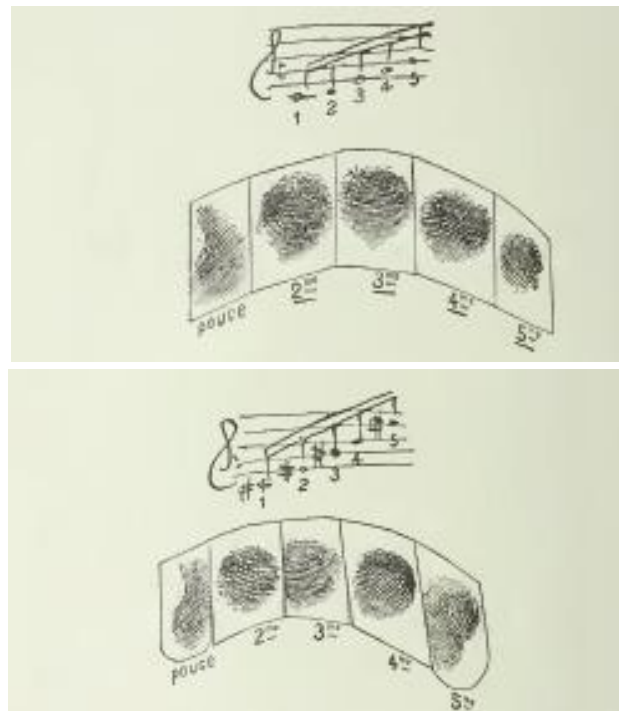


Figure 5.35 An example of the empirical analysis on piano touch made by Marie Trautmann Jaëlle¹⁴.

Marie Trautmann Jaëlle's research shows how a scientific approach can help performers to better understand the process of their performance practice and to make it more efficient. Similarly, my artistic research aims at exploring a connection between the self-reflection on my interpretation and the empirical analysis of my performance. This connection involves a meta-perspective that considers an interdisciplinary or transdisciplinary exchange between art and science (see also Dogantan-Dack et al., 2015).

The relation between sound and gesture is an essential feature of music performance. Therefore, my investigation focused on the physical and sonic dimension of my performance to explore how gestures produce intended sound and how intended sound results from gestures. Sound is produced by gestures (Delalande, 1988) and gestures accompany sound with an expressive intention finalized to musical communication (Wanderley et al., 2005; Dahl & Friberg, 2010; Jensenius et al., 2010). To study this relationship I decided to use specific software

¹⁴ Jaëlle Trautmann, M., (1897). *Le mécanisme du toucher*. Armand Colin et c, p.62.

to perform a detailed analysis of the audio (see section 5.2.1) and motion capture (3D-video technology) to learn about my bodily engagement (see section 5.2.2). Finally, I used a multimodal annotation software to facilitate the comparative analysis and alignment of my qualitative and quantitative data. In this way, the third-person perspective (meta-perspective) of technology was used as an “augmented mirror” to support my subjective monitoring (first-person perspective) of my performance practice and artistic process. The outcome of this study also leads to a model of how augmented mirroring might be used by other musicians, in view of a future user-friendly methodology for the enhancement of piano practice.

5.2.1 Audio analysis: visual inspection and quantitative analysis

To obtain feedback and evaluate the performance, musicians often record themselves by using simple audio/video digital devices. For example, I used to handle a Zoom Q4 for the recording of my own playing and for listening. Thanks to software development, these recordings can be complemented with the possibility to inspect the audio waveform. Examples of sound analysis software are Audacity or Sonic Visualiser. In my work, I used Sonic Visualiser, an open source application for viewing, analysing and annotating music audio files (Cannam et al., 2006, 2010). The use of Sonic Visualiser enables musicians to select fragments on which to apply the wanted analysis. Sonic Visualiser provides a set of plug-ins (in the vamp plugin format) to be added to the software in function of the analytical demands. By importing a waveform to the software and by applying specific plug-ins, it is possible to obtain straightforwardly the note onset (directly from the software or through manual annotation), timing, dynamics (like the energy of the signal approximated by computing the root-mean-square, RMS) and spectrograms over the given segment.

In the course of my study, I was interested in extracting the duration and dynamics of a specific performed piano fragment and aligning it with the note onsets (Figure 5.36).

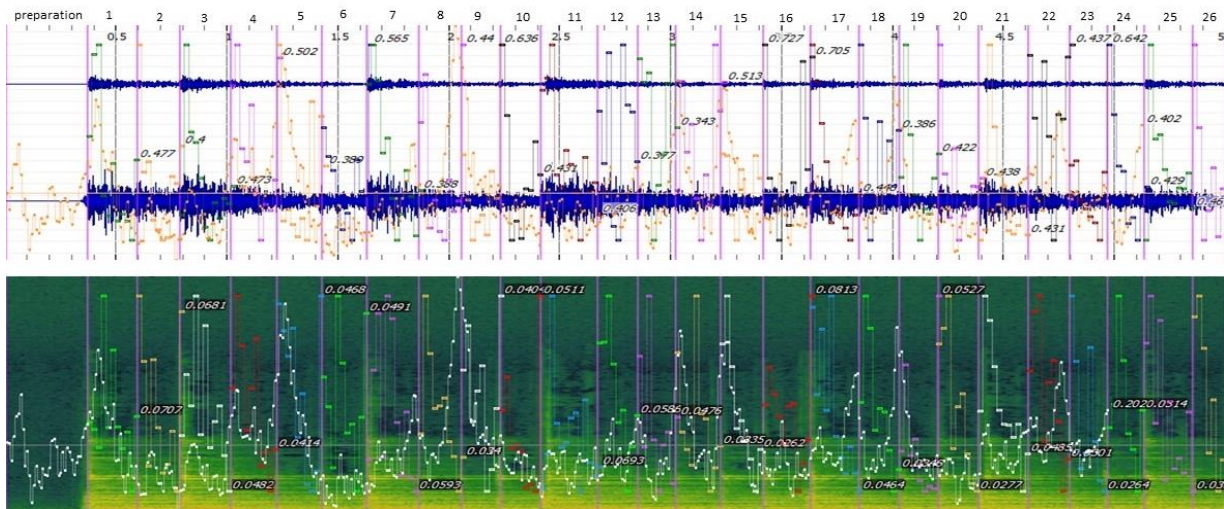


Figure 5.36 An example of audio analysis from Sonic Visualiser by selecting the waveform and spectrogram views per 26 note onsets.

Working with the audio analysis of the fragment imported from my audio recording, I could test the real sound result of my performance as represented in waveform. For example, when comparing the dynamics of each note in my initial performance and my developed performance, it was a stimulating discovery to observe that there were subtle differences between both approaches. When focusing on the rhythmical pattern that I took as a reference point of my analysis, I noticed how an accented note sounded different (Figure 5.37).

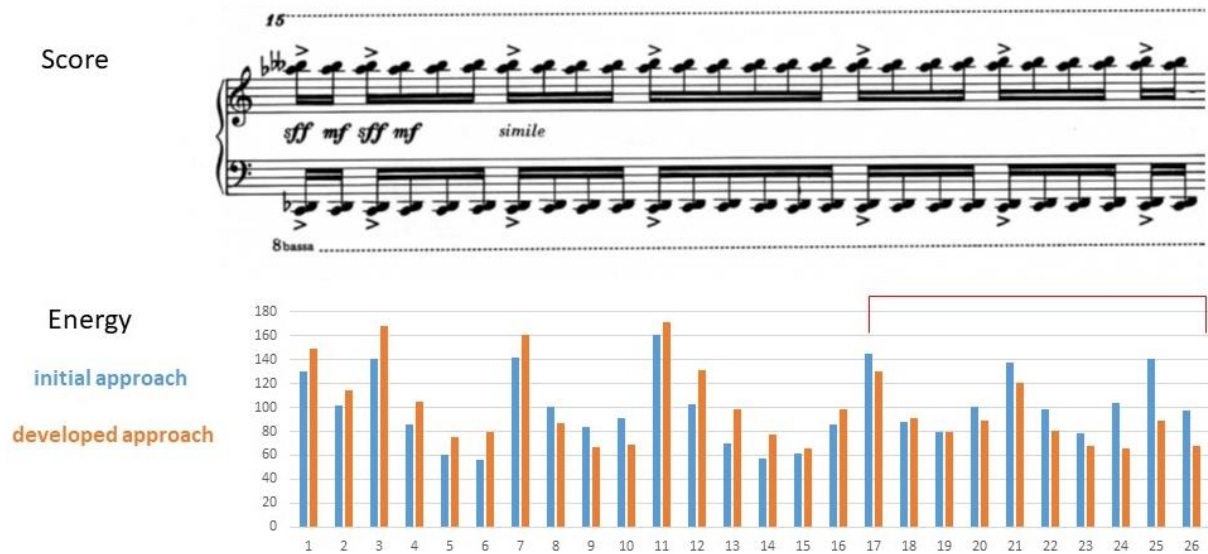


Figure 5.37 The lower panel shows a graphical representation of the energy (the root-mean-square, RMS) calculated by Sonic Visualiser. The energy of each note from the score in the initial execution (blue lines) is compared with the energy of each note of the fragment in the developed execution (orange lines). The score notation in the top panel was taken as a reference point.

This “mirror” provides an example on how quantitative data can support and add significant elements to artistic expectations. As reported in the *verbatim* of the experiment (see appendix A.5), my subjective intention was indeed to give different sound and energy to the accented note by modifying my gestural approach. I had the impression that the wider gestures of my developed approach could more easily provide a more resonant timbre, compared to the narrow gesture of the initial approach. As reported in Figure 5.37, the audio data matched my artistic expectation in the first part of the score passage. As shown in the graph above, it is evident that the last three groups from the score presented a different sound result (major in the initial approach). This quantitative result made me think on how I should adjust my gestures to maintain my performance efficient until the end.

5.2.2 Gestural analysis for body awareness

Motion capture (MoCap) recording of a performing musician constitutes a complex but highly intriguing new phenomenon. Well known to film and gaming production (Goebel, et al. 2014), a motion capture recording not only enables reproducing the natural movements of a person into a video, but it also provides accurate and detailed tridimensional data on body postures and gestures. The possibility to use the MoCap data for gestural analysis has turned motion capture technology into one of the most used methods in empirical studies on music performance (e.g. Davidson, 1993; Dahl & Friberg, 2007; Nusseck & Wanderley, 2009; Desmet et al., 2012). However, from the perspective of artistic research this application has not been thoroughly investigated yet. Previous studies which implemented the use of motion capture (Desmet et al., 2012; Westney et al., 2015; Coorevits et al., 2016) were not conducted directly by the performers themselves. From my artistic perspective, I assumed that there was a need to better explore and understand the use of the motion capture system from the inside out. Therefore, I planned to directly experiment how the ‘corporeal computation’ of music performance could work as useful information for practice-based research.

In preparing the motion capture for my performative experiment, I faced many technological challenges. A preliminary work was needed to find the right setting of cameras and markers (see chapter 4 and appendix A.4). Normally, musicians are used to set one camera, or two, for the video footage of their performance. The motion capture, in order to be able to explore its full power, needs a precise configuration of a number of infrared cameras (up to 8 and more different cameras), depending on the kind of movements one wants to record (e.g. arms, hands). Finger movements, for example are not recorded in my study. In order to accurately track the performers’ body movements, reflective markers need to be positioned on the body in such a way that interference generated by occlusions and reflections is avoided. This means that musicians/researchers involved in this work have to conceive a clear positioning strategy of cameras and markers and imagine their bodily activity while performing (self-perception).

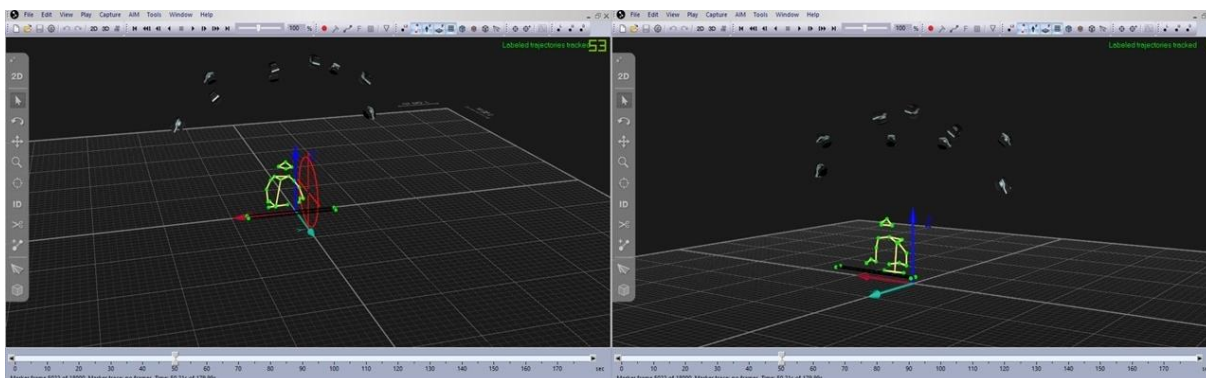


Figure 5.38 My body as visualized by the Motion Capture System (QUALYSIS) in the tridimensional performance space.

As written in chapter 3 and 4, this challenge induced me to reflect on the morphology of my body while performing in a determined.

First, to set the cameras and the markers, for example, I carefully watched the video footages of my previous performances to have a major consciousness of my gestural approaches to the piano. This video observation made me decide which parts of my body I had to focus on and where I had to place the reflective markers. In this way I could define also the threshold of my performance space (Jensenius, 2007) for the camera configuration.

Second, the primary data generated by the capturing system is a video where the performer's body is figured out as an *avatar*, i.e. a skeleton-like visual representations on the basis of interconnected dots. In respect to a normal mirror or a simple video camera, even at this stage, performers can intuitively work on their gestures in a more accurate manner by interacting with the system to observe their body performing from different perspectives. In my experiment, I used the Optitrack System first. Then, I experienced the new version, Qualisys Motion Capture System¹⁵ shown in the figures above, which is easier for musician-researchers to use.

¹⁵ <https://www.qualisys.com/>

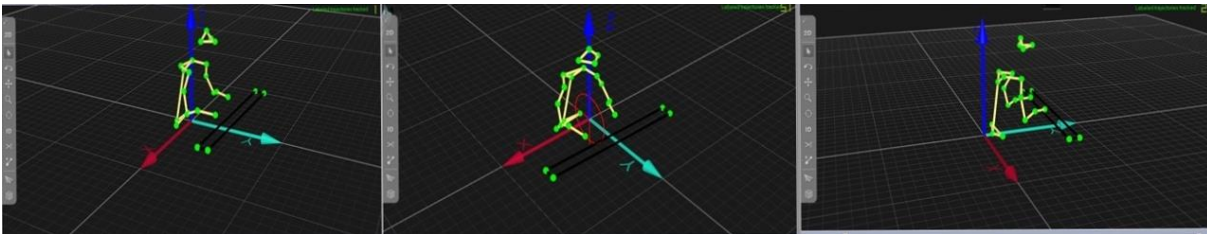


Figure 5.39 My body seen in the virtual space through the MoCap Qualisys System from different perspectives.

The motion capture visualization allows me zooming in and out the joints or moving and rotating my *avatar*.

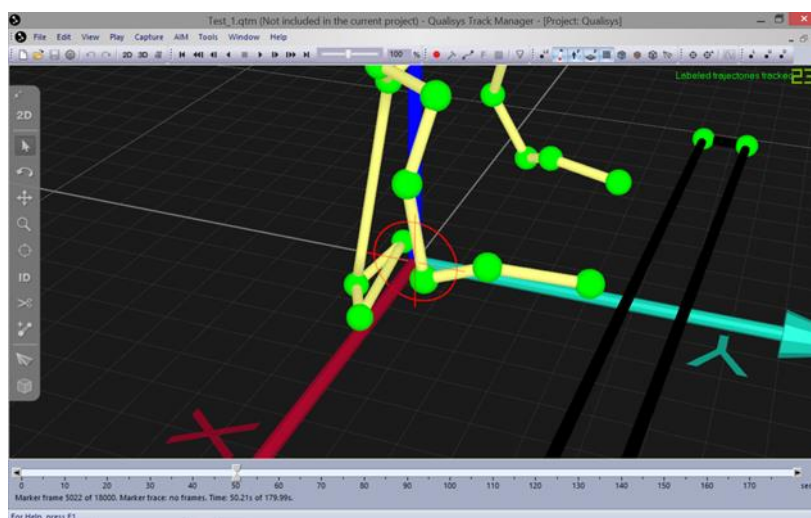


Figure 5.40 An example of zooming in my *avatar* right elbow.

The Motion Capture System thus allows musicians to visualize their body form different perspectives while performing. It thus acts as a mirror that allows focusing on specific body parts, from different 3D-perspectives. Moreover, the capture recording has the advantage that it generates data concerning the motion tracking, which is an additional tool for a detailed research on music performance and for the transmission of knowledge.

Dealing with the motion capture data requires, however, specific computational skills. The raw data have to be exported to other software packages such as Matlab, and processed accordingly. I explored different ways of processing the data, both in terms of data extraction and data analysis. These explorations were initiated as a way to solve problems with regard to occlusion and gaps in the motion capture data (see chapters 3-4). From the motion capture of my performative experiment, I extracted videos from different angulations and processed the data in Physmo2 (Barracough, 2011), a software for frame-by-frame video analysis of motion. The software Physmo2 provided raw data concerning the horizontal and vertical displacements (x-y) of gestures. From these data, I calculated the velocity and acceleration of the body parts, which were of interest in my research.

Table 5.1 provides an overview of the average displacement of different body parts along the y-axis (vertical displacement) of the MoCap system. In green there are: right hand (RH), right elbow (RE) and head (H) in both versions (1= initial approach, 2= developed approach) per 26 note onsets. The numbers highlighted in red represent the accented note of the fragment in Figure 5.37. The values are averages based on subtracting the maximum vertical displacement value (Max) and minimum vertical displacement value (Min). The vertical displacement in the real space corresponds to the y-axis of the MoCap system (because it was accordingly configured).

Table 5.8 A comparison between the first approach (1) and second approach (2) of the averages in the vertical displacement of right hand (RHy), right elbow (REy) and head (Hy).

Note onsets	RHy1	RHy2	REy1	REy2	Hy1	Hy2
0	28	51	7	35	3	8
1	58	137	18	47	2	5
2	21	54	8	34	5	11
3	76	141	16	56	7	33
4	13	72	3	36	1	37
5	26	34	7	10	2	4
6	25	32	5	26	1	5
7	76	151	19	68	7	31
8	37	32	30	15	2	25
9	22	38	7	13	2	5
10	38	36	6	11	2	11
11	96	125	15	53	14	21
12	25	78	26	25	10	29
13	34	43	11	15	1	12
14	24	31	3	8	3	3
15	32	45	7	7	6	11
16	45	39	5	32	3	19
17	97	129	9	80	10	25
18	26	68	24	29	8	15
19	34	52	16	24	2	15
20	41	13	11	19	2	6
21	79	142	10	57	6	16
22	28	43	23	16	4	8
23	15	55	13	22	2	12
24	33	26	18	10	4	10
25	83	141	13	53	6	30
26	58	36	26	28	18	27

These data had an important added value to my research due to their impact on the awareness of my bodily engagement during my practice. As shown in this table above, for example, the retrieved empirical data supported my subjective impression (see the *verbatim* in appendix A.5) regarding a major amplitude in the vertical displacement of the right hand in approaching the first accented note of the fragment in Figure 5.37 performed in the developed approach (see the numbers circled in Table 5.8: for example from the note onsets in the accented note in red, number 1, its value corresponds to $Rhy2=137 > Rhy1=58$).

These data constituted an alternative representation of my performance which supported my verbal self-reflections gathered from my experiment (see the *verbatim* in appendix A.4 and the performance model Figure 4.26).

5.2.3 Alignment of qualitative and quantitative analysis

Once the audio and motion capture data were prepared and analysed, I wanted to correlate the qualitative and quantitative data. To do so, I used the multimodal annotation software ELAN (see Chapters 3-4).

In ELAN, it is possible to import the video recordings, the audio tracks and data gathered from the motion capture (displacement, velocity and acceleration) plotted in graphical representations. The system enables to connect all the data in one project and to work at their connection per note onsets detected as they were previously segmented in Sonic Visualiser. The self-reflections on the score can be verified through a parallel configuration of all the measurements (video, audio and motion) and through the annotation of the labelled gestures when they exactly occur through the sound pitches. In this way, ELAN appears as an amplified mirror where all the parameters from the performance are systematically reported in details.

As fully explained in chapter 4, I associated more accurately the body movements per note at the level of the note onsets and, then, I labeled and integrated them in my categorization of gestures (see Table 4.2). This means that I could align the produced sound (duration and dynamics) with gestures and verify if this result met my expectation as reported in my self-reflection (see the *verbatim* in appendix A.5). The scenario presented in ELAN is an example on how quantitative data can complement qualitative approach, and vice versa. The parallel configuration of the computed sound and gestures aligned with qualitative observations has the advantage to give musicians, who want to carry on a research on their performance, a complete and more precise picture on what they are producing.

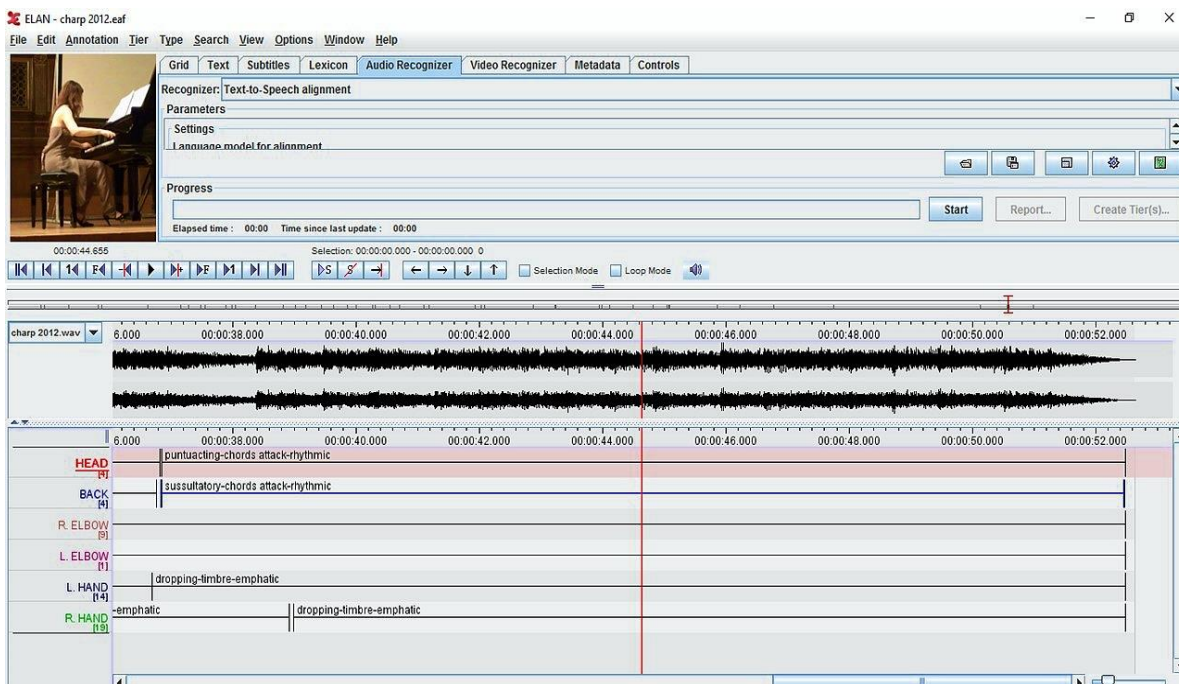


Figure 5.41 Elan project.

The screenshot shows the video annotation of my initial performance in 2012, using the ELAN software. The video, audio, and segmentation are aligned. Segments can be played that show progression over time in the video, audio and segmentation views. The upper panel shows the video, the middle panel shows the audio track and the lower panel shows my segmented annotation.

5.3 General discussion

In the recent decades, the artistic process, especially on music performance, has become an area of common interest for performers/researchers and scientists. On the one hand, performer-researchers need tools for monitoring their practice and, on the other hand, scientists want to better understand the meaning of raw data concerning gestures in music performance in relation to specific musical structures.

In my study, the empirical music performance analysis was a supporting tool for the development of my artistic process. My approach can be generalized, although more work would be needed to develop it as a user-friendly tool for practicing. Moreover, performers' perspective is needed to connect empirical data to musical structures and the performers should become aware of the ways in which this connection can be established. So far, however, empirical studies are needed as examples on how technology can be applied in the observation of music

performance replacing the traditional mirror or video and audio devices. Ultimately, this technology has the potential to become an “augmented mirror” that can enhance musicians’ practice in checking their personal reflection and in improving their efficiency in performing. The utility of the quantitative data is definitely meant to reinforce musicians’ self-reflective approach.

The goal of the performer-*based* analysis method (Caruso et al., 2016) is to connect the top-down and bottom-up feedback about the performance. Such a feedback enriches the artistic process and contributes to define the expressive intention of the performer. By connecting the qualitative and quantitative approach, the artistic intuitions can be strengthened by objective foundations and the empirical studies can regain the unicity of a performance (what Walter Benjamin called *aura*¹⁶). The objective results remain, indeed, outcomes related to the particular style of each performer. In my research project, for example, the score and my interpretation are always taken as a point of reference.

By interacting with Sonic Visualiser, Motion Capture System and ELAN, I had the possibility to verify my artistic intuition concerning my corporeal approach and the sound related to my interpretation (see chapters 3 and 4). Measurements of my gestures and sound constitute the objective issues that enabled me to reach a major awareness of my performance as a pianist and researcher.

Quantitative data can offer a meta-perspective for one’s own analysis of a performance and provide information for a better understanding of one’s own gestures and intentionality. This type of analysis is useful to identify differences in gestures and sounds and to support the description and evaluation of the artistic process. For example, the changes traced in the data analysis regarding the displacement, velocity and acceleration of the gestures of my head, hands and elbows met with what I had expected from my self-reflection (see the *verbatim* in appendix A.5).

Technology has still many limitations, however, and I do not make any claim that the “augmented mirror” can be easily used by other musicians. In order to be useful as a technology for practicing musicians, one should avoid the kind of technological difficulties that I was confronted with at the beginning of my study, and have something more user-friendly at hand. From that perspective, my study was just a starting point towards the development of future technologies for musical practice. My case study illustrates the potential usefulness of the technology-enhanced mirror contributing to renovate the traditional general approach to music performance analysis in artistic research.

¹⁶ Benjamin, W. (1936). *L’œuvre d’art à l’ère de sa reproductibilité technique*, tr. fr. Librairie Alcan.

5.4 Conclusion

Considering the contribution of the application of technology in music performance analysis, this chapter explains how during my exploratory study, technology and objective measurements was integrated as a meta-perspective for the analysis of my own performance. I discussed my approach referring to the software applied and the quantitative findings that helped me to define the development of my artistic process in terms of gestural and musical awareness as a pianist and researcher.

This study served, firstly, to explore my personal artistic process and, secondly, to investigate the connection between gestures and intentions in view of developing a technology-enhanced mirror approach to musical practice. My case study showed that technology used in relation to one's practice can offer new insights to the artistic development. Artistic outcomes and "scientific" findings represent here two sides of the same coin. The performer's interactive approach with technology constitutes a meta-perspective of investigation. Musician-researchers, who want to conduct their music performance practice within an artistic research, could test and verify their artistic expectations in order to enhance their own artistic practice and research.

As I will explain in detail in the next chapter, technology gave me new insights on my performance and, thereby, this empirical study became part of my artistic process. I believe that the digitization of movement and sound and computational methods can constitute nowadays new frontiers for the self-observation and self-evaluation of music performances and for the transmission of knowledge in artistic research.

Chapter 6

Artistic process: experimenting, performing and disseminating

6.1 Introduction

In this chapter, I describe and discuss my artistic process in form of a retrospective self-report (Chaffin & Imreh, 2001) thereby referring to all the experiences that shaped my artistic growth as performer and researcher. As explained in chapter 1 (see Figure 1.2), practice is considered one of the determinant components of artistic research. Practice (from the ancient Greek *praxis*) is the process of applying knowledge, and, thus, artistic research is mainly based on all the activities that concern artistic practice informed by a conceptual framework (Coessens et al., 2009).

The retrospective self-report of this chapter aims at reconstructing the phases of my performance practice of the *72 Etudes Karnatiques*. Through practice and empirical evaluations, I experienced how to think and rethink my interpretation of the *72 Etudes Karnatiques* from an initial approach to a “re-oriented” approach. In the artistic process, which englobes artistic research (see also the structure of TARS Fig. 1.2), the acts of experimenting, performing and disseminating form a triangular trajectory determined by their interplay (see Figure 6.42):

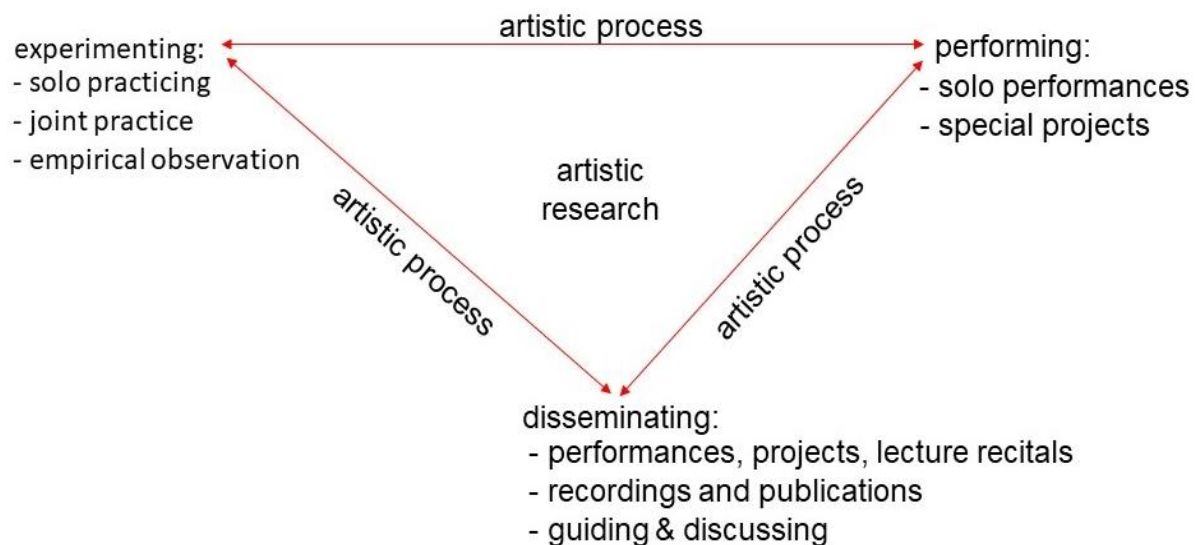


Figure 6.42 The artistic process, represented by a triangular configuration, shows the interplay between the acts of experimenting, performing and disseminating.

Experimenting included my solo practicing and joint practice with the composer, masterclasses and lessons with musicians trained in the West-European conservatory tradition and Indian music experts. Moreover, my experimentation embraced the empirical studies I conducted for monitoring my performance practice which combines traditional approaches (written and verbal self-observation and self-evaluation) with technological implementations (Caruso et al., 2016).

Performing consisted of my *72 Etudes Karnatiques* solo performances and the multidisciplinary project *Re-Orient*, which displayed the process of embodiment. Disseminating referred to all my performances, projects, recordings and publications, lecture-recitals, and students' guidance and discussion. The exchanges between my reflections and external experiences determined the style of my musical interpretation of *72 Etudes Karnatiques*.

The artistic activity inherent to my artistic research is resumed and illustrated here in the timeline and are outlined in detail in my portfolio (see appendix A.6) and

archived in my media-portfolio¹. Among my practicing, concert activities, conference concerts and experimentation, there are specific events that I conceived as “milestones” in my research (highlighted in red points in Figure 6.43, 6.44, 6.45). These bear witness to how and why I re-oriented my artistic practice. This timeline comprises also the period I spent in setting up my performative experiment and in conducting the data analysis. The quantitative results obtained through the technology-enhanced mirror offered me a meta-perspective to evaluate at a distance (third person perspective) my performance practice. As explained in chapter 5, here I define more precisely how the empirical approach is part of my artistic process that contributed to shape my artistic practice.

Artistic Practice and Concerts

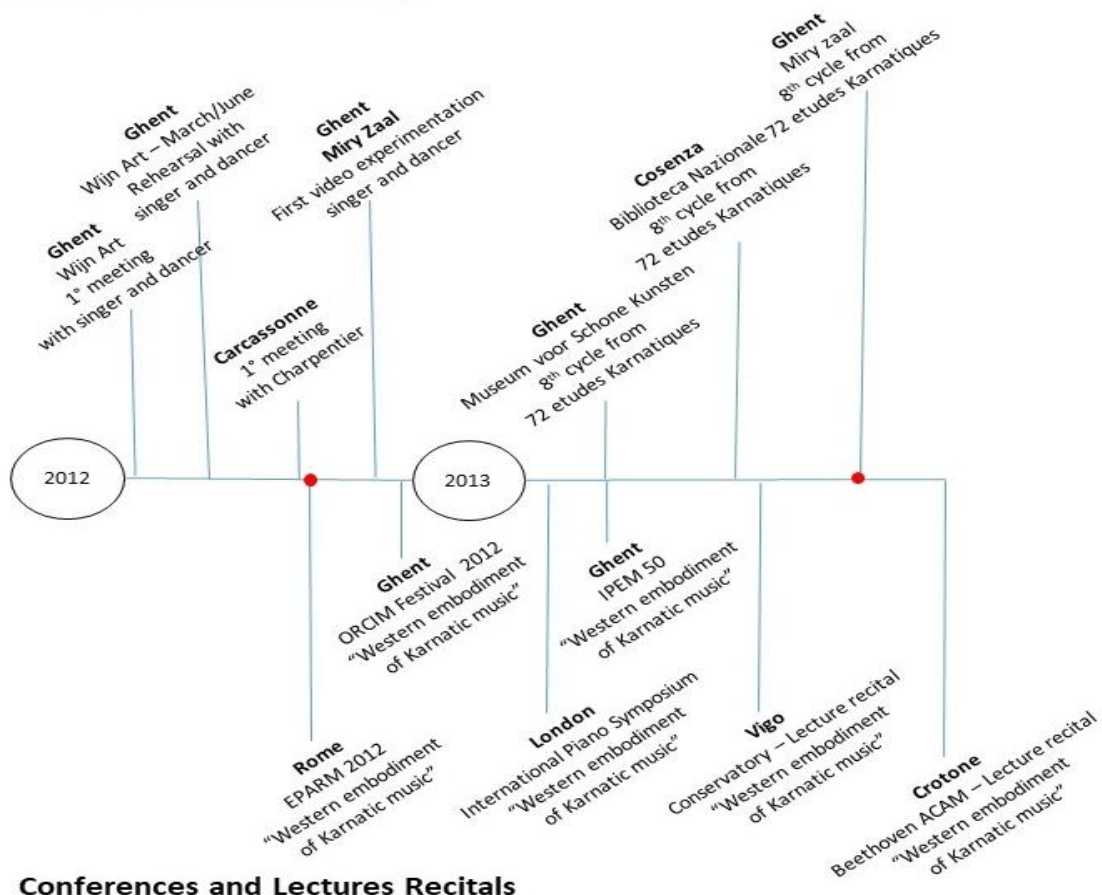
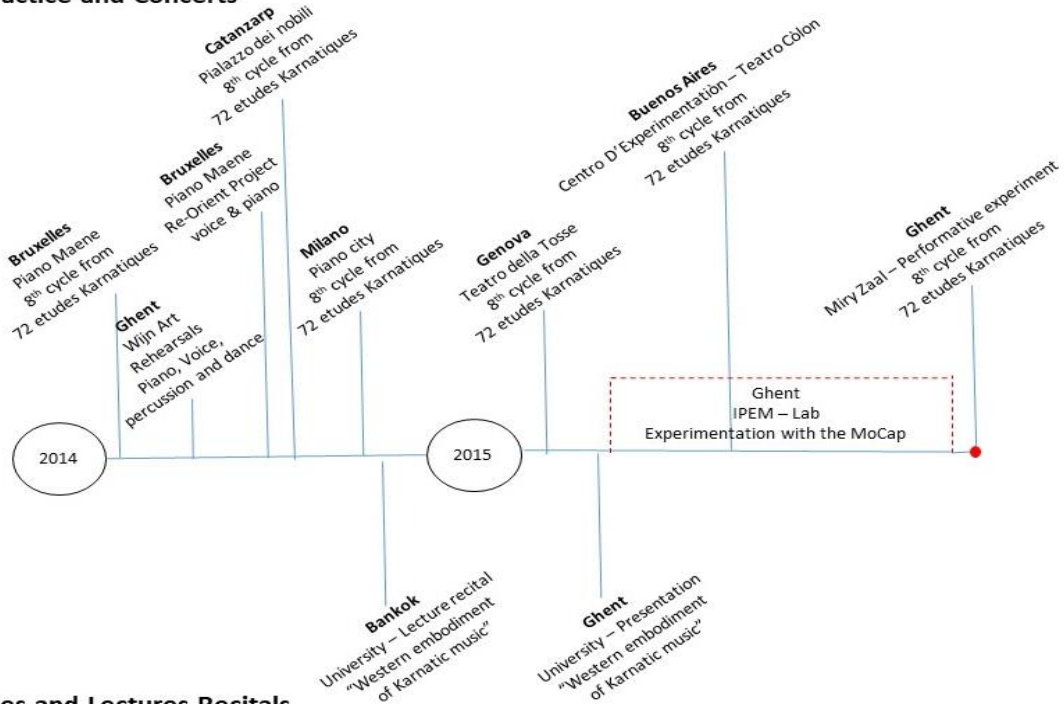


Figure 6.43 This timeline shows a prospect of my artistic process from 2012 to 2013. The red points constitute the milestones of my artistic research.

¹ The media-portfolio inherent to my artistic research is available on <https://www.giusycaruso.wordpress.com>

A complete view of all my artistic activity is available on my website www.giusycaruso.com

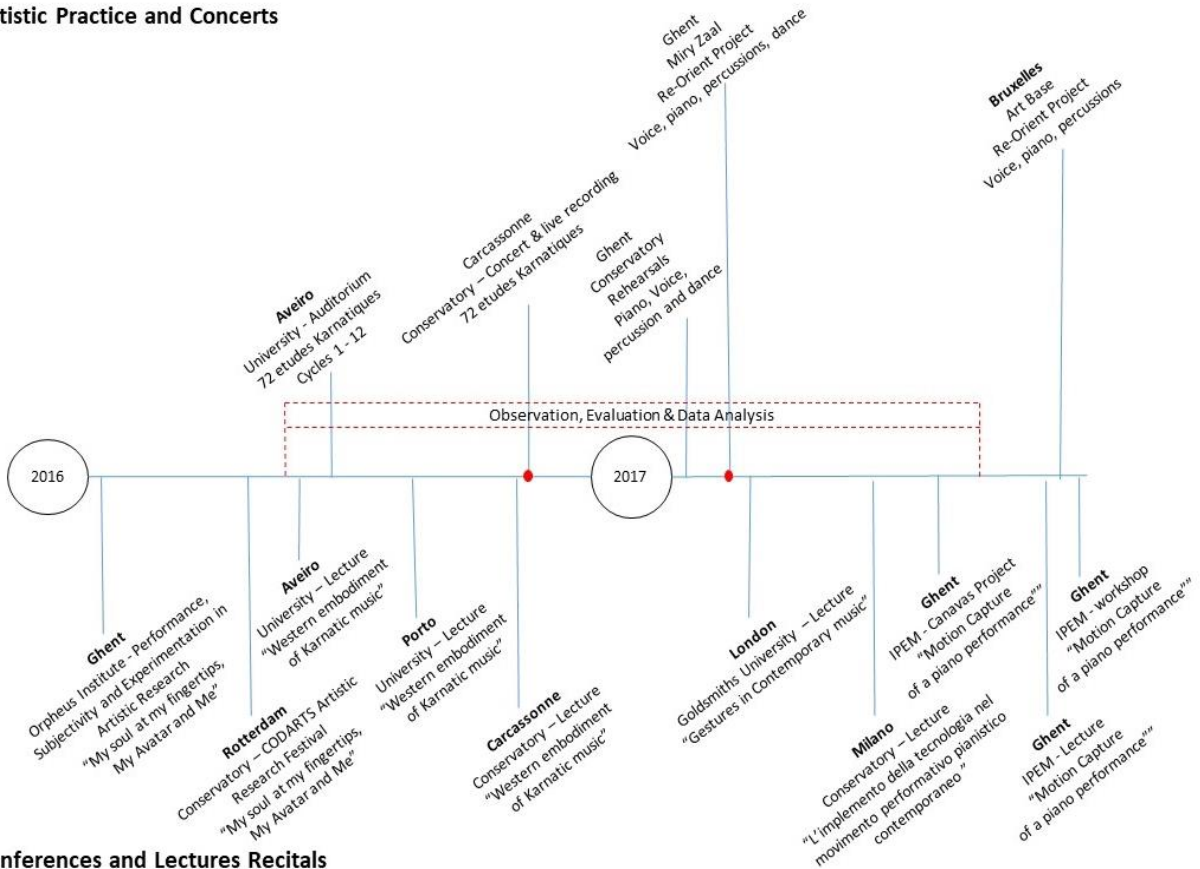
Artistic Practice and Concerts



Conferences and Lectures Recitals

Figure 6.44 This timeline shows a prospect of my artistic process from 2014 to 2015. The red points constitute the milestones of my artistic research.

Artistic Practice and Concerts



Conferences and Lectures Recitals

Figure 6.45 This timeline shows a prospect of my artistic process from 2016 to 2017. The red points constitute the milestones of my artistic research.

My artistic process is outlined in this chapter according to triangular configuration subdivided into experimenting, performing and disseminating (see Figure 6.42 and also Coessens et al. 2009):

- 1) Experimenting:
 - solo practicing
 - joint practice
 - empirical observation
- 2) Performing:
 - solo performances
 - special projects
- 3) Disseminating:
 - performances, projects, lecture recitals
 - recordings and publications
 - guiding and discussing

6.2 Experimenting

6.2.1 Solo practicing

My first approach to the piece goes back to my first year of ManaMa (Post-Master in Contemporary music) at the Royal Conservatory of Ghent when I started practicing the 8th cycle of the *72 Etudes Karnatiques* (February 2012). Each of the 12 cycles of the 72 etudes concerns six etudes written on one scale from the *Melakarta Ragas*. Each Karnatic mode is clearly indicated in Western notation by the composer himself at the beginning of each etude (see also chapter 2). First, I followed the instructions in the score written by Charpentier. Later, through my personal studies on the Karnatic music theory, I became familiar with the Indian philosophical concepts and the meanings of the *ragas* and the *talas* applied to Western notation. Karnatic music is based on fixed pitches (a scale) on which singers, sitarists etc. can improvise by using some micro-intervals.

My first sensation when I heard and when I played for the first time Charpentier's piece was to associate his music to the French contemporary music style of Olivier Messiaen. The same considerations came out when I performed the entire 8th cycle *Quasi una Sonata* during piano lessons and masterclasses with musicians trained in the West-European conservatory tradition. I received guidance concerning the

attack of the key in the numerous accented notes of the piece which had to be played with a precise gesture to obtain sharp timbres and to create more contrasts in the dynamics. Other advices concerned the irregular rhythmical pattern to be performed more precisely, without running, and by following the metronome markings indicated by the composer. During my performance practice, I had two recordings of the piece as point of reference: a first recording by the pianist Ann Gaels (1996) and the most recent one made by the pianist Michael Schäfer (2012). Searching on the literature and recordings available, I was all the more spurred to develop expertise on Indian music to better understand the connection between both musical cultures (Indian and Western) and to shape an interpretation of the piece in respect to the intentions of the composer and the Indian inflections.

6.2.2 Joint practice with the composer and Indian music experts

6.2.2.1 Meetings with Jacques Charpentier

On 5th May 2012, I met the composer Charpentier at Carcassonne. I spent two intensive days discussing about his life, his relation with Indian Music and his relationship with the composer Olivier Messiaen². In that occasion, I performed for him the entire 8th Cycle from his *72 Etudes Karnatiques*. I was at an initial stage of practicing the piece. From his lessons, I learned the philosophical aspects linked to the Indian music tradition and envisioned the piece in terms of articulation, timbre, pedalling and expressive gestures. As I wrote in chapter 2, Indian philosophy and cosmology had a strong impact on Charpentier's conception of sound as it is revealed in his music.

«C'est donc en lisant, en écoutant, en réfléchissant et en étudiant, notamment en découvrant les travaux d'un grand musicien hindou : Sharngadeva (1210-1247) que, petit à petit, je découvris un trésor dont je pressentais qu'il y avait en lui de quoi nourrir et régénérer mon idéal musical»³.

During our meetings, Charpentier gave me the copies of the manuscript of his thesis *Introduction à l'étude des lois de la Musique de l'Inde* (1956) where he explained the Indian music theory, referring to both the Hindustani and Karnatic tradition. In this way, I became aware not only of how he used the modes in Western

² See the interview reported in appendix A.1 and links on my media-portfolio: <https://giusycaruso.wordpress.com/indian-inspired/>

³ From https://www.youtube.com/watch?time_continue=1&v=Dn7jJdwCFTY

notation but of how he also elaborated also some rhythms from the musical tradition of North India. In fact, most of the time, the accented notes of his etudes aim at underlining specific rhythmic pulses which derive from some of these Indian rhythmical patterns, *deçî-tâlas* (see the table in appendix A.2). Other times, accented notes are used in a symbolic meaning to emphasize the idea of sound as vibration (see chapter 2). Therefore, from Charpentier's teachings, I learned more about his organisation of the Karnatic modes in Western notation and his conception of sound and rhythm, and I discovered his connection with the North India rhythmical patterns. Thus, I understood that there were more musical aspects related to the two different Indian music traditions (from the North and from the South) which needed to be deepened in his *72 Etudes Karnatiques*.

First, I had to improve in my execution some rhythmical passages related to the North India music tradition (Figure 6.46). Here are some remarks by the composer:

«...respectez bien les durées [...] ici c'est une imitation de tabla [...] du rythme niççanka... niççanka c'est une signature, c'est la signature de Sharngadeva et Sharngadeva a été le plus grand musicologue de l'histoire de l'humanité. Il a composé le volume Sangita-Ratnakara⁴ traduit par Alain Daniélou... »⁵.

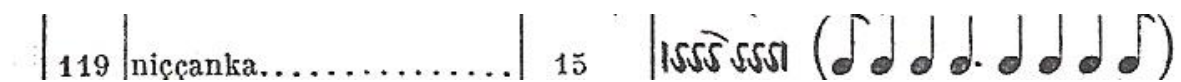


Figure 6.46 The original *niççanka* rhythm form the 120 *deçî-tâlas*.

The composer explained:

« j'ai tiré la noir pour faire de miroir... [dans le morceau] il y a des talas originaux et des talas avec des variations des talas existants »⁶.

⁴ The *Sangita-Ratnakara* literally "Ocean of Music and Dance", is one of the most important Sanskrit musicological texts from India. Charpentier's citation from

https://www.youtube.com/watch?time_continue=1&v=Dn7jJdwCFTY

⁵ From https://www.youtube.com/watch?time_continue=1&v=Dn7jJdwCFTY

See also: Council, I. (2017). The Indian Sarangi : Sound of Affect, Site of Contest. In *Regula Burckhart Qureshi Source : Yearbook for Traditional Music*, Vol.29 (1997), pp. 1-38 Published by : International Council for Traditional Music Stable URL: <http://www.jstor.org/stable/768295>

⁶ From https://www.youtube.com/watch?time_continue=1&v=Dn7jJdwCFTY

The image displays a musical score for a piece in B-flat major, marked with a tempo of quarter note = 15. At the top, a single melodic line consists of seven notes: B-flat, B-flat, B-flat, B-flat, B-flat, B-flat, and B-flat. Below this, two piano accompaniment systems are shown. Each system consists of a treble and bass staff. The first system includes dynamic markings: *sff*, *mf*, *sff*, *mf*, and *simile*. The piano part features a complex rhythmic pattern with many sixteenth notes, accented with red slurs and accents (>). The second system is a mirror image of the first, with the same piano accompaniment but without the dynamic markings.

Figure 6.47 Here there is the elaboration of the *niççanka* rhythm in mirror form made by the composer.

Then, we discussed a lot about the accented notes, which are used most of the time to underline the rhythmic pulse but also to emphasize notes extracted from the relative Karnatic mode on which the etude is based, like in this passage:

43. Gavambodi

Jouer 3 fois
 1ère fois *forte*
 2ème fois *piano*
 3ème fois *fortissimo* } Pédale ouverte jusqu'à la fin de la 3ème fois

(*fff*)

8 basses
 Péd.

R.h. 3
 R.h. 5

The image shows a musical score for a piece titled '43. Gavambodi'. It consists of two systems of piano and right-hand parts. The first system includes performance instructions: 'Jouer 3 fois' (play 3 times), with dynamics '1ère fois forte', '2ème fois piano', and '3ème fois fortissimo'. A bracket indicates 'Pédale ouverte jusqu'à la fin de la 3ème fois' (pedal open until the end of the 3rd time). The score features various musical notations including slurs, accents, and fingerings (1-4). A yellow box highlights a specific passage in the right-hand part. The second system continues the musical notation with similar markings.

Figure 6.48 The accented notes of this passage from the 8th cycle constitute the *Gavambodi* scale.

Finally, we focused on the sustain pedal in the perspective of the Indian concept of sound and its resonance⁷. The composer emphasised how the sustain pedal should not be changed in a romantic style during the transition of harmony neither to accomplish legato passages in the cantabile nor to create some particular timbre. In some passages, the pedal is used by Charpentier to emphasize the resonance of the sound that, when it is sustained, it can reproduce all the series of its harmonics:

«... ne pas coupez la pédale [...] ici il y a la résonance de tout ça..»⁸.

⁷ The piano pedalling technique is an issue of debate in most of the piano production by composers inspired by Oriental music and the concept of resonance, like Debussy, Messiaen, Scelsi, etc.

⁸ From https://www.youtube.com/watch?time_continue=1&v=Dn7jJdwCFTY



Figure 6.49 This figure shows the passage from the 8th cycle where the composer asked to maintain the sustain pedal to create the effect of resonance.

From the composer, I received precious musicological and practical information concerning the interpretation of the 8th cycle and of his entire work. He inspired me to develop an interesting practice through Indian music (both Karnatic and Hindustani) in function of an original interpretation and performance of his piano work.

In January 2015, in occasion of an award conferred to Jacques Charpentier, I went to Carcassonne once more. There, I met Vincent Moreau, who had done in 1989 a first study on Charpentier in his master musicological thesis, *Jacques Charpentier, l'homme et l'œuvre*, Université de Paris 4 Sorbonne. He forwarded me a copy of his thesis although it was not published yet⁹. Moreau's thesis is the unique original historical source available on the composer and his music. In his thesis, I found a very interesting chapter on the *72 Etudes Karnatiques* that contributed to reinforce my idea to start a joint practice with Indian music experts to improve the Karnatic and Hindustani competences. In the following excerpt from Charpentier's interview for Radio France (1985), his choice of Karnatic music is explicit:

«Ni le rigorisme des uns, ni le laisser aller des autres, ou un éventuel exotisme ne surent m'attirer; je m'appliquais donc à réaliser un ensemble d'études, [...] traitant des structures musicales: hauteurs-durées-intensités-timbres, pour lequel le système Karnatique ma parut comme le mieux adapté»¹⁰.

⁹ Moreau, V. (1989). *Jacques Charpentier, l'homme et l'œuvre*, Université de Paris 4 Sorbonne, (private document)

¹⁰ Moreau, V. (1989). *Jacques Charpentier, l'homme et l'œuvre*. Thesis, Université de Paris 4 Sorbonne, p.46 (private document).

6.2.2.2 “Indian-inspired” practice

The idea of re-orienting my practicing and my interpretation of the *72 Etudes Karnatiques* with the aid of Indian Music experts was mostly fostered by the meetings with the composer Jacques Charpentier. I started approaching my “Indian-inspired” practice¹¹ in the winter 2013. At first, I began practicing with the Karnatic singer to see how the Karnatic chant could fit the Western well-tempered system. Charpentier indicates in the score the transcription of the Karnatic modes in Western notation as found in the *Encyclopédie de la Musique* by Lavignac. My first meeting with the singer concerned a discussion on the Karnatic music theory I had learned theoretically by reading Indian music sources (see chapter 2 and bibliography). Through this experience, I realized how the Karnatic *ragas* system (*Melakarta*) is really systematically organized and how it can be transported into the Western scale system (see chapter 2). Then, I experimented with the Karnatic singer how to reproduce some *ragas* on the piano. When I played the Karnatic scales written in Western notation from Charpentier’s score, the singer immediately started singing recognising them. He explained to me, as I had also found in the literature¹², that each Karnatic *raga* is organised in eight fixed pitches - (SA_RI_DA_MA_PA_DHA_NI_SA) - as in our scale where the first and the eighth note are the repetition of the first one. The note SA and the note PA are the central notes of the Karnatic scale and they are placed as the tonic and the dominant in the Western system. Concerning micro-intervals (*śruti*), he explained to me that in the Indian chant they mainly occur in the ornamentation called *Gamaka* (see also chapter 2). Therefore, we considered possible to perform together (piano and voice) improvising on the music of Charpentier to recall the concept of resonance and overcome the limit of the fixed-pitches on the piano¹³. We made some experiments on this practice (documented in my media-portfolio¹⁴). To be sure about the artistic value of these experiments, I started searching on Indian performances and practices to evaluate our idea on performing with hybrid Western/Indian elements and instruments. I discovered some piano performances made by the young Indian pianist Utsav Lal in ensemble with other Indian

¹¹ The term “Indian-inspired” is used here specifically to mean my joint practice with Indian music experts that allowed me to deepen both the Karnatic and Hindustani tradition respectively from South and North India.

¹² See Krishna, A. (2013). *Southern Music. The Karnatik Story*. HarperCollins Publishers.

¹³ The experimentation regarding this joint practice also recalls to me the experimentation that Giacinto Scelsi did by playing the “Ondiola”, which is the first electronic instrument able to produce quarter and eighth tone notes.

¹⁴ See my media-portfolio <https://giusycarusso.wordpress.com/indian-inspired/>

instruments (*tablas*, *Indian flutes*, *sitar*, etc.) including singers¹⁵. I traced another example of the combination of Western/Eastern instrumental practice in other compositions like *Poèmes pour flûte, alto, harpe et trio Ca Trù* (2006) by the Vietnamese contemporary composer Ton-That-Thiet (1933).

These hybrid performances with Western/Oriental instruments spurred me towards a possible combination and fusion of Western and non-western instrumental practice. Playing with the Indian singer made me understand that it is a common Western legend to consider Eastern music based only on free improvisations (Perinu, 1983). In Indian music, as in many other Eastern musical traditions, modes, scales, rhythms, techniques are fixed systems. However, even if Eastern performance practice remains strongly linked to the popular tradition, it holds theoretical values as strong as the Western ones.

Charpentier wrote in his thesis:

«...l'Inde nous offre une des plus étonnantes théories musicales de tous les temps»¹⁶.

Nowadays, Western musicologists agree that the Indian music system is the “third musical system” in the history of music, along with jazz and Western music¹⁷.

These findings reinforced my will to start a collaborative practice together with Indian music experts to “re-orient” my practice and interpretation of the *72 Etdues Karnatiques*. Furthermore, the idea of a joint practice was strengthened also by some advices I received by the Belgian composer, Jan Van Landeghem, in his email in which he comments my first performance of the *Re-Orient* project in the version with piano and voice (26 April 2014)¹⁸. The Belgian composer, who conducted a research on the use of the Karnatic rhythm in Western composition, advised me to study Charpentier’s pieces with some percussionists trained in Indian music in order to improve the precision of the Indian rhythms used in the *72*

¹⁵ Some example of hybrid Indian performances with the use of a grand piano are available on YouTube:
<https://www.youtube.com/watch?v=NJonYYAPJX8>
<https://www.youtube.com/watch?v=LJMAaXLwhvA>
<https://www.youtube.com/watch?v=adov4WQqmpM>

The pianist Utsav Lal was also the first performer on the *fluid piano* invented by Geoffrey Smith. The *Fluid Piano* is acknowledged throughout the world as a revolutionary acoustic musical instrument. It incorporates *Fluid Tuning* mechanisms that enable musicians to alter each note individually and separately by precise microtonal intervals. <http://www.thefluidpiano.com/>

¹⁶ Charpentier, J. (1956). *Introduction à l'étude des lois de la Musique de l'Inde*, p.2 (private document).

¹⁷ Perinu, R. (1983). *La musica Indiana*. Zanibon, Milano, p.8.

¹⁸ See my media-portfolio: <https://giusycarusso.wordpress.com/re-orientproject/>

*etudes Karnatiques*¹⁹. Furthermore, he suggested me to look at the work *Applying Karnatic Rhythmical techniques to Western music* by Rafel Reina, professor at the Royal Conservatory of Amsterdam²⁰. Reina's work suggests a creative rhythmical training through the Karnatic rhythmical techniques in performing complicated rhythmical passages from contemporary music. Reina uses schemes taken from the Karnatic rhythmical system as a method for teaching rhythmic solfege at a higher education. He demonstrated how this learning strategy can improve the creation and interpretation of complex contemporary classical and jazz music. The approach of Reina encouraged me to continue working with Indian music experts in order to acquire an aware interpretation of the rhythmical patterns used in Charpentier's piano work (even if they were elaborated from the 120 Hindustani *deçî-tâlas* from North India). Moreover, my decision was also supported by Roberto Perinu, professor of Indian Music at the Conservatory of Vicenza, during some discussions. He underlined how his own experience with Indian music changed his performing classical music, especially regarding the rhythmical approach²¹.

From these talks, I decided to approach Indian solfege, *konnakol*, by reading Reina's book and by practicing with Western percussionists trained in Indian music. This helped me to learn Indian rhythm in Western notation and to apply *konnakol* structures to some of Charpentier's rhythmical patterns inspired by the 120 *deçî-tâlas* by Sharngadeva in order to refine the precision of my execution. From that moment, I started analysing Charpentier's etudes using the Indian musical structures from the Sharngadeva's system. In this way, I discovered a method to better organize the continuum flux of rhythm (often not systematized in bars). This method, borrowed from the Indian *konnakol* gave me the right key to interpret difficult rhythmical passages as in the example reported in Figure 6.50.

¹⁹ From the email 27/04/2014: *Dear Giusy, herewith I send you some further suggestions for your Karnatic project: - you need to discover the more complex Karnatic rhythms, to study them and to integrate in your improvisations- you might need a professional Indian percussion player to improve rhythmic precision and to reach sensations typical for Karnatic grooves*
Thanks again for the music, wishing you a nice Sunday, send you my kindest regards
Jan Van Landeghem

²⁰ Reina, R. (2015). *Applying Karnatic Rhythmical techniques to Western music*. Ashgate, now Routledge Taylor & Francis Group.

²¹ Perinu, R. (1983). *La musica Indiana*. Zanibon, Milano, p.8.

24 | rangapradipaka..... | 10 | ᳚᳚᳚᳚ ($\text{♩} \text{♩} \text{♩} \text{♩} \text{♩}$)

16.. CHAKAVAKA

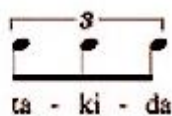
Très vif (♩ = 184 environ)

PIANO
dur et violent

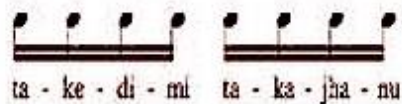
Figure 6.50 This figure shows how I applied the subdivision of the Indian rhythm *rangapradipaka* in Charpentier's *Chakavaka* etude n. 16.

When I started practicing this fragment on the basis of my Western solfège competences, I used to get lost in the voicing structure of this polyphonic passage. Then, after being aware that the composer used the *rangapradipaka* rhythm by Sharngadeva's system in this etude, I organized its rhythmical flux by applying the *rangapradipaka* rhythm structure. In this way, the contrapuntal interplay between the voices was evident and easier to be performed, as shown in the Figure 6.50. The etude n. 24 *Varunaprya* presented another example of a possible *konnakol* application. Before starting thinking in terms of *konnakol* (see Figure 6.51), I had difficulties in following the repetitive rhythmical loop of this piece. Then, the collaboration with the Western percussionists and the application of the *konnakol*²² facilitated the embodiment of the passages in Figures 6.52 and 6.53:

Tisra:



Chatusra:



Khanda:



Misra:



or ta-ke-di-mi-ta-ki-da can also be used.

Figure 6.51 Examples of Indian *konnakol* taken from Reina's work²³.

²² See an extract of my performance together with the percussionists in my media-portfolio: https://www.youtube.com/watch?time_continue=4&v=rUNDvyUCzxo

²³ Examples of basic *konnakol* taken from Reina, R (2015). *Applying Karnatic Rhythmical techniques to Western music*. Ashgate, now Routledge Taylor & Francis Group, p.8.

24.. VARUNAPRYA

Vivace

mf

8^a bassa

8^a b.

8^a b.

Figure 6.52 The initial fragment of the *Varunaprya* etude n.24.

The image displays four systems of handwritten musical notation for a passage from the Gavambodi etude n.23. Each system consists of a grand staff with a treble and bass clef. The notation includes rhythmic patterns and specific konnaKol symbols (D, T, L, R) written above the notes. The first system (measures 15-18) features a treble clef with a key signature of two flats (B-flat and E-flat) and a bass clef with a key signature of one flat (B-flat). The konnaKol notation above the treble staff is: DT - | D - 5 - | D - T | D - | DT - | D - T - | D - T | D - . The second system (measures 19-22) has a treble clef with a key signature of one flat (B-flat) and a bass clef with a key signature of one flat (B-flat). The konnaKol notation above the treble staff is: L, RL, LRL, RL. The third system (measures 23-26) has a treble clef with a key signature of one sharp (F-sharp) and a bass clef with a key signature of one flat (B-flat). The konnaKol notation above the treble staff is: L, RL, LRL, RL. The fourth system (measures 27-30) has a treble clef with a key signature of one flat (B-flat) and a bass clef with a key signature of one flat (B-flat). The konnaKol notation above the treble staff is: L, RL, LRL, RL. Each system includes a dotted line labeled '8 bass' at the bottom of the bass staff.

Figure 6.53 The *konnaKol* applied to a passage from the *Gavambodi* etude n.23.

My “Indian-inspired” practice enriched not only my interpretation of the *72 Etudes Karnatiques* but also improved my skills in piano improvisation through the acquisition of new skills taken from Indian music (as it already happens in jazz or pop music, for example).

Other than working on the conception of sound, timbre and rhythm, I also considered practicing my expressive bodily gestures by collaborating with a Western dancer trained in Indian music. The dancer made me understand the Indian correspondence between sound and gestures, especially as it occurs in an Indian performance:

«...the dancer presents pure abstract movements [...]. The rhythmic structures by the dancer’s feet movements are reproduced on the mrdanga (Indian percussive instrument) [...].The vocalist, as we know, is also connected to the dancer [...]. This is a fine balance, which ensures that music and dance become one...»²⁴ .

During our rehearsals, we co-developed gestural “mirroring” correspondences, as it happens in the Indian performance. The Indian *hastamudras* (hand gestures), like the so-called flowering lotus and the elephant trunk, became the gestural themes of our interactions.

Since the rhythm in the *72 Karnatic Etudes* is based on elaboration of rhythms taken from the Hindustani tradition of North India, we decided to work on two dance styles called *rajasthani* and *kathak*²⁵.

²⁴ Krishna, A. (2013). *Southern Music. The Karnatik Story*. HarperCollins Publisher, pp.224-225.

²⁵ See an extract of the performance on my media-portfolio:
https://www.youtube.com/watch?v=_jbSmWmrz44



Figure 6.54 A moment from the rehearsal with the dancer.

6.2.3 Empirical observation: application of technology and body awareness

On practicing the *72 Etudes Karnatiques*, I was interested in discovering a method to observe and evaluate my body engagement with music.

A way to empirically investigate music performance is to explore the musicians' body reaction to music by applying technology (Leman, 2007). For musicians, technology constitutes a means to achieve a state of body awareness in performing and to collect and transmit the empirical results.

During the International Summer School in Systematic Musicology (ISSM 2012) (see my portfolio in appendix A.6, Hamburg, 2012), I encountered different case studies where technology was applied to the analysis of dance and music performance. Since music performance implies body enactment (Leman, 2016) like in dancing, Motion Capture technology seemed to me a useful tool for the monitoring task of practice-based research, especially for the investigation on the "mirroring" relation of expressive gestures and intentions.

The application of technology as a medium between myself as subject and my body spurred me to start in 2015 a collaboration with the IPEM group. A performative experiment (see chapters 3 and 4) was conceived to verify through the use of technology my body behavior in the performance space (Jensenius, 2007).

As I fully explained in chapter 5, the interaction with technology in the observation of music performance consists in a practice added to a normal practice. The idea of technology as “augmented mirror” led to the co-developed concept of technology-enhanced mirror as a tool that could support music performance analysis in artistic research. The use of technology during my experimentation at IPEM fostered my awareness of my body presence in the performance space. Furthermore, the empirical results gave me a deeper perception on how my gestures are organized in respect to their displacement, velocity and acceleration, and how this organization depends on my music interpretation and intentions (see chapter 5).

Most of the performers’ gestures are consciously controlled in relation to their intentions (Leman, 2007; Legrand, 2007). During their practicing, performers define their motor strategies on their instrument to be applied as pre-constituted models during the performance. These models are used to anticipate and prepare the real actions (see the concept of feedforward by Jeannerod, 2009 and the process of enactment by Leman, 2016). The aspect of preparation of an action refers also to the attitude of performers to imagine their actions (Reed, 1982; Godard, 2002). It often happens to me, before a performance, to mentally study the piece imagining and simulating my actions on the piano. This is a way to prepare my body schema (repertoire of gestures) through my body image (Gallagher, 2005). In this challenge, the perception of the body is translated into a “virtual” place where it is imagined moving in a performance space (Pitozzi, 2011a; 2011b; 2012). Technologies, like the Motion Capture, can simulate gestures and give this specific biofeedback (Pitozzi, 2014). As seen in chapters 3-4-5, the computer simulation offers the opportunity to create models (*avatars*) from the performers’ physical reality to be used as an interface for tracking gestures and producing corporeal measurements. In this virtual reality, the body presence in the performance space is mediated by technology.

In my artistic process, the mediation of technology created a meta-perspective to study my body presence in the performance space. The performative experiment (14 October 2015)²⁶ and the consequent data analysis are other milestones of my

²⁶ See the reportage on my media-portfolio: <https://www.youtube.com/watch?v=tOmF4YeBgvY>

artistic practice because, as elicited in chapter 5, this experimentation concerns the quantitative data that supported the qualitative reflections on my artistic process.

In this way, my practice regarded two circular perspectives, from artistic to scientific and from scientific to artistic, which brought me to assume different levels of experimentation (philosophical reflections, empirical observation and self-evaluation) to a final entanglement of art and science.

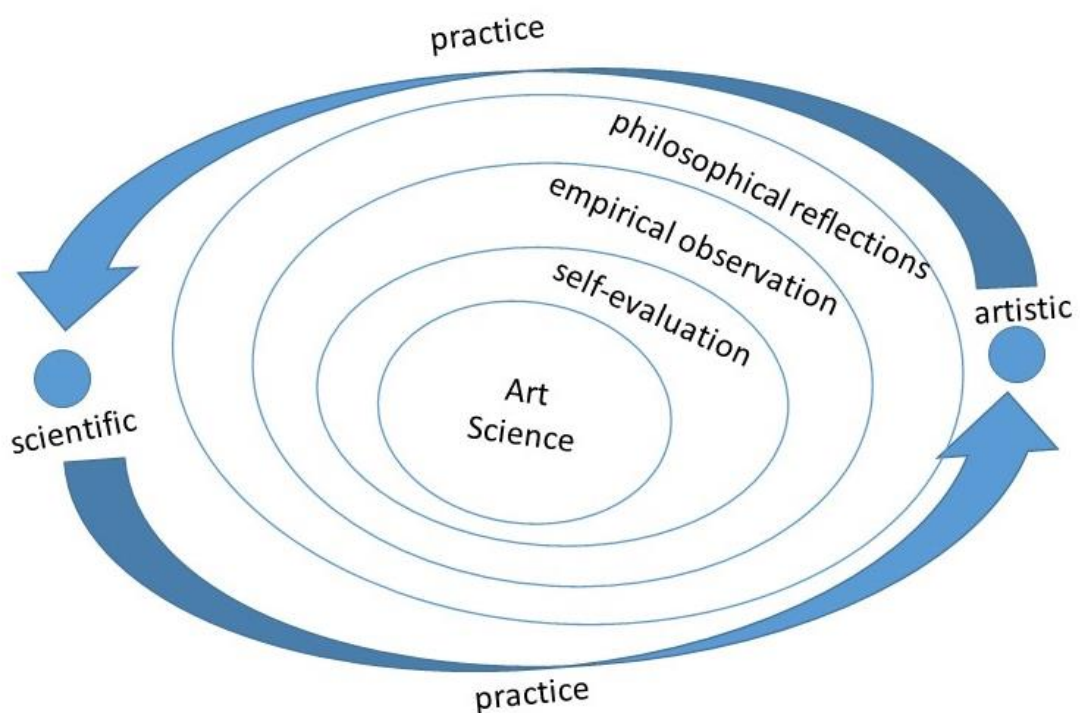


Figure 6.55 The artistic and scientific entanglement in my artistic process.

6.3 Performing

6.3.1 Solo performances

The artistic process also passes through the staging experience documented by written reflections, audio and video recordings. Staging represents for performers the highest level of evaluation of one's own performance since it implies the feedback from the audience. My first staging of the 8th cycle from the *72 Etudes Karnatiques* was programmed on 9th May 2012 in occasion of my performance and lecture at the conference EPARM 2012²⁷. Since this performance took place a few days after my first meeting and lesson with Jacques Charpentier at Carcassonne, I did not have time to practice the piece and to improve my interpretation respecting the teachings I received from the composer. For this reason, I consider this performance the first "milestone" in my artistic process since it represented my initial interpretation of the piece.

When I started collaborating with the Karnatic singer and the dancer, I noticed, by observing my practicing and staging footages, how my bodily approach was changing by my "Indian-inspired" practice. I began to feel a deeper agency in the music being more conceptually involved with the rhythm and with the sound. For example, I noticed how I emphasized my expressive gestures by applying different fingerings, physical approaches and pedal in some passages, as suggested by the composer²⁸. I amplified my gestures to achieve a warmer vibrant timbre in the long notes or to act out some rhythmical patterns. This new "Indian-inspired" approach to the keyboard became evident to me by watching at the 8th cycle video recording I had made for the final recital of my Post-Master in Contemporary music²⁹. This performance constituted the second "milestone" in my staging experience (see Figure 6.43) because it revealed the changes I had from my initial to my developed approach.

In March 2015, I had the opportunity to perform the first part of the *72 Etudes Karnatiques* (6 cycles) during my concert at the University of Aveiro where I was invited to give a lecture-workshop. This performance was another milestone in my staging whose final goal was the solo performance of the entire 12 cycles at the Francis Huster Auditorium of the Conservatory of Carcassonne in the presence of the composer for a special event entitled, *Hommage à Jacques Charpentier* (26

²⁷ See my media-portfolio: <https://www.youtube.com/watch?v=Fxj6VkmB8-A>

²⁸ A detailed explanation is provided in appendix A.5.

²⁹ See my media-portfolio: <https://www.youtube.com/watch?v=TXIzP39cAZw>

November 2016)³⁰. The composer asked me to play the entire piece in three parts, 1 hour each, and to perform, at the beginning of each etude, the inherent Karnatic scale. The concert was recorded live and published by the American label Centaur Records (the three CDs are attached to this dissertation). The live recording of this concert represents the artistic outcome of my research³¹.

6.3.2 The *Re-Orient* project

The project *Re-Orient* was firstly inspired by my experimental practice with the Karnatic singer. It consists of the performance of a selection from Charpentier's 72 *Etudes Karnatiques* enriched by vocal and piano improvisations on Karnatic modes. This project gave me the possibility on the one side to experiment with a live hybrid performance based on a fusion of Indian and Western music; on the other side I was spurred to reflect on the impact of contemporary music on our society (see section 3.2.1 performance space-frame and social dimension). I thought that this project could have become a format accessible to a larger audience. I discussed this idea with Charpentier, who positively reacted to this proposal encouraging me to experiment with new ways to perform his music and to present the contemporary repertoire to a non-expert audience. As reported in the time line Figure 6.43, I gave a first public performance in an embryonal format of the project with the Karnatic singer (26 April 2014, see the portfolio in appendix A.6). The programme included Charpentier's 8th cycle from the 72 *Etudes Karnatiques* and the Suite *Ttai* by Giacinto Scelsi by interweaving voice and piano improvisations³².

³⁰ See my media-portfolio:

<https://giusycarusso.wordpress.com/2016/12/30/carcassone-concert-hommage-a-jacques-charpentien/>

³¹ For the concert *Hommage à Jacques Charpentier* at Carcassonne, I received an important feedback from the composer, a significant review by the French journal *L'Indépendant* and a comment by the French musicologist Brigitte Francois Sappey published as a preface to my program note in the CD booklet. Sappey underlined the historical relevance of this event and of my work comparing it to what Yvonne Loriod had done by performing Olivier Messiaen's piano works (see the details in my media portfolio: <https://giusycarusso.wordpress.com/>).

³² See an extract of the performance on my media-portfolio: <https://giusycarusso.wordpress.com/re-orientproject/>



Figure 6.56 The *Re-Orient* project in Brussels (26 April 2014).

This performance was an opportunity to verify on stage the connection between piano and Karnatic chant. As reported above, the Belgian composer van Landeghem, who attended the concert, spurred us to work on the application of Indian rhythms in our improvisations on Charpentier's music.

At that time, I already had the plan to work with a dancer and Western percussionists trained in Indian music. After a period of practicing singularly with the singer, dancer and percussionists, all together we ended up to conceive the multidisciplinary version of the *Re-Orient* project. The selection from the *72 Etudes Karnatiques* was imbued by Karnatic vocal improvisations, Hindustani rhythmical accompaniment in the percussions and dance to recall the Indian music practice and atmosphere. The idea to improvise in Indian style on the music by Charpentier was not to veil his work but, on the contrary, to emphasize its hybrid content (Indian/Western) enriched by traditional Indian music practice. In accordance with the composer, this performance was conceived to create a performative conjunction between Western and Indian sounds, rhythms and gestures. Our elaboration of Charpentier's piano work recalls the idea of transcription and reproduction of pieces for different instruments, as it already happened in classical music (i.e. the piano transcriptions and paraphrases by Franz Liszt, Ferruccio

Busoni's or the orchestral transcriptions by Maurice Ravel and Modest Mussorgsky).

The *Re-Orient* performance was a fundamental part of my creative process because through this project I reflected on a possible *artistic representation* of the process of musical embodiment, specifically the “mirroring” relation between intentionality and gesture.

Thanks to the collaboration with the Indian music experts, I accomplished my personal interpretation of Charpentier's piano work and, furthermore, I acquired new skills for piano improvisations. I strongly believe that my artistic research could not have been totally achieved without the stage experience I had with the *Re-Orient* project because it represents, for me, the practical and artistic way to live and show the concept of music embodiment.

The *Re-Orient* project is based on this idea of “mirroring” intentionality and gesture, where performance gesture become intended sound and the produced intended sound comes from intended gesture. The Indian dance vocabulary aimed at emphasizing the expressive gestures evoked by the music repertoire through an interaction between the dancer and the musicians. The dancer shaped her choreography by interacting with all the musicians, especially with me, as the pianist (see Figure 6.57)³³.

³³ Extracts from the performance are available on my media-portfolio:
<https://giusycarusso.wordpress.com/re-orientproject/>



Figure 6.57 Some pictures from the *Re-Orient* project performed in the Miry Zaal at the Royal Conservatory of Ghent (8 March 2017).

6.4 Disseminating

6.4.1 Performances, projects, lecture-recitals, recordings and publications

Performances, projects, lecture-recitals, recordings and publications are the way to disseminate one's own artistic research. As outlined in the timeline in Figure 6.43, 6.44, 6.45, complemented by my website (www.giusycaruso.com), my media-portfolio (www.giusycaruso.wordpress.com/) Facebook page and my portfolio in appendix A.6, I had many occasions during these years to present my research in form of performances and lecture-recitals not only in Europe ((Belgium, Italy, Germany, Spain, Portugal, Great Britain, France) but also in South America (*Centro d'Expérimentation Teatro Colon*, Buenos Aires) and Thailand (University of Bangkok), and finally to publish articles and my CDs (A complete list is reported in appendix A.6 with my reflections on some experiences). However, here, I would refer, in particular, to some salient circumstances showing how the disseminating phase affected my artistic process and the orientations of my artistic research.

The question on how to disseminate contemporary music in our society was one of the element that led me to the *Re-Orient* project format. The *Re-Orient* project has the double aim to artistically explore and disseminate the concepts of embodiment, interaction and empathy between different musical cultures (Western/Indian). The visual impact produced by the presence of the dancer was also conceived to render more accessible and comprehensible, especially for a non-expert audience, the conceptual content behind the contemporary piano work by Charpentier and behind the theory of embodiment.

As Pitozzi wrote

«...empathy is a process that concerns the body in presence – meaning, physically present in front of the spectator's eyes...»³⁴.

The *Re-Orient* project aims at this: stimulating through visual and audible interactions the spectators in « ... a reorientation of significance, in which dancers, musicians and audiences all lose track of the North Star »³⁵.

³⁴ Pitozzi, E. (2014). The Perception is a Prism: body, presence, and technologies. In *Brazilian Journal on Presence Studies*. Porto Alegre, v. 4, n. 2, p.174-204.

³⁵ From the brochure of the *Re-Orient* project premiere (8 March 2017) published by the Royal Conservatory of Ghent. See appendix A.7 and my media-portfolio: <https://schoolofartsgent.be/en/calendar-news/calendar/miry-contemporary-giusy-caruso-reorient>

Concerning my lecture-recitals, I should say that questions from my audience (mostly students) contributed to rethink some aspects of my methodology and practice.

During my presentation in Thailand (July 2014), for example, I was really astonished about the reactions of students from a non-western culture to my research proposal. They were very interested in my way of approaching the interpretation of the piece and careful to understand this concept of “mirroring” intentionality and gesture related to the embodiment process. Concerning this issue, they asked me many questions regarding my piano techniques and practice, and requested empirical examples on what were the real corporeal changes during my artistic practice. My answers, supported by my gestural simulations on the piano, clarified my assumptions regarding the relation between my body involvement and intentions but did not cover completely the request on objective references concerning these corporeal changes. This experience strongly contributed in questioning myself on new methods for observing and monitoring artistic practice in artistic research from a more empirical perspective. At that time, I was evaluating and improving my performance only by observing my performance through video and audio recordings. Therefore, I started considering the need of a method that would allow musicians to go one step further in their artistic research by comparing subjective description and empirical results. From that, the idea of the later co-developed performer-*based* analysis method (see chapter 3-4-5).

My artistic process also comprises moments of written reflections in reports, proposals and articles and publications whose reviews always brought out ideas to be developed in my artistic practice and research (e.g. the connection between musicians trained in different musical cultures, the fusion of different instruments, and the encounter of art and science).

6.4.2 Guiding & Discussing

Guiding students and discussing with other researchers and professional musicians who tested the same approach was a good opportunity to explore from a distant prospective how the co-developed performer-*based* analysis method could be applied by other musicians. My scientific and artistic approach transferred to other musicians gave me the opportunity to reflect much more on the weaknesses and strengths of my own artistic process. An interactive exchange is always established between the practices from who is guiding (guiding approach) and who is guided (reproducing approach), as Figure 6.58.

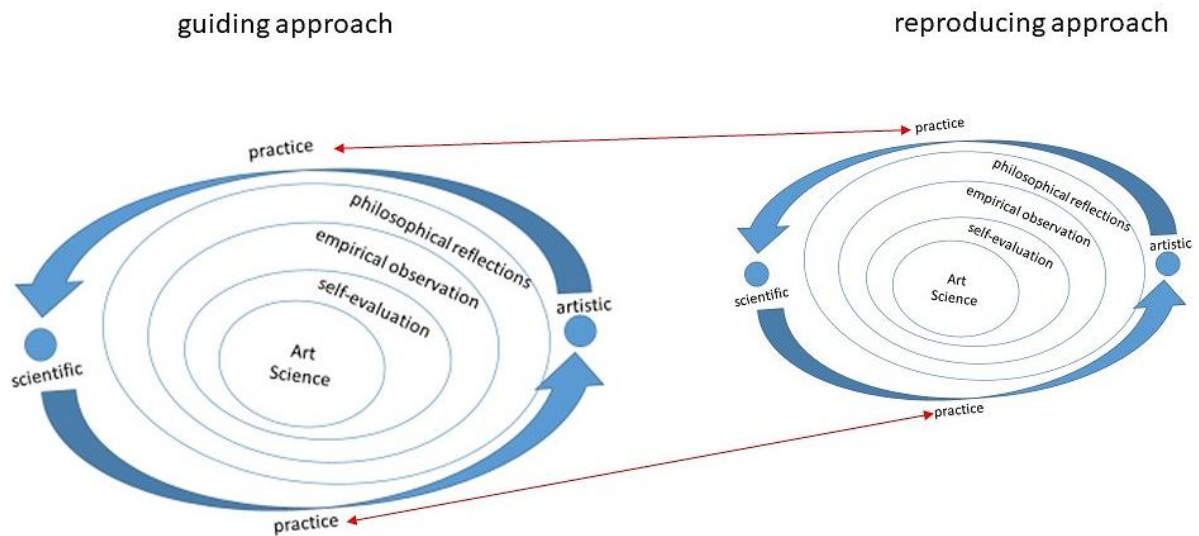


Figure 6.58 Guiding and Reproducing approaches. This figure shows the prospective in observing one's work made by others. The red arrows show the interactive exchanges between the practices from who is guiding (guiding approach) and who is guided (reproducing approach).

This interactive exchange brought me to reflect on how we can learn from the student's perspective³⁶.

6.4.2.1 Experiences with students

During my research, I was a co-promoter to a master student. The objective of the master student's research was to explore gestures in contemporary music, specifically the *Sonatas and Interludes* for prepared piano by John Cage.

We made a performative experiment following the same procedure of the performer-based analysis method (see chapters 3-4). The student gave his performative experiment the afternoon after my experiment (on 16 October 2015). As in my performative experiment, we made motion capture, video and audio recordings of two performances of three fragments from Cage's score, one with the

³⁶ Cook-Sather, A. (2010). *Learning from the student's perspective: a sourcebook for effective teaching*. Paradigm Publishers.

preparation of the piano and the other one without, to see how gestures change in relation to the different sound impact.



Figure 6.59 The performative experiment by Bart Lysens (16 October 2015).

We decided to focus only on the motion analysis in order to investigate how expressive gestures changed in relation to the preparation of the piano. The motion analysis conducted through the software Physmo2 revealed changes in the displacement, specifically major amplitude in the hand gestures during the performance with the piano preparation³⁷. This experimentation brought me to focus on the phenomenon of adaptation of gestures in relation to the produced sound. I realized that an accurate audio analysis was needed to understand the connection between gestures (physical actions) and intentions (related to the interpretation of the score) through the audio feedback.

My experience in guiding the master student led me to consider the need to conduct an audio analysis in my research project. In this way, I could have gathered important audio data to be compared with my qualitative intuition on the musical parameters like tempo, articulation and dynamics, which were part of the

³⁷ See the master thesis by Lysens, B. (2016) *Oriental traces and music intentionality in the performance practice of John Cage's work "Primitive" for prepared piano*. Master Thesis, Ugent.

interpretative cues in my performance model (see chapter 4, Figure 4.26). The comparison between my personal evaluation of the sound feedback of my performance and the empirical results gathered from the audio analysis gave me a concrete awareness of the connection sound-gesture in my performance (see chapter 5).

Further workshops with conservatory and university students (see the detailed list in the portfolio in appendix A.6) led me to deeply reflect on the impact of my artistic research on other musicians. Students' recurrent question concerned the concrete application of complex technologies, like the Motion Capture, in artistic practice. After my experience, I encouraged them to experiment this method because, as explained in chapter 4 and underlined precisely in chapter 5, there are nowadays software that can intuitively be managed by non-experts in computing, like me. From the students' perspectives and questions I was all the more motivated to improve some aspects regarding the dissemination of my methodology and results. These experiences strongly contributed in reinforcing my skills regarding the transmission of knowledge in the context of artistic research, as a researcher and performer.

6.4.2.2 Experiences with researchers and professional musicians

The feedback from professors, supervisors and colleagues are fundamental for one's artistic growth and research progress. I had the opportunity to work at my project in the environment of the IPEM group. Outcomes of my collaboration within the IPEM group are retraced in chapters 2-3-4, which are, actually, two published articles and one in submission. Besides working on my performative experiment, I was involved within the IPEM group in the *Canvas* project. This project took place at the end of my research and it was a salient opportunity to share and discuss the application of the performer-based analysis method with professional concert pianists. The aim of this project, made in collaboration with the IMEC department and recorded by the Canvas television, was to explore the differences recurring between professional musicians and amateurs concerning the bodily approach to the instrument comparing tracked gestures, level of stress and heart beating. The test took place on 20th September 2017 and some data revealed differences in the stress parameters (accentuated in the amateur). More accurate studies and analysis on this project will be undertaken in the future.

On discussing the performer-based analysis method, one of the professional pianists said:

«It is very useful to be able to look in an 'augmented mirror'; being able to hear and see oneself perform a piece from the perspective of the audience but also analysing the movements one makes in combination with an annotated score. This might entail new strategies, by becoming more aware of habits and the impact (un)conscious decisions, and can lead to a further deepening of the interpretation of the piece.»

This experimentation and my interaction with other professional pianists supported me to pursue this pioneering idea of technology-enhanced mirror for self-observation in music performance.

6.5 Conclusion

In this chapter, I outline my artistic process in the form of a retrospective self-report pointing out the activities which determined my artistic growth as a performer and researcher. By adding reflections, comments and examples, I underline how all the experiences I had during these 5 years contributed to draw my artistic pathway and my sense of agency in the interpretation of the *72 Etudes Karnatiques* as well as in my entire research. To transmit musical meanings to the audience, performers have to make interpretive decisions on sound, timing and gestures respecting the composer's idea and implementing at the same time their personal style. Rather than simply analysing the score by naming chords or following harmonies while playing, musicians constantly find inspiration for their interpretation from their lived experiences since the performance is an act of imagination linked also to narratives or metaphors, as recalled by Alfred Cortot³⁸. In this interpretative process, performers transfer their own artistic and performative experience into their interpretations which comprise both aesthetic concerns and performance practice approaches.

My acts of experimenting, performing and disseminating are presented in this chapter through my reflections, witnesses of colleagues, artists and people that affected my research work (documented by my portfolio and media-portfolio). All these experiences constitute a trace of the enrichment I achieved by acquiring new competences and skills as a performer and researcher that determined my embodiment of the *72 Etudes Karnatiques*.

³⁸ Cortot, A.(1939). *Corso d'interpretazione*. (Italian version) Alberto Curci, Milano, Edizioni Curci.

Chapter 7

Discussion and Conclusion: New frontiers for music performance practice and research.

7.1 Introduction

In recent years, music performance analysis has increasingly become an area of studies for performer-researchers and scientists.

Artistic research on music performance has traditionally been dominated by phenomenological reflective observations on, and descriptions of, one's own performance (Borgdorff, 2012). However, the application of subjective narrative methods has opened up questions regarding the validity and reliability of these artistic findings (Coessens et al., 2009).

- Can artistic intuitions be accepted to provide objective data?
- Can individual subjective findings be disseminated as general knowledge?

Scientific research on music performance, on the contrary, is based mainly on verifying hypotheses and on generating objective knowledge by applying empirical methods supported by technology. However, it is argued that performance analysis must incorporate the perspective of the performer to be credible (Hannula, 2005).

1. How can quantitative data explain music performance without referring to the subjectivity of the performers?
2. How can raw measurements offer a complete overview of the artistic phenomenon?

On the one hand, empirical methods based on the digitization of movement and sound are becoming useful references for musicians involved in a research on their

performance (Goebel et al., 2014). On the other hand, the investigation of the variable aspects of the musicians' body articulation and adaptations in performance are becoming of particular interest to scientists (Leman, 2016).

While from the scientific side there is a motivation to develop methodologies that can interweave artistic findings and quantitative data, particularly in the investigation on music performance (Leman, 2016), from the artistic side the collaboration of art and science is welcomed as it can bring innovative and creative approaches to artistic research (Borgdorff, 2012).

Accordingly, a dialogue between art and science may constitute a possible answer in developing methods in the empirical music performance analysis and in opening up new frontiers for artistic research in music performance practice. After all, in this way artists involved in the scientific area can discover through empirical studies a support for the analysis of their artistic process and, conversely, scientists can be supported in the interpretation of retrieved quantitative data by insights from the artistic perspectives¹. And yet, a real entanglement of art and science has not been thoroughly explored.

Until now, a collaborative approach has been applied in a limited amount of studies in the empirical field (see Desmet et al., 2012; Coorevits et al., 2016) as well as in the artistic field (see Schacher, 2015; Dries, 2017).

As a pianist-researcher involved in both artistic/philosophical and scientific domains, I decided to explore in my artistic research the arts-science connection and to experiment with a possible application of empirical approaches in the observation and analysis of my piano performance practice. The aim was to explore whether quantitative data can be really useful for artistic practice and, conversely, to see whether the artistic insights can offer new outlooks to the empirical studies on music performance. The main question concerned how to associate quantitative results to qualitative artistic findings and vice versa.

My performance of the contemporary piano piece *72 Etudes Karnatiques* constituted the case study to explore empirical methodologies applicable to artistic research and to investigate the "mirroring" relation between musical intentionality (my interpretation) and gesture (my physical approach in my performance). My interest in understanding and addressing the process of embodiment in music performance, led me to search how technology could be applied to monitor one's own music performance. To do so, I conducted a performative experiment based

¹ Lapointe, F., J. (2016). On the Role of Experimentation in Art (and Science). In *Journal of the New Media Caucus* | ISSN: 1942-017X, V.12 N.01.
<http://median.newmediacaucus.org/research-creation-explorations/6095-2/>.
(Accessed on 26/09/2017)

on a mixed methodology (performer-*based* analysis method, see Caruso et al., 2016 in chapter 3 and 4 of this dissertation), which integrates subjective (qualitative/top-down approach) and objective perspectives (quantitative/bottom-up approach). Theory (*thinking*), practice (*reflecting while doing*) and production (*doing*) were interweaved in a synthetic conjunction following the triangular artistic research system (see TARS in chapter 1 section 1.3, Figure 1.2).

In this final chapter, the findings of my investigation are discussed to illustrate the contribution of this research work to the artistic and scientific domains and to address the debate on the conjunction of art and science. The entanglement of art and science and the idea of technology-enhanced mirror are proposed in this research as new frontiers for music performance practice and research.

7.2 New frontiers for music performance practice and research

7.2.1 The artistic-scientific entanglement

«...the separation of science and non-science is not only artificial but also detrimental to the advancement of knowledge. If we want to understand nature, if we want to master our physical surroundings, then we must use all ideas, all methods, and not just a small selection of them..»².

Almost forty years ago, the philosopher of science Feyerabend proposed a “pluralistic methodology”³ stating that empiricism, pure thought and creativity should stand together in a method of analysis that is free from a rigid rational schema to discover nature in its totality and guarantee the advancement of knowledge⁴. Accordingly, this research wanted to foster the conjunction of a scientific and artistic approach and the implementation of technology as new frontiers for the investigation on music performance practice.

2 Feyerabend, P. K. (1978). *Against Method: Outline of an Anarchistic Theory of Knowledge*. Verso, London, England, p.305-306.

3 *ibid.* p. 27.

4 *ibid.* p. 21.

Recent empirical studies on music performance (Furuya & Altenmüller, 2013; Buck et al., 2013; Jakubowsky et al., 2017) have not yet sufficiently taken into consideration the performers, i.e. the acknowledgment of their artistic perspective and activity, as integral part of their empirical findings. Performers are mostly considered as mere participants in the experiments, and not as equal partners contributing to hypothesis building, research design, data analysis and interpretation. Therefore, a real partnership in research is still missing (Doğantan-Dack, 2012).

Artistic research on music performance, conversely, is mainly focused on subjective approaches and the systematic dimension is still the matter of open debate (Busch, 2009). As with any other type of research, *practice-based* research requires an object (ontological questions), a boundary of knowledge (epistemological questions), and appropriate procedures (methodological questions)⁵. However, with artistic practice central (art for art's sake), artistic research should not superimpose theory (pure thought) upon practice⁶. Frayling (1993), therefore, proposed a categorization of three artistic research territories of analysis, each of which defines a different angle of investigation on art without being hierarchically organized:

- *into art* a critical and theoretical description of the process of creating an artifact,
- *for art* the discovery of tools and insights for the benefit of the practice of art itself,
- *through art* the investigation of the artistic process and the role of the artifact as subject and object of the research.

Assuming the differences between artistic and scientific investigation identified in the qualitative and quantitative approaches, this dissertation proposes a way to go beyond the dichotomy of art and science and encourages their complementarity and entanglement. This exploratory study illustrates to musicians the possibility of applying empirical methods in the analysis of their performance practice and offers to scientists an example on how to integrate performers' perspectives in their experimentations on music performance.

⁵ Borgdorff, H. A. (2012). *The conflict of the faculties: perspectives on artistic research and academia*. Publisher: Leiden University Press: Amsterdam, p.31.

⁶ Coessens, K., Crispin, D. & Douglas, A. (2009). *The artistic turn: A manifesto*. Ghent, Belgium: Orpheus Institute. Leuven University Press, p.27.

Unlike a conventional deliberate piano performance practice (Rink, 2004), through my empirical work at the IPEM Lab, I had the opportunity to experiment with new tools to enhance my practice and, therefore, to evaluate my artistic expectations from an empirical perspective. While remaining a musician at all times, I also took on the role of a laboratory researcher, engaged in a performative experiment in which technology was applied as an “augmented mirror” to look retrospectively at my practice. However, the mere results from the objective measurements were not the central aim and tool of my artistic research. Rather, data was utilized as an additional means to analyse and comprehend my artistic process and, at the same time, my artistic process was the key in interpreting the data in relation to the music score.

In this way, the quantitative data, including their analysis and interpretation, can be seen as an alternative “narrative” way to “talk” about artistic practice, and qualitative information can be used as a guide to explain data results. In other words, the systematic approach and the implementation of technology have the advantage of revealing aspects of the performance that are not always evident in the musicians’ experience and findings and, conversely, performers possess crucial information to better understand the artistic meaning of raw measurements.

Taking into consideration the mutual resources of art and science, this research argues for hybrid research and proposes a vital role for dialogue between researchers from these two different areas. In short, quantitative data can support the validity, and reliability of the artistic intuition or even develop performance practice and, conversely, the artistic findings serve to give credibility to the quantitative results.

A shared voice between artists and scientists implies the necessity to learn not only a common language but also to master some skills from one side to the other.

As a musician, I tried to acquire the scientific language and procedures required to systematize my investigation; and, in order to interpret empirical results and to guide data analysis, I had to implement my musical vocabulary and expertise.

As a researcher, I highlighted the connection between artistic findings and quantitative results in order to fill the gap concerning the performer’s subjectivity as a variable dimension in the empirical music performance analysis.

Being conscious of the need for further improvements, this artistic research carried on “multiple journeys” which wanted to fuse “multiple forms”⁷ of practicing and analysing. The aim was to achieve an aware and clear image of my performance practice.

⁷ Coessens, K., Crispin, D. & Douglas, A. (2009). *The artistic turn: A manifesto*. Ghent, Belgium: Orpheus Institute. Leuven University Press.p.14.

In entangling art and science, this study can be seen as a pioneering work fostering an interdisciplinary approach to research on music performance in the academic discourse.

7.2.2 The technology-enhanced mirror for self-observation and dissemination of knowledge in the research on music performance

The advances in science and technology offer new means that can improve the analysis and dissemination of knowledge in music performance (Thomsons & Luck, 2012). Traditional technologies, like video and audio recording devices, are already used in performance practice as means to capture and reproduce a live performance (Donağantan-Dack, 2014). In that sense, music performance recordings allow “the reproducibility” of the unique style of each performer (what Benjamin called *aura*⁸). While Benjamin thought that the idea of reproducibility in art constitutes a homologation and, consequently, a demolition of the *aura*, conversely, modern technology could be seen as a foundation of the social (re)construction of the *aura*. Technology permits the transmission and dissemination of the audio and video tradition and stimulates at a social level a reflexive awareness of the expressive and aesthetic qualities of the performances (Heinich, 1983).

Nowadays, there are more sophisticated digital devices than the traditional audio and video recording ones to reproduce and preserve a music performance. These devices are not only capable of reproducing a music performance but also of generating detailed data concerning movement and sound. The Motion Capture System is an example of a digital recording able to reproduce in an augmented reality the body of the performer. The recorded motion capture data is mapped on a digital model in 3D software which tracks the parameters concerning gestures (displacement, velocity, acceleration, quantity of motion).

Audacity and Sonic Visualiser are examples of other technologies that enable the recording and annotation of sound data (timing, loudness, energy, pitches, etc.). Until now, the meta-languages to describe a music performance were traditional writing, sketches designs or graphical representations (Malins & Gray, 1995). From now on, through the use of augmented reality, musicians could look at detailed aspects of their performance in third person, from a distance. They could observe the raw data of their performance from an external perspective (meta-perspective),

⁸ Benjamin, W. (1936). *L'oeuvre d'art à l'ère de sa reproductibilité technique*. tr. fr. Librairie Alcan.

while perceiving detailed information on their performance execution. In that sense, the integration of objective measurements in the self-analysis allows one to move from a first-person evaluation to a third-person evaluation (Caruso et al., 2016, see chapter 3). Subjective reflections on one's own artistic practice are therefore, mediated by technology, which generates empirical results useful to have a better understanding of the artistic process.

Such a quantitative measurement furnishes an alternative representation of the music performance in respect to the traditional narrative one that can reinforce the validity and reliability of the subjective findings and intuition.

In this way, the implementation of technology in artistic research contributes to:

- experimenting with new mirroring methods which can document performance practice;
- performing new practice;
- disseminating knowledge through digital data.

In my artistic research, the idea of the technology-enhanced mirror converged in the co-developed performer-based analysis method applied during my performative experiment (see chapter 3-4-5). This method helped me to evaluate and improve my performance of the *72 Etudes Karnatiques* (see chapter 4-5-6) through an experimental process that aimed at exploring the “mirroring” aspect of intentionality and gesture.

The implementation of the technology-enhanced mirror is a new way for musicians to observe their performance, to disseminate knowledge and to convert their artistic practice into artistic research.

7.3 From artistic practice to artistic research and from artistic research to artistic practice

The artistic process itself entails an implicit investigative nature; it is the natural attitude of the artists to search inspirations, ideas, and techniques from different contexts and to put their findings into practice when creating an artwork. The amount of knowledge acquired while researching in the artistic context constitutes a know-how not separable from the practice itself (Klein, 2010). The question arises then, as to:

What is the boundary between practice and research in the artistic context? What facilitates and determines the passage from artistic practice to artistic research? What is the impact of artistic research on artistic practice?

Artistic research occurs when artistic practice follows specific methods to study and reflect on one's own artistic process (Borgdorff, 2012). Then, the natural research attitude of the artists is turned into conscious research and into a systematic and explicit study finalized at producing (performance and dissemination) (see Coessens et al., 2009). In the artistic process, practice and research are steered in a continuous development from one side to the other. The conjunction of art and science is something that drives the artistic process by moving the artist's practice along this continuum (Figure 7. 60) from an intuitive to a deliberate practice turned into artistic research (see also Baets & Nijs, 2015).

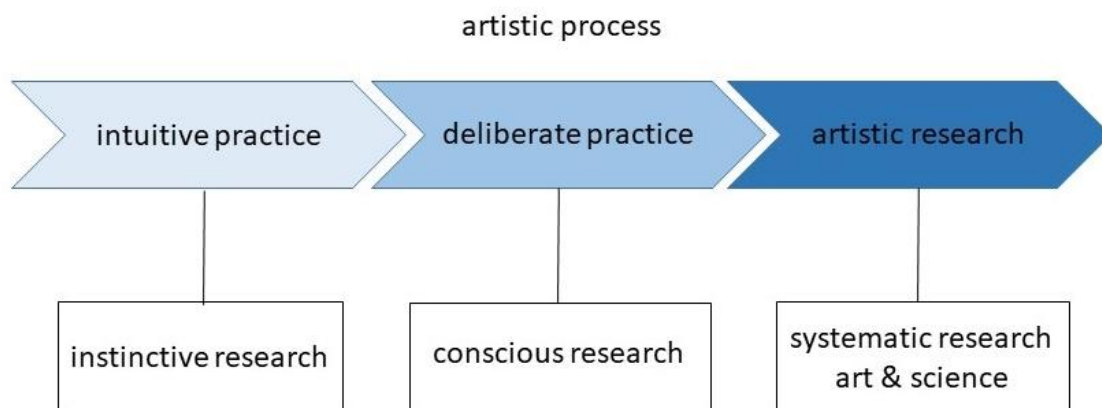


Figure 7.60 The development of the artistic process from intuitive practice (instinctive research) to deliberate practice (conscious research) and then to artistic research (systematic research envisioned in the entanglement of art and science).

In this way, the entanglement of art and science plays a crucial role in the passage from artistic practice to artistic research. If the scientific approaches help to acknowledge the validity and reliability of the subjective artistic findings by contributing to systematic description and dissemination, the artistic intuition preserves the idiosyncrasy of the artistic research outcomes offering credibility to scientific findings.

In my artistic research, the empirical approach and the application of the technology-enhanced mirror are used as feedback to investigate on and to improve my own performance, while directing my practice towards a systematic research

level. In this way, through the co-developed performer-based analysis method (Caruso et al., 2016), I analysed my interpretation of the *72 Etudes Karnatiques* on the basis of the “mirroring” connection between my gestural approaches and intentions, in order to have a conscious perception of my performance.

If the artistic process can follow a path from intuitive to deliberate and finally to systematic research, the outcomes of the artistic research, conversely, may foster new perspectives in the artistic practice.

In my own study, my systematic research reinforced my practice on the basis of three processes: *push-and-pull* process, *experiential learning* process and *disseminating* process.

First, the *push-and-pull* process (extending the concept by Nijs, 2017) concerns the interweaving of the internal and external musical world. My performance practice, based on my traditional musical and cultural background and piano performance approach, was affected by the external stimuli from my environment (i.e. approaching another musical culture, like the Indian one, and applying new empirical studies in monitoring music performance).

The joint practice with the composers and the Indian music experts added explicit knowledge to the tacit information I first had gathered from the score of the *72 Etudes Karnatiques*. This transcultural experience affected my interpretation of the piece, enhanced my skills in my improvisation (in integrating *ragas* and *talas*) and spurred me to create a new performative format appropriate for a larger audience. With regard to the application of technology, quantitative data offered me a meta-perspective for the analysis of my performance. This additional information contributed to a deeper perception of the “mirroring” relation between my intentionality and gesture. The motion and audio data from my performance were a source of significant learning and awareness about my performance in order to control my articulation for better sound results in the future performances.

Second, my agency in the music was determined by all the knowledge I had acquired through my research, characterized as an *experiential learning* (Kolb, 1984).

As Kolb asserts:

«...learning is the process whereby knowledge is created through the transformation of experience»⁹.

⁹ Kolb, D. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Pearson Education, USA, 2015, p.38.

Kolb's *learning model* (Figure 7.61) involves the acquisition of abstract concepts from practice that can be re-integrated into practice in a range of different situations. The concrete experience followed by observation of and reflection on leads to the formation of abstract concepts (analysis) and generalizations (conclusions) which are, then, used to test hypothesis in future situations and to improve further new experiences. Similarly, the process of learning a musical piece consists in the transformation into sound of the musical ideas taken from practical experiences and the self-reflections (researching on music performance). In this sense, Kolb's *learning cycle* can be applied to a music performance learning model (see Figure 7.61).



Figure 7.61 (1). Kolb's *learning model*; (2) music performance learning model.

Within this model, musicians pass from a concrete level of experience (performance practice) to reflective observations, that serve to generate abstract conceptualization (artistic knowledge), to be experimented within a performance (Figure 7.61). This means that the *experiential learning* generates knowledge that that has an impact on the practice.

The *experiential learning* I had through my interactive practice with the composer and Indian music experts let me experiment concretely with the theoretical information on *ragas* and *talas* learned during my theoretical research. This experience converged into staging solo performances and the *Re-Orient* project which show the process of embodiment. Additionally, the *experiential learning* I had in analysing the quantitative data of my performance provided detailed information to help comprehend the connection between my gestures and sound and, then, to describe and evaluate my artistic process more precisely.

Third, practicing while researching aims not only at producing artworks but also at generating knowledge to be disseminated (Coessens, et al., 2009). Dissemination in artistic research includes writings, lectures, performances and recordings. For this task, the integration of the empirical approach assisted and enhanced not only the articulation of my artistic practice but also the validity and reliability of my artistic findings. Furthermore, the transcultural approach gathered from my *Re-Orient* project helped me to conceive new performative ideas for the dissemination of contemporary music to a larger audience.

My study, based on a transcultural musical interplay and supported by cutting edge technology, provides a new frontier for music performance, practice and research. It aims to contribute to the development of:

- a) methods that support the passage from artistic practice to artistic research and emphasize the role of the performer's perspective in the empirical studies;
- b) research approaches that enhance music performance practice;
- c) performative experimentations that promote the dissemination of artistic knowledge to the community of musicians/researchers and to a larger audience.

7.4 Conclusion

The dialogue and entanglement of art and science are proposed in this study as a new frontier for music performance practice and research.

This doctoral dissertation outlines the pathway carried at the core of my artistic research, which focused on my interpretation and practice of the *72 Etudes*

Karnatiques by Jacques Charpentier with the aim of exploring the “mirroring” relation between intentionality and gesture in a piano performance.

To pursue this goal, a methodology, structured in a triangular artistic research system (TARS), was conceived to synthesize theoretical knowledge, practical experiences and experimental approaches conducted using technology. A performer-based analysis method was co-developed and displayed in a performative experiment in order to align subjective experience (top-down approach) and the objective computational analysis (bottom-up approach) as parts of a whole discourse. By foregrounding the value of musicians’ embodied experiences, the performative experiment conceived within this research work shows how the quantitative data represent an easy and accessible feedback for musicians who want to investigate on and improve their own performance. In converging theoretical knowledge, empirical practice and mediation technology, the challenge was to analyse the process of embodiment in piano performance through the analysis of my performance of the *72 Etudes Karnatiques* by using alternative methods to the traditional phenomenological approach (self-reflections).

The contribution of this study to artistic and scientific research was highlighted by revealing how quantitative measurements can support artistic findings and how artistic findings serve for a deeper interpretation of quantitative measurements. Quantitative data provides detailed information that can give deeper insights to the sound and gesture parameters produced by performers, and the performers’ artistic perspectives give information necessary to interpret raw data on gesture and sound. The aim was to bring out and to render explicit the tacit dimension of performance practice in both the artistic and scientific domain.

As a performer and researcher, it was very stimulating for me to sustain the essential contribution of the artistic aspect in the empirical studies on music performance and, conversely, to discover the utility of empirical studies in artistic research.

To sum up, in this study, the scientific and artistic conjunction had an impact in generating new insights concerning my way of *experimenting*, *performing* and *disseminating* as a performer and researcher.

Experimenting with:

1. **Musical ideas.** The Indian music structures, acquired through my theoretical and practical research, added new musical ideas to my artistic practice which re-oriented my interpretation (rhythmical execution, phrasing, timbre, pedal) systematically summarized in the music performance model (see chapter 4, Figure 4.26).

2. **Procedures and methodologies.** The mixed methodology based on both top-down and bottom-up approaches gave me new inspiration in articulating the procedure of my research work as a scholar and in organizing my performance practice as a pianist, keen to carry on an artistic research.
3. **Technology-enhanced mirror.** The implementation of technology in my research provided meaningful creative and intellectual experiences: a) the empirical study on the gestural engagement in music performance led me to reflect on my personal process of enactment, in particular on the changes I produced in my motor strategies; b) the quantitative achievement acquired through the audio and motion analysis supported my artistic expectation regarding the relation between sound and gestural changes.

Performing:

1. **Innovative practice.** Working in a laboratory gave me the opportunity to reinvent my performance practice by implementing technology as an augmented mirror.
2. **Multidisciplinary projects.** The integration of the concept of embodied music cognition in performance practice led me to the multidisciplinary performance *Re-Orient*, specifically directed towards a larger audience.
3. **Multimedia performances.** This experience with technology has stimulated me to conceive of future performance challenges in combining audio/visual technologies with piano performance.

Disseminating:

1. **Language and expertise.** By working in a scientific environment, I had the possibility to expand my vocabulary and to improve my expertise as a researcher and performer.
2. **Validity credibility and reliability.** The integration of the quantitative findings gave me a ground to validate the knowledge acquired from my artistic practice to be transferred to the community of musicians/researchers.
3. **Generalization.** The concepts, the vocabulary and the performative skills acquired through my research led me to disseminate this work through lecture-performances, solo performances, the *Re-Orient* project, the publications of papers and a 3 CDs box for the Centaur Records label.

All the possible outlooks proposed above are summarized in the following figure.

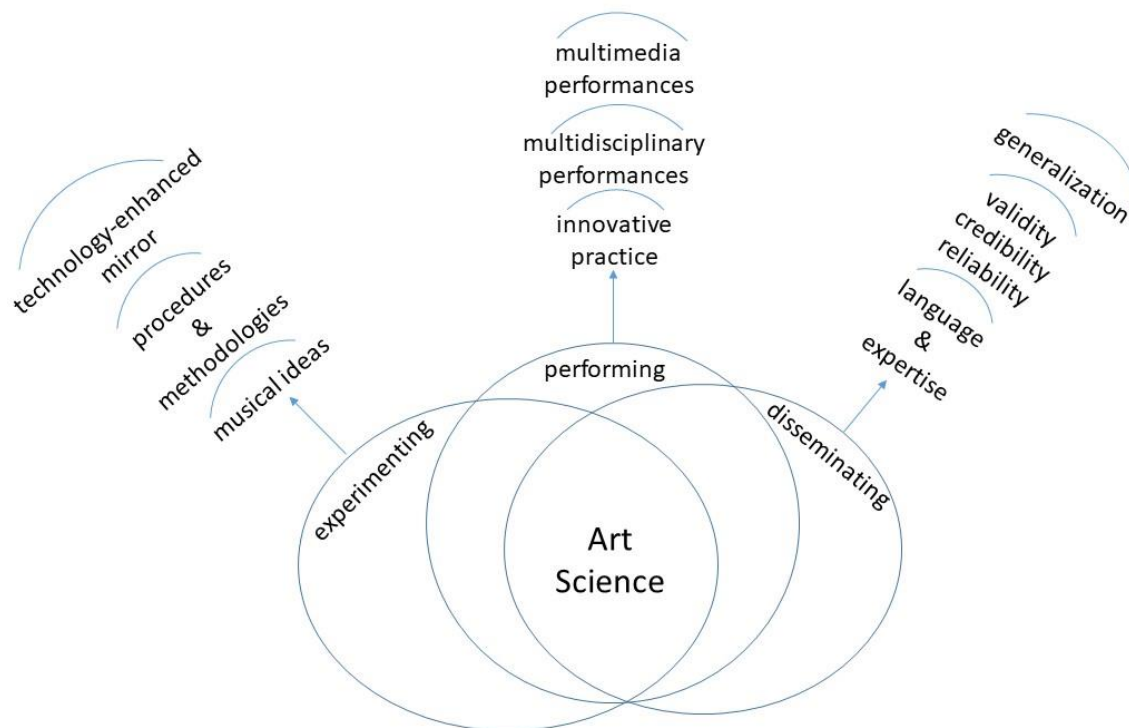


Figure 7. 62 This figure shows how the entanglement of art and science augmented the prospect of possible new outlooks in music performance practice and research.

My experience and the results of this study could open further research works:

1. **Application of Indian music competence in performing.** Indian theory is a precious knowledge to be applied in the interpretation of other contemporary music repertoires and improvisation (see also Reina, 2015)
2. **Extension of the performer-based analysis method for contemporary musicians.** The co-developed methodology of my research could be expanded to different styles, genres, instruments and ensembles to better investigate the connection between intentionality and gesture, and also the interaction and the entrainment between performers, including musicians and dancers.

3. **Studies regarding the connection of gestures, intentionality and timbre.** The integration of midi-recordings for the analysis of sound could include complementary data to generate more accurate results concerning sound and touch related to gesture and intentionality.
4. **Augmented mirror in performance.** The technology-enhanced mirror used in this research for the purpose of music performance analysis could be used for staging purposes, by creating new multimedia performances, which combine audio/visual technologies with acoustic instruments. Research could address the challenges and potential in this, and explore the impact, if any, on audience experience.
5. **Augmented instruments.** The implementation of the motion capture while performing by applying a 3D surround sound with acoustic instruments could contribute to generate new timbre and performative possibilities.

The scenario of this doctoral dissertation outlines how the relation between performers and their performance practice can be changed towards inventive activities that involve the use of technology. The fusion of different musical cultures (Western and Indian in this case) and the entanglement of art and science constitute new frontiers in music performance practice and research, which can open innovative interpretative approaches, renew monitoring methods and facilitate the transmission of knowledge.

Bibliography

- Alon, J., Athitsos, V., Yuan, Q., & Sclaroff, S. (2009). A unified framework for gesture recognition and spatiotemporal gesture segmentation. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 31, 1685–1699.
- Badura Skoda, P. (1962). *L'art de jouer Mozart au piano*. Buchet-Chastel, 1974.
- Barraclough, J. K. (2011). *Phys - Video Motion Analysis* [Computer Software] <http://physmo.sf.net>.
- Beauchamp, J. W. (2010). Perceptually correlated parameters of musical instrument tones. *Proceedings of the Second Vienna Talk*, pp. 19–21, University of Music and Performing Arts Vienna, Austria.
- Benjamin, W. (1936). *L'œuvre d'art à l'ère de sa reproductibilité technique*. tr. fr. Librairie Alcan.
- Benson, B. E. (2003). *The Improvisation of Musical Dialogue: A Phenomenology of Music*. Cambridge, Cambridge University Press.
- Bevilacqua, F., Naugle, L., Dobrian, C. (2007). *Music control from 3D motion capture of dance*. University of California, Irvine.
http://music.arts.uci.edu/dobrian/motioncapture/SoundControl_MotionCapture.pdf
(Accessed on 06/05/2015)
- Bhairavi, S. *The scales of Sindhu Bhairavi*,
<https://sujamusic.wordpress.com/sindhu-bhairavi/> (Accessed on February 2013)
- Bhattacharjya, N. (2000). Book review on *Gerry Farrell Indian Music and the West in Asian Music*, University of Texas Press.
- Bisesi, E. & Parncutt, R. (2010). An accent-based approach to automatic rendering of piano performance. *Proceedings of the Second Vienna Talk on Music Acoustics*, pp. 26-30, Vienna.
- Bloom, B. S. (1953). Thought-processes in lectures and discussions. In *The Journal of General Education*, 7(3), pp. 160–169.

- Bonnie Wade, C. (1978). *Music of India: the Classical tradition*, Edition, illustrated, reprint. Publisher, 1987, Riverdale Company, Incorporated.
- Borgdorff, H. A. (2012). *The conflict of the faculties: perspectives on artistic research and academia*. Publisher: Leiden University Press: Amsterdam.
- Borgdorff, H. A. (2007). *The debate on research in the arts*. Bergen: Kunsthøgskoleni Bergen.
- Botstein, L. (2001). "Modernism". *The New Grove Dictionary of Music and Musicians*, second edition, edited by Stanley Sadie and John Tyrrell. London: Macmillan Publishers.
- Bourgeau, A. (2006). *L'audience de la musique hindoustani*. Ethnographiques.org, 11. <http://www.ethnographiques.org>. (Accessed on 06/02/2008)
- Bowman, W. (1998). Music as experienced. In W. Bowman (Ed.), *Philosophical perspectives on music* (pp. 254–267). New York, NY: Oxford University Press.
- Bransford, J. D., Brown, A. L. & Rodney, R. (2000). *How People Learn: Brain, Mind, Experience and School*. Washington D.C.: National Academy Press. pp. 3-23.
- Broughton, M. & Stevens, C. (2009). Music, movement and marimba: An investigation of the role of movement and gesture in communicating musical expression to an audience. In *Psychology of Music*, 37(2), 137-153.
- Broughton, M. C. & Davidson J. W. (2014). Action and familiarity effects on self and other expert musicians' Laban effort-shape analyses of expressive bodily behaviours in instrumental music performance: a case study approach. In *Front. Psychol.*, 29 October.
- Bruner, J. S. (1986). *Actual minds, possible worlds*. Cambridge, Mass: Harvard University Press.
- Buck, B., MacRitchie, J. & Bailey, N. J. (2013). The interpretive shaping of embodied musical structure in piano performance. In *Empirical Musicology Review*, Vol. 8, n. 2, pp. 92-119.
<http://emusicology.org/article/view/3929/3558>.
- Busch, K. (2009). Artistic Research and the Poetics of Knowledge. In *Art Research*, 2(2), 1-7. Retrieved from
<http://www.artandresearch.org.uk/v2n2/busch.html>
- Cadoz, C. & Wanderley, M. M. (2000). Gesture: music. In M.M. Wanderley & M. Battier (Eds.), *Trends in gestural control of music* (pp. 71-93). Paris, IRCAM/Centre Pompidou.
- Cadoz, C. (1988). Instrumental gesture and musical composition. *Proceedings of the 1998 International Computer Music Conference*. The Hague, The Netherlands, 60C-73.
- Cage, J. (1946). East in the West. In *Asian Music*, Vol. 1, No. 1 (Winter, 1968-1969), pp. 15-18 Published by: University of Texas Press.

- Cannam, C., Landone, C. & Sandler, M. (2010) Sonic Visualiser: An Open Source Application for Viewing, Analysing, and Annotating Music Audio Files. *Proceedings of the ACM Multimedia 2010 International Conference*.
- Carroll, N. (2001). *Beyond Aesthetics*. New York: Cambridge University Press.
- Caruso, G., Coorevits, E., Nijs, L., & Leman, M. (2016). Gestures in contemporary music performance: a method to assist the performer's artistic process. In *Contemporary Music Review*, Volume 35, Issue 4-5: Gesture-Technology Interactions in Contemporary Music.
- Caruso, G. (2016). La femme au toucher ineffable : la pianiste, pédagogue et chercheuse Marie Trautmann, épouse Jaëll. In *Cahiers internationaux de symbolisme*, (C. LEJEUNE, Ed.)143-144-145 (Genre), pp. 27-42.
- Caruso, G. & Leman, M. (2015). Le patrimoine musical indien dans le répertoire pour piano d'Olivier Messiaen et de Jacques Charpentier. In *Cahiers internationaux de symbolisme*, (C. LEJEUNE, Ed.) 140-142 (Patrimoines), pp. 23-56.
- Caruso, G. (2006). Aspects and features of Western and Indian cultures in Olivier Messiaen's conception of music. In *Seminarium Stowarzyszenia De Musica*. <http://seminarium.demusica.w.interia.pl/435/>
- Castellano, G., Mortillaro, M., Camurri, A., Volpe, G. & Scherer, K. (2008). Automated analysis of body movement in emotionally expressive piano performances. In *Music Perception*, 26, pp. 103-119.
- Cervino, A., Lettberg, M., Lisboa, T., & Laws, C. (2011). *The Practice of Practising*. Universitaire Pers Leuven.
- Chadefaux, D., Wanderley, M. M., Le Carrou, J. L., Fabre, B. & Daudet, L. (2012). Experimental study of the musician/instrument interaction in the case of the concert harp. *Proceedings of Acoustics*, 131(1), pp. 844-855.
- Chaffin, R. (2007). Learning Clair de Lune: Retrieval Practice and Expert Memorization. In *Music Perception* 24, pp. 377-93.
- Chaffin, R., Imreh, G., Lemieux, A. F. & Chen, C. (2003). "Seeing the big picture": Piano practice as expert problem solving. In *Music Perception*, 20, pp. 461-485.
- Chaffin, R. & Imreh, G. (2002). Practicing perfection: piano performance as expert memory. In *Psychological Science: A Journal of the American Psychological Society / APS*, 13(4), pp. 342-349.
- Chaffin, R., Imreh, G. (2001). Comparison of Practice and Self-Report as Sources of Information About the Goals of Expert Practice. In *Psychology of Music*, Vol. 29, N. 1, pp. 39-69.
- Charpentier, J. (1956). Introduction à l'étude des lois de la Musique de l'Inde. Private document.
- Charpentier, J. (1984). *72 Etudes Karnatiques*. Vol. 1-12. Alphonse Leduc.

- Clarke, E. & Doffman, M. (2014). Expressive performance in contemporary concert music. In D. Fabian, R. Timmers & E. Schubert, (Eds.), *Expressiveness in music performance: Empirical approaches across styles and cultures* (pp. 98-114). Oxford: Oxford University Press, USA.
- Clarke, E. & Davidson, J. (1998). The body in performance. In Whyndham T (Ed.), *Composition, Performance, Perception: Studies in the creative process in music* (pp. 74-92). Aldershot: Scolar Press.
- Cochrane, T., Fantini, B. & Scherer, K. R. (2013). *The emotional power of music: Multidisciplinary perspectives on musical arousal, expression, and social control*. Oxford: Oxford University Press.
- Coessens, K., Crispin, D. & Douglas, A. (2009). *The artistic turn: A manifesto*. Ghent, Belgium: Orpheus Institute. Leuven University Press.
- Cook, N. (1999). Analysing Performance and Performing Analysis. In *Rethinking Music*, Vol. 8, pp. 239-61.
- Cook-Sather, A. (2010). *Learning from the student's perspective: a sourcebook for effective teaching*. Paradigm Publishers
- Coorevits, E., Moelants, D., Östersjö, S. & Gorton, D. (2016). Decomposing a composition: On the multi-layered analysis of expressive music performance. In M. Aramaki, R. Kronland & S. Ystad (Eds.), *Lecture notes in computer science (LNCS): Post-proceedings of the 11th International Symposium on CMMR* (n.p.). Berlin: Springer.
- Cortot, A. (1950). *Aspects de Chopin*. Italian translation by A. Curci. Edizioni Curci, Milano.
- Cortot, A. (1939). *Corso d'interpretazione*. (Italian version) Alberto Curci, Milano, Edizioni Curci.
- Council, I. (2017). The Indian Sarangi : Sound of Affect, Site of Contest. In *Regula Burckhart Qureshi Source : Yearbook for Traditional Music*, Vol.29 (1997), pp. 1-38 Published by : International Council for Traditional Music Stable URL: <http://www.jstor.org/stable/768295>
- Cruz, R. & Lurnço, S. (2010). Antagonism and Mutual Dependency. Critical Models of Performance and "Piano Interpretation Schools". *CITAR JOURNAL*, pp. 50-53.
- Dahl, S. & Friberg, A. (2007). Visual perception of expressiveness in musicians' body movements. In *Music Perception*, 24(5), 433-454.
- Dahl, S. & Friberg, A. (2004). Expressiveness of musician's body movements in performances on marimba. In A. Camurri & G. Volpe (Eds.), *Gesture-based communication in human-computer interaction*, LNAI 2915 (pp. 479-486). Berlin, Springer Verlag.
- Dalla Bella, S. & Palmer, C. (2011). Rate Effects on Timing, Key Velocity, and Finger Kinematics in Piano Performance. *PLoS ONE*6(6): e20518.

- Danuser, H. & Binkley, T. (1992). *Musikalische Interpretation*. Laaber: Laaber-Verlag.
- Davidson, J. W. (2007). Qualitative insights into the use of expressive body movement in solo piano performance: A case study approach. In *Psychology of Music*, 35(3), pp. 381-401.
- Davidson, J. W. (2005). Bodily communication in musical performance. In Miell D, Macdonald R and Hargreaves D J (Eds.), *Musical Communication* (pp. 215-228). New York: Oxford University Press.
- Davidson, J. W. (1993). Visual perception of performance manner in the movements of solo musicians. In *Psychology of Music*, 21(2), 103-113.
- De Baets, T. & Nijs, L. (2015). Onderzoek door muzikdocenten, is dat wel wetenschap? In *CULTUUR+EDUCATIE*, 15(42), pp. 8-19.
- Delalande, F. (1988). La gestique de Gould : éléments pour une sémiologie du geste musical. In *Glenn Gould* pluriel G. Guertin (Ed.), Glenn Gould, Pluriel. Montreal: Louise Courteau Editrice, pp. 83-111.
- Delalande, F. (1995). Meaning and behavior patterns: The creation of meaning in interpreting and listening to music. In Tarasti E (Ed.) *Musical Signification Essays*. Berlin: Mouton de Gruyter, pp. 219-228
- Deleuze, G. & Parnet C. (2006). *Dialogues II*. New edition, trans. by H. Tomlinson, B. Habberjam, and E. R. Albert. London: Continuum.
- Deliège I, (1987). Grouping conditions in music listening: An approach to Lerdahl and Jack- endoff's grouping preference rules. In *Music Perception*, 4(4), pp. 325-360.
- Desmet, F., Nijs, L., Demey, M., Lesaffre, M., Martens, J. P. & Leman, M. (2012). Assessing a clarinet player's performer textures in relation to locally intended musical targets. In *Journal of New Music Research*, 41(1), pp. 31-48.
- Doğantan-Dack, M. (2015). *Artistic Practice as research in Music: theory, criticism, Practice*. ASHGATE. University of Oxford, UK.
- Doğantan-Dack, M. (2012). The art of research in live music performance. In *Music Performance Research*, 5, pp. 34-48.
- Drake, C., & Palmer, C. (1993). *Accent Structures in Music Performance*. University of California Press Stable URL: <http://www.jstor.org/stable/40285574> (Accessed on 26/06/2016)
- Dreyfus, H. (1996). *The Current Relevance of Merleau-Ponty's*. University of California – Berkeley.
[http:// ejap.louisiana.edu/EJAP/1996.spring/dreyfus.1996.spring.html](http://ejap.louisiana.edu/EJAP/1996.spring/dreyfus.1996.spring.html).
(Accessed on 20/02/2013).
- Dreyfus, L. (2007). Beyond the interpretation of music. In *Tijdschrift Voor Muziektheorie*, 12(3), 253.

- Dries, K. (2017). *“Voyages” – Dualism in artistic research and performance of a saxophone player*. An Interdisciplinary approach. VUB, Brussels.
- Edler, A. (1991). *Schumann e il suo tempo* (Robert Schumann und Sein Zeit), Italian traslation by Laura Dallapiccola, E.D.T. Torino.
- Escaich, T. (1993). Entretien avec Jacques Charpentier. *Intemporel bulletin de la Société Nationale de Musique* n.5, Mars.
<http://mediatheque.ircam.fr/HOTES/SNM/ITPR05ESCA.html>.
(Accessed 05/04/2012)
- Fabian, D., Timmers, R. & Schubert, E. (2014). *Expressiveness in music performance: Empirical approaches across styles and cultures*. Oxford: Oxford University Press, USA.
- Farrell, G. (1997). *Indian Music and the West*, Oxford University Press: Oxford.
- Feyerabend, P. K. (1978). *Against Method: Outline of an Anarchistic Theory of Knowledge*. Verso, London, England.
- Field, M., Gordon, S., Peterson, E., Robinson, R., Stahovich, T. & Alvarado, C. (2009). The effect of task on classification accuracy: Using gesture recognition techniques in free-sketch recognition. *Proceedings of EUROGRAPHICS Symposium on Sketch-Based Interfaces and Modeling*, New Orleans, LA, USA, pp. 499–512.
- Friberg, A. & Bisesi, E. (2014). Using computational models of music performance to model stylistic variations. In D. Fabian, R. Timmers & E. Schubert, (Eds.), *Expressiveness in music performance: Empirical approaches across styles and cultures* (pp. 240-259). Oxford: Oxford University Press, USA.
- Friberg, A. & Battel, G. U. (2002). Structural communication. In Parncutt, R. and McPherson, G. E. (eds.) *The Science and Psychology of Music Performance: Creative Strategies for Teaching and Learning*. Oxford: Oxford University Press, pp. 199-218.
- Furuya, S. & Altenmüller, E. (2013). Flexibility of movement organization in piano performance. In *Frontiers in Human Neuroscience*, 7(July), 173.
<http://doi.org/10.3389/fnhum.2013.00173> (Accessed on 02/02/2016).
- Gabrielsson, A. & Juslin, P. N. (2003). Emotional expression in music. In *Handbook of affective sciences*, ed. R. J. Davidson, K. R. Scherer & H. H. Goldsmith, pp. 503 -34. Oxford University Press.
- Gadamer, H. G. (1960). *Verità e metodo*, Italian translation by G. Vattimo, Bompiani, Milano 1983.
- Gallagher, S. (2005). *How the Body Shapes the Mind*. New York: Oxford. University Press.
- Gallagher, S. (1986). Body image and body schema: A conceptual clarification. In *Journal of Mind and Behaviour*, 7(4), pp. 541-554.
<http://doi.org/10.2307/43853233>.

- Giorgi, A. (2009). *The Descriptive Phenomenological Method in Psychology: A Modified Husserlian Approach*. Pittsburgh, PA: Duquesne University Press.
- Glowinski, D., Baron, N., Shirole, K., Coll, S. Y., Chaabi, L., Ott, T., Rappaz, M. A. & Grandjean, D. (2015). Evaluating music performance and context-sensitivity with Immersive Virtual Environments. In *EAI Endorsed Transactions on Creative Technologies*, Vol. 2, Issue 2-3.
- Godard, H. (2002). Le Geste et sa Perception. In Ginot, I., Michel, M. *La Danse au XXe Siècle*. Paris: Larousse, pp. 235-241.
- Godøy, R. I. & Leman, M. (2010). *Musical gestures: Sound, movement, and meaning*. New York: Routledge.
- Godøy, R. I., Jensenius, A. R., Voldsund, A., Glette, K., Høvin, M. E., Nymoen, K., Skogstad, S. A. & Torresen, J. (2012). Classifying music-related actions. *Proceedings of 12th International Conference on Music Perception and Cognition*, Thessaloniki, Greece.
- Godøy, R.I. (2010). Gestural affordances of musical sound. In R.I. Godøy & M. Leman (Eds.), *Musical gestures: sound, movement, and meaning* (pp. 103-125). New York: Routledge.
- Goebel, W., Dixon, S. & Schubert, E. (2014). Quantitative methods: Motion analysis, audio analysis, and continuous response techniques. In D. Fabian, R. Timmers, & E. Schubert (Eds.), *Expressiveness in music performance - Empirical approaches across styles and cultures* (pp. 221–239). Oxford: Oxford University Press.
- Goebel, W., & Palmer, C. (2013). Temporal Control and Hand Movement Efficiency in Skilled In *Music Performance*. PLoS ONE 8(1): e50901.
- Goebel, W. & Palmer, C. (2009). Synchronization of timing and motion among performing musicians. In *Music Perception*, 26, pp. 427-438.
- Goebel, W. & Palmer, C. (2008). Tactile feedback and timing accuracy in piano performance. In *Experimental Brain Research*, 186, pp. 471-479.
- Goffman, E. (1974). The frame. In C. Counsell & L. Wolf (Eds.), *Performance analysis: An introductory coursebook* (pp. 24-30). New York: Routledge.
- Goodman, N. (1969). *Languages of Art: An Approach to a Theory of Symbols*. Oxford: Oxford University Press.
- Guichard, C. (2004). *Marie Jaëll: The Magic Touch. Piano Music by Mind Training*. Algora Publishing, United States.
- Hannula, M., Suoranta, J., & Vaden, T. (2005). *Artistic research: theories, methods and practices*. Published by Academy of Fine Art, Helsinki, Finland and University of Gothenburg / ArtMonitor, Gothenburg, Sweden 2005.
- Heaton, R. (2012). Contemporary performance practice and tradition. In *Music Performance Research*, 5, pp. 96-104.
- Hegel, G. F. W. (1973). *Fenomenologia dello spirito*, Italian translation E. De Negri, La Nuova Italia, Firenze.

- Heinich, N. (1983). L'aura de Walter Benjamin. In Notes sur L'œuvre d'art à l'ère de sa reproductibilité technique, dans *Actes de la recherche en sciences sociales*, n° 49.
- Himonides, E. (2012). The Misunderstanding of Music-Technology-Education: A Meta Perspective. In *The Oxford Handbook of Music Education*. Oxford University Press, New York, pp. 433-456.
- Huang, E. W. & Fu, L. C. (2009). Gesture stroke recognition using computer vision and linear accelerometer. *Proceedings of 8th IEEE Conference on Automatic Face & Gesture Recognition*, 2008. FG'08, Amsterdam, The Netherlands. pp. 1-6.
- Huang, J., Gamble, D., Sarnlertsophon, K., Wang, X. & Hsiao, S. (2013). Feeling Music: Integration of Auditory and Tactile Inputs. In *Musical Meter Perception. Advances in Experimental Medicine and Biology*, 787, pp. 453-461. http://doi.org/10.1007/978-1-4614-1590-9_50
- Hubrich, S. G. B. (2016). The performer's body in creative interpretations of repertoire music. In *Arts and Humanities in Higher Education*. Vol. 15, issue: 3-4, pp. 337-352.
- Hunter, P. & Schellenberg, E. (2010). Music and emotion. In M. Riess Jones, R. Fay, and A. Popper (Eds.), *Music Perception*. Springer Handbook of Auditory Research, pp. 129–164. New York: Springer.
- Huron, D. & Royal, M., (1996). What is melodic accent? Converging evidence from musical practice. In *Music Perception*, 13, pp. 489-516.
- Jaëlle Trautmann, M. (1897). *Le mécanisme du toucher*. Armand Colin.
- Jakubowski, K., Eerola, T., Alborn, P., Volpe, G., Camurri, A., & Clayton, M. (2017). Extracting Coarse Body Movements from Video in Music Performance: A Comparison of Automated Computer Vision Techniques with Motion Capture Data. In *Frontiers in Digital Humanities*, 4(June), 9. <http://doi.org/10.3389/fdigh.2017.00009>
- Jeannerod, M. (2009). *Le Cerveau Volontaire*. Paris: Odile Jacob.
- Jensenius, A. R., Wanderley, M. M., Godøy, R. I. & Leman, M. (2010). Concepts and methods in research on music-related gestures. In Godøy R I and Leman M (eds.) *Musical Gestures: Sound, Movement, and Meaning*, pp. 12-35. New York: Routledge.
- Jensenius, A. R. (2007). Action - sound: Developing methods and tools to study music- related body movement. *PhD thesis*. Department of Musicology. University of Oslo, Norway.
- Juslin, P. (2005). From mimesis to catharsis: Expression, perception, and induction of emotion in music. In Miell D, MacDonald R and Hargreaves D (Eds.), *Musical communication*, pp. 85-115. Oxford: Oxford University Press.
- Kelchtermans, G., (2009). Who I am in how I teach is the message: self-understanding, vulnerability and reflection. In *Teachers and Teaching: Theory and Practice*, 15(2), pp. 257-272.

- Keller, P. E. (2012). What movement force reveals about cognitive processes in music performance. In Mornell A (Ed.), *Art in motion II*, pp. 115-153.
- Kelley, R. T. (2000). *Tradition, the Avant-Garde, and Individuality in the Music of Messiaen*. <http://www-student.furman.edu/users/r/rkelley/messiaen.htm> (Accessed on 06/05/2015)
- Kivy, P. (1995). *Authenticities: Philosophical Reflections on Musical Performance*. Ithaca, N.Y.: Cornell University Press.
- Klein, J. (2010). The Other Side of the Frame. Artistic Experience as Felt Framing: Fundamental Principles of an Artistic Theory of Relativity. In *Habitus in Habitat II - Other Sides of Cognition*, edited by Sabine Flach and Jan Söffner, 121-137. Bern: Verlag Peter Lang.
- Kolb, D. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Pearson Education, USA, 2015.
- Krishna, A. (2013). *Southern Music. The Karnatik Story*. HarperCollins Publishers.
- Krishnaswamy A. (2004). Melodic atoms for transcribing Carnatic music. *Proceedings of Fifth International Conference on Music Information Retrieval*, Barcelona, Spain, 10-15 October, pp. 345-34.
- Kumar, M. (2017). *Quantum*, Mondadori.
- Kurkela, K. (1995). Tempo deviations and musical signification: A case study. In Tarasti E (Ed.), *Musical signification. Essays in the semiotic theory and analysis of music* (pp. 301-317). New York: Mouton de Gruyter.
- Lapointe, F., J. (2016). On the Role of Experimentation in Art (and Science). In *Journal of the New Media Caucus* | ISSN: 1942-017X, V.12 N.01. <http://median.newmediacaucus.org/research-creation-explorations/6095-2/> (Accessed on 26/09/2017)
- Lavezzoli, P. (2006). *The dawn of Indian music in the West: Bhairavi*. Continuum International Publishing Group.
- Legrand, D. (2007). Subjectivity and the body: introducing basic forms of self-consciousness. In *Conscious Cogn*, vol. 16(3), pp. 577-582
- Leman, M., Nijs, L. & Di Stefano, N. (2017). On the Role of the Hand in the Expression of Music. In Bertolaso M, Di Stefano N (eds) *The Hand. Studies in Applied Philosophy, Epistemology and Rational Ethics*, vol 38. Springer, Cham.
- Leman, M. (2016). *The expressive moment: How interaction (with music) shapes human empowerment*. Cambridge, MA: MIT Press.
- Leman, M. (2008). Systematic musicology at the crossroads of modern music research. In Schneider, A. (Ed.), *Systematic and Comparative Musicology: Concepts, Methods, Findings*. Hamburger Jahrbuch für Musikwissenschaft, 24. Frankfurt am Main: Peter Lang, pp. 89-115.

- Leman, M. (2007). *Embodied music cognition and mediation technology*. Cambridge, MA: MIT Press.
- Lerdahl, F. & Jackendoff, R. (1983). *A generative theory of tonal music*. MIT Press, Cambridge, MA.
- Lourenço, S. (2010). European piano schools: Russian, German and French classical piano interpretation and technique. In *J. Sci. Technol. Arts* 2, 6-14. doi: 10.7559/citarj.v2i1.7
- Lysens, B. (2016) *Oriental traces and music intentionality in the performance practice of John Cage's work "Primitive" for prepared piano*. Master Thesis, Ugent.
- Maes, P. J. (2016). Sensorimotor Grounding of Musical Embodiment and the Role of Prediction: A Review. In *Frontiers Psychol.*; 7: 308.
- Maes, P. J., Giacofci, M. & Leman, M. (2015). Auditory and motor contributions to the timing of melodies under cognitive load. In *Journal of experimental psychology-human perception and performance*. 41(5). pp. 1336-1352
- Maes, P. J., Leman, M., Palmer, C. & Wanderley M. M. (2013). Action-based effects on music perception, *Frontiers in Psychology*, 4, <http://journal.frontiersin.org/Journal/10.3389/fpsyg.2013.01008/full> (Accessed on 19/03/2015).
- Malins, J. & Gray C. (1995). Appropriate Research Methodologies for Artists, Designers & Craftspersons. In *Research as a Learning Process*. The Centre for Research in Art & Design, Gray's School of Art, Faculty of Design, The Robert Gordon University, Aberdeen, Scotland, UK.
- Mazzoni, D., & Dannenberg, R. (1999). *Audacity: A Free, Cross-Platform Digital Audio Editor*. Ver. 1.2.6. Available from www.audacity
- Merleau-Ponty, M. (1962). *Phenomenology of Perception*. London, UK, New York, NY: Routledge & Kegan Paul.
- Messiaen, O. (1999) *Technique de mon langage musical* (1944). Paris, Leduc
- Messiaen, O. (1992) *Traité de Rythme, de Couleur, et d'Ornithologie*. Vol. 1, 2, 7 (1949). Paris, Alphonse Leduc. .
- Metzinger, T. & Windt, J. M. (2015). *Open MIND*. Frankfurt am Main: MIND Group. DOI: 10.15502/9783958571020 <http://open-mind.net/collection.pdf>
- Miranda, E.R., Kirke, A., & Zhang, Q. (2010). Artificial evolution of expressive performance of music: An imitative multi-agent systems approach. In *Computer Music Journal*, 34(1), pp. 80-96.
- Moreau, V. (1989). *Jacques Charpentier, l'homme et l'œuvre*. PhD Thesis, Université de Paris 4 Sorbonne.
- Mudaliyar, A.M.C. (1982) *Oriental Music in European Notation* (1893). Gowri Kuppuswamy & M Hari Haran Cosma publications, Cosmo.
- Narayan, R. & Sorrell, N. (1980). *Indian Music in Performance: A Practical Introduction*. Publisher, Manchester University Press.

- Naveda, L. & Leman, M. (2010). The spatiotemporal representation of dance and music gestures using Topological Gesture Analysis (TGA). In *Music Perception*, 28(1), pp. 93-111.
- Neuhaus, H. (1973). *The art of piano playing*. New York: Praeger Publishers Inc.
- Ng, K., Larkin, O., Koerselmans, T., Ong, B., Schwartz, D., & Bevilacqua, F. (2007). The 3D augmented mirror: motion analysis for string practice training. *Proceedings of the 2007 International Computer Music Conference*, Vol. II, *Immersed Music*, Copenhagen, pp. 53-56.
- Nijs, L. (2017). The merging of musician and musical instrument: incorporation, presence and the levels of embodiment. In Lesaffre, M., Maes, P. J. & Leman, M. *The Routledge Companion to Embodied Music Interaction*, pp.49-57.
- Nijs, L., Lesaffre, M., & Leman, M. (2013). The Musical Instrument as a natural extension of the musician. In M. Castellengo & H. Genevois (Eds), *Music and its instruments* (pp. 467-484). Sampzon, Editions Delatour France.
- Nusseck, M. & Wanderley, M. M. (2009). Music and motion – how music-related ancillary body movements contribute to the experience of music. In *Music Perception*, 26(4), pp. 335-353.
- Pallant, J., (2010). *SPSS Survival Manual: a Step by Step Guide to Data Analysis Using SPSS*. Maidenhead: Open University Press/McGraw-Hill Print.
- Palmer, C. (1997). Music performance. In *Annual Review of Psychology*, 48, pp. 115-38.
- Palmer, C. & Drake, C. (1997). Monitoring and planning capacities in the acquisition of music performance skills. In *Can. J. Exp. Psychol.* 51, pp. 369-384.
- Parncutt, R. (2003). Accents and expression in piano performance. In *Perspektiven und Methoden einer Systemischen Musikwissenschaft* (Festschrift Fricke), Niemöller K.V. [Ed.], pp. 163-185, Peter Lang, Frankfurt/Main, Germany.
- Parncutt, R. (1997). Modeling piano performance: Physics and cognition of a virtual pianist. T. Rikakis (Ed.). *Proceedings of the International Computer Music Conference*, Thessaloniki, Greece (pp. 15-18). San Francisco: International Computer Music Association.
- Parncutt, R. (1994a). Pulse salience and metrical accent in musical rhythms. In *Music Perception*, 11, pp. 409-464.
- Parncutt, R. (1994b). Categorical perception of short rhythmic events. In Friberg A et al. (Eds.), *Proceedings of the 1993 Stockholm Music Acoustics Conference* (pp. 47-52). Stockholm: Royal Swedish Academy of Music.
- Parncutt, R., & McPherson, G. (2002). *The science & psychology of music performance: Creative strategies for teaching and learning*. Oxford: Oxford University Press, USA.
- Pearson, L. (2013). Gesture and the sonic event in Karnatak music. In *Empirical Musicology Review*, Vol 8, No 1.

- Perinu, R. (1983). *La Musica Indiana*. Zanibon, Milano.
- Pfordresher, P. Q. (2003). The role of melodic and rhythmic accents in musical structure. In *Music Perception*, 20, pp. 431-464.
- Pitozzi, E. (2014). The Perception is a Prism: body, presence, and technologies. In *Brazilian Journal on Presence Studies*, Porto Alegre, Vol. 4, N. 2, pp. 174-204.
- Pitozzi, E. (2012). Corpográficos. In Isaacsoon, M. L., Torres Neto, W., *Corpo, Performance, Tecnologia*. Porto Alegre: Universidade Federal do Rio Grande do Sul, pp. 18-42.
- Pitozzi, E. (2011a). Lógica da Composição, Notas sobre a Cena Tecnológica. Moringa, Paraíba, In *Departamento de Artes Cênicas*, Vol. 2, n. 1, pp. 91-112.
- Pitozzi, E. (2011b). Tecnologias da Percepção. Epistemologia do gesto e cena contemporânea. In: Santana, I., Pereira, A., *Poéticas Tecnológicas*. Salvador: Universidade Federal da Bahia, pp. 1-19.
- Platz, F., Kopiez, R., Lehmann, A. C. & Wolf, A. (2014). The influence of deliberate practice on musical achievement: A meta-analysis. In *Frontiers in Psychology*, 5(JUN), pp. 1-14.
- Puissance, H. S. (1970). A Historical and Comparative Approach to the Classification of ragas. In *Selected Reports*, Vol. 1, n. 3. Los Angeles, Institut de musicologie, Université de Californie.
- Rahaim M., (2012) *Musicking Bodies: Gesture and Voice in Hindustani Music (Music Culture)*. Wesleyan University press Middletown CT.
- Rahaim, M. (2011). That Ban(e) of Indian Music: Hearing Politics in The Harmonium. In *The Journal of Asian Studies*, 70(03), 657-682. <http://doi.org/10.1017/S0021911811000854>
- Rahaim, M. (2008). Gesture and Melody in Indian Vocal Music. In *Gesture* 8(3): pp. 325–347.
- Rattalino, P. (1982). *Storia del Pianoforte*. Il Saggiatore, Milano.
- Reed, E. (1982). An Outline of Theory of Action System. In *Journal of Motor Behavior*, London, Taylor & Francis Group, Vol. 14, n. 2, pp. 98-134.
- Reina, R. (2015). *Applying Karnatic Rhythmic techniques to Western music*. Ashgate, now Routledge Taylor & Francis Group.
- Repp, B. H. & Keller, P. E. (2010). Self versus other in piano performance: Detectability of timing perturbations depends on personal playing style. In *Experimental Brain Research*, 202(1), pp. 101–110.
- Repp, B. H. (1997). The aesthetic quality of a quantitatively average music performance: Two preliminary experiments. In *Music Perception*, Vol. 14, pp. 419-44.

- Repp, B. H. (1992). Diversity and commonality in music performance: An analysis of timing microstructure in Schumann's *Träumerei*. In *Journal of the Acoustical Society of America*, Vol. 92, pp. 2546-2568.
- Rink, J. (2004). The State of Play in Performance Studies. In Davidson, J. *The Music Practitioner: Research for the Music Performer, Teacher and Listener*. Aldershot: Ashgate
- Rosen, C. (1995). *The Romantic generation*. Harvard University Press, 1998.
- Rowell, L. (2000). Scale and Mode in the Music of the Early Tamils of South India. In *Music Theory Spectrum*, Vol. 22, n. 2, University of California Press.
- Rowell, L. (1992). *Music and Musical Thought in Early India*, Chicago. University of Chicago Press.
- Rudhyar, D. (1979). *Rebirth of Hindu Music*. Theosophical Publishing House of India, 1928, reissued by Samuel Weiser.
- Said, E. W. (1978). *Orientalism*. New York: Pantheon Books.
- Salveti, G. (1991). *La nascita del Novecento*. Torino, E.D.T.
- Sambamurthy, P. (1998). *A practical course in Carnatic music*. The Indian Music publishing house, (15th edition)
- Samuel, C. (1986). *Olivier Messiaen: Musique et couleur*. English translation by E. T. Glasow, 1994, Amadeus Press, Portland U. S. A.
- Sangeetha Kala Acharya, S. Rajam and Kallidaikurichi Veenai S. Venkatesan, A Confluence of Art and Music on 72 Melakarta ragas. Corporate Communications Dept of L&T, ECC division Chennai, p. 1,
<http://www.indian-heritage.org/music/Melakarta%20Raga%20Booklet%20-%20new.pdf>
(Accessed on 05/05/2015)
- Schacher, J. C., Järveläinen, H., Strinning, C. & Neff, P., (2015). Movement Perception in Music Performance - A Mixed Methods Investigation. *Proceedings of the International Conference on Sound and Music Computing*, SMC'15, Maynooth, Ireland.
- Schön, D. (1984). *The reflective practitioner*. Basic Books: New York.
- Schonberg, H. (1992). *Horowitz: His life and music*. New York: Simon & Schuster.
- Schoonderwaldt, E. & Demoucron, M. (2009). Extraction of bowing parameters from violin performance combining motion capture and sensors. In *The Journal of the Acoustical Society of America*.
- Searle, J. (1983). *Intentionality: An Essay in the Philosophy of Mind*. Cambridge: Cambridge University Press.
- Sherlaw, R. J. (1975). *Messiaen*. JM DENT & SONS LTD, London.
- Simundza, M. (1987) Messiaen's Rhythmical Organisation and Classical Indian Theory of Rhythm (I-II). In *International Review of the Aesthetics and Sociology of Music*, Vol. 18, No. 1. Croatian Musicological Society.
<http://www.jstor.org/stable/836909>

- Sloboda, J. A., Davidson, J. W., Howe, M. J. A., & Moore, D. G. (1996). The role of practice in the development of performing musicians. In *British Journal of Psychology*, 87 (November 2015), pp. 287–309.
- Sloboda, J. A. (1991). Music structure and emotional response: Some empirical findings. In *Psychology of Music*, vol.19, pp. 110-120.
- Suja Sundaram, A. I. (1989) *Shree Muthuswami Dikshitar Keertanaigal*- Madras Book Publications, Mylapore, Chennai.
- Sundberg, J. (1988). Computer synthesis of music performance. In Sloboda J A (Ed.) *Generative processes in music*. Oxford: Clarendon.
- Sutil, N. S. (2015). *Motion and Representation: The Language of Human Movement*. Cambridge, MA: MIT Press.
- Swift, G. (1990). South Indian “Gamaka” and the Violin. In *Asian Music* 21 (2): 71–89. doi:10.2307/834112, University of Texas Press.
- Thomassen, M. T. (1982). Melodic accent: experiments and a tentative model. In *Journal of the Acoustical Society of America*, vol. 71, pp. 1596-1605.
- Thompson, M. & Luck, G. (2012). Exploring relationships between pianists’ body movements, their expressive intentions, and structural elements of the music. In *Musicae Scientiae* 16(1), pp. 19-40.
- Thompson, M. & Luck, G. (2008). Exploring relationships between expressive and structural elements of music and pianists’ gestures. *Proceedings of the Fourth Conference on Interdisciplinary Musicology (CIM08)*, Thessaloniki, Greece, pp. 1–10.
- Tournemire, C. (2008). Messiaen as improviser. In *Dutch Journal of music theory*, Vol.13, n. 2.
- Troncon, R. (1992). *Ricordo di O. Messiaen*, Diastemia.
- Van den Haak, M. J., & De Jong, M. D. (2003). Exploring two methods of usability testing: *Proceedings of Concurrent versus retrospective think-aloud protocols. Professional Communication Conference, 2003. IPCC 2003*. IEEE International, pp. 285-287.
- Van Manen, M. (1990). *Researching lived experience: Human science for an action sensitive pedagogy*. Albany: State University of New York Press.
- Vijayakrishnan, K. G. (2007). The Grammar of Carnatic Music. In *Phonology and Phonetics*. <http://doi.org/10.1515/9783110198881>
- Von Arx, V. A. (2014). *Piano Lessons with Claudio Arrau: A Guide to His Philosophy and Techniques*. New York: Oxford University Press.
- Wanderley, M. M. (1999). Non-obvious performer gestures in instrumental music. In A. Braffort, R. Gherbi, S .Gibet, J. Richardson, & D. Teil (Eds.), *Gesture Workshop: Lecture Notes in Computer Science* (vol. 1739) (pp. 37–48). Berlin: Springer Verlag.

- Wanderley, M. M., Vines, B.W., Middleton, N., McKay, C. & Hatch, W. (2005). The musical significance of clarinetists' ancillary gestures: An exploration of the field. In *Journal of New Music Research*, 34(1), pp. 97–113.
- Westney, W., Grund C. M., Latimer, J., Cloutier A., Yang, J., O'Boyle M., Hou J. & Fang, D. (2015). Musical Embodiment and Perception: Performances, Avatars and Audiences. In *Signata* 6, pp. 353-381.
- Widmer, G. & Goebel, W. (2004). Computational models of expressive music performance: the state of the art. In *Journal of New Music Research*, vol. 33, pp. 203–216. doi: 10.1080/0929821042000317804
- Williamson, R. (2009). Hegel Among the Quantum Physicists, in *International Journal of Žižek Studies* 3 (1).
- Wittenburg, P., Brugman, H., Russel, A., Klassmann, A. & Sloetjes, H. (2006). ELAN: A professional framework for multimodality research. *Proceedings of LREC 2006*, Genova, Italy, 1556–1559.
- Yih, A. (2013). Connecting analysis and performance: a case study for developing an effective approach. In *Gamut* 6/1 (Special feature: A music-theoretical matrix: essay in honor of Allen Forte, Part IV). New Found Press.

Entretien avec Jacques Charpentier¹

1) G.C.: Pourriez-vous parler de votre expérience en Inde et ce qui vous a incité à entreprendre ce voyage pour y rester pendant environ deux ans ?

J.C.: A l'âge de 18 ans, je gagnais ma vie comme pianiste accompagnateur, remplaçant au théâtre des 3 Baudets à Paris où la musique populaire alternait avec des sketches comiques (Pierre Dac, Francis Blanche, Georges Brassens, Jacques Brel, etc....)

J'accompagnais également dans les cinémas de la Société Gaumont les « attractions » qui intervenaient entre les projections des films.

A l'issue d'une prestation, un spectateur est venu me demander si j'étais intéressé par un emploi de pianiste classique au grand Hôtel de Calcutta pour assurer une ambiance musicale de qualité au déjeuner et au diner du grand restaurant de l'hôtel.

Il m'a demandé également si j'étais marié et m'a annoncé qu'il prendrait en charge le voyage et le séjour de ma femme.

J'ai épousé alors Danielle Vouaux, jeune 1^{er} prix des classes de chant du Conservatoire National Supérieur de Musique de Paris, et nous avons embarqué à Southampton sur le bateau polonais « le Batory » qui nous amena 3 semaines plus tard à Bombay. Logés dans le somptueux palace « le Taj Mahal » nous partions deux jours plus tard, en avion pour Calcutta.

¹ This appendix concerns the interview I had with the composer Jacques Charpentier at Carcassonne, 18 March 2015, published in: Caruso, G. & Leman, M. (2015). Le patrimoine musical indien dans le répertoire pour piano d'Olivier Messiaen et de Jacques Charpentier. In *Cahiers internationaux de symbolisme*, (C. LEJEU-NE, Ed.) 140-142 (Patrimoines), pp.23-56.

Le choc de la foule indienne, mêlant ses riches couleurs à une pauvreté inconnue en France fût très violent.

Il nous fallut plusieurs jours d'adaptation car nous étions dans l'ignorance totale d'une civilisation, d'une langue, d'une magnifique écriture parfaitement illisible pour nous, et d'un art musical qui était présent partout, dans les rues et les résidences privées, un art chargé de virtuosité, de profondeurs émotives toutes neuves, un art étranger plein d'attirances et de richesses prometteuses. Je fus séduit !

2) G.C.: Comment avez-vous commencé votre approche avec la musique indienne ? Accidentellement ou intentionnellement ? Qui a été votre gourou, votre professeur indien ?

J.C.: Il est impossible aux Indes d'échapper à la présence de la musique traditionnelle, (du moins à cette époque). La différence des langues m'empêcha de trouver un maître. Ce sont les écrits d'Alain Daniélou qui furent mes premiers maîtres notamment celui intitulé : Introduction to the study of musical scales, Printed by A.Bose at the press.LTD-Bénares (1943).

3) G.C.: Avez-vous eu une expérience pratique de la performance d'ensemble avec de musiciens indiens ?

J.C.: Non, je n'en avais ni le temps, ni les moyens techniques. J'écoutais au hasard des rencontres tous les groupes instrumentaux et vocaux. J'étais fasciné.

J'ai gratté un peu le Sitar mais j'ai vite compris la puissance de ce magnifique instrument et le nombre des années de travail qu'il faudrait pour parvenir à la maîtriser. Ce ne m'était pas possible.

C'est donc en lisant, en écoutant, en réfléchissant et en étudiant, notamment en découvrant les travaux d'un grand musicien hindou : Sharnga-Déva (1210-1247) que, petit à petit, je découvris un trésor dont je pressentais qu'il y avait en lui de quoi nourrir et régénérer mon idéal musical.

4) G.C.: De retour de l'Inde vous avez été étudiant d'Olivier Messiaen au Conservatoire de Paris et bientôt, vous avez commencé à rédiger les 72 Etudes Karnatiques. Quelle importance vous a fourni, votre expérience en Inde et votre relation avec Messiaen, compositeur tout aussi attiré par la musique indienne ?

J.C.: Ce qui captivait essentiellement Olivier Messiaen ce n'était pas tant la musique de l'Inde dans son ensemble mais prioritairement la pensée rythmique, la structure, la symbolique, la théorie et la pratique virtuose des thèmes rythmiques, véritables personnages sonores, ils demandent une maîtrise difficile à imaginer en occident, d'autant que les ragas (les œuvres) ne sont pas écrits...

C'est la victoire suprême de l'expression rythmique qui définit l'écoulement du temps, à travers toutes les parties musicales, mélodies, timbres, percussions et

ordonnance du mouvement. (Nous observons la même maîtrise rythmique dans la musique exclusivement vocale du plain chant, grégorien occidental.)

Lorsque je rencontrais Olivier Messiaen fin 1954, il travaillait déjà à son futur traité de rythme. J'ai pu, modestement, lui indiquer que les rythmes pentaphones (base de 5 et ses multiples) symbolisent le Dieu Shiva, Dieu créateur et destructeur, maître du temps et de l'espace.

Et c'est dans les rythmes hindous, notamment les 120 Déci- Talas et les rythmes grecs qu'il avait étudiés avec Maurice Emmanuel qu'il découvrit le principe des rythmes non rétrogradables. Ils joueront un rôle éminent dans ses œuvres.

Venant de créer les modes à transposition limitée, il ne s'est pas penché sur les structures des modes de la musique classique de l'Inde. Constatons que les 72 modes karnatiques sont nés d'une réflexion qui remonte aux textes védiques (-3000 -2000 avant J.C) et qu'ils sont le catalogue de la totalité des modes de 7 sons. Notamment ceux des Grecs, des Perses, des Arabes, des Musulmans et l'ensemble des musiques chrétiennes. Contenus dans l'octave, ils traverseront les douze degrés inscrits dans la même octave sonore comme les 7 planètes visibles à l'œil nu vont et viennent en parcourant l'espace visuel gradué et défini par les douze constellations visibles.

5) G.C.: Vos 72 études suivent exactement la séquence des 72 modes karnatiques, tel que le système de la « Melakarta Ragas ». Quelle a été la source indienne qui vous a donné l'inspiration ? Y a-t-il une table de modes karnatiques déjà transcrits dans le code occidental, ou bien avez-vous du personnellement indiquer chaque mode en employant la notation occidentale au début de chaque étude ?

J.C.: Les 72 modes karnatiques ont été publiés pour la première fois en occident dans l'Encyclopédie de la Musique-Dictionnaire du conservatoire, dirigé par Albert Lavignac, Professeur au Conservatoire édité à Paris : Librairie Charles Delagrave en 1913.

Ils se trouvent dans le premier volume, à l'intérieur du chapitre intitulé : « INDE » Histoire de la musique des origines à nos jours, écrit par Joanny Grosset, de la faculté des lettres de Lyon.

Les 72 modes karnatiques y sont notés dans leurs deux classes : 1/ avec la quarte juste, 2/ avec le mode relatif ayant la quarte augmentée.

Les noms des modes sont cités dans leur langue originelle (sanskrit) écrits caractère latin. Leur traduction m'a été donnée par Alain Daniélou.

J'ai tenu à les citer pour chaque cycle (6 modes de 7 sont élevés sur le même tétracorde inférieur) pour aider l'interprète à lire et comprendre l'évolution sonore de chacun d'eux. Leur traduction est dans la notice de l'intégrale des 72 études karnatiques enregistrée par Anne Gaels.

6) G.C.: Dans la musique karnatique chaque mode représente une divinité de la philosophie védique et a un caractère et un sens musical très précis. Est-ce que ça a été une source d'inspiration symbolique pour la composition de vos 72 études ? Les explications que vous avez données comme titre ajouté à chaque étude sont-ils reliés à la signification symbolique indienne des modes karnatiques ?

J.C.: Chaque mode est le père d'une construction sonore. Il est le seul à l'origine du discours musical dans lequel je l'ai librement utilisé. Mais j'ai tenu à donner la liste des modes avec leur traduction française pour la beauté des expressions et la force de leur imaginaire.

7) G.C.: Certaines études montrent l'application de cellules rythmiques appartenant aux Talas indiens. Quelles ont été vos critères précis de choix ? Messiaen a déclaré d'avoir utilisé la table de 120 déci-talas. Et vous, à quelle tableau rythmique vous vous êtes inspiré ?

J.C.: J'ai utilisé des rythmes originaux, ainsi que quelques déci-talas, en toute liberté de choix, selon la couleur du mode choisi et de sa place dans la continuité des 72 études.

8) G.C.: La dernière étude "L'Etoile" à une structure en forme d'étoile très complexe et laisse libre l'interprétation même si vous donnez quelques suggestions. Quelle est, donc, la structure de mise en œuvre que vous recommanderiez aux pianistes de l'occident ?

J.C.: La 72^{ème} étude laisse à l'interprète la libre ordonnance des racines sonores indiquées dans « l'Etoile » ;

Elle est en totale différence avec la première étude qui est une sorte de choral en sons- durées, portail d'entrée d'une œuvre qui se termine sans achèvement personnel.

La 72^{ème} étude est l'estuaire de ce long parcours rigoureux. L'interprète devient alors le créateur d'une musique soumise à sa seule inspiration .De ce fait l'ouvrage n'aura jamais de fin identique.

Ceci un hommage à la musique traditionnelle de l'Inde : essentiellement de transmission orale, elle est toujours présente et vivante mais, comme l'eau du fleuve qui s'écoule devant nous, elle n'est jamais la même...

9) G.C.: Dans les 72 études karnatiques le piano y est traité en percussions avec étagement de résonances, avec des sonorités rappelant certains instruments de l'Inde. Pourriez-vous me dire quelles sont exactement ces instruments indiens qui vous ont inspiré et en quelle manière?

J.C.: Je ne peux pas dire qu'un instrument m'a plus inspiré qu'un autre.

La facture instrumentale indienne est d'une richesse et d'une variété exemplaires. Il leur fallait inventer des sources sonores exploitant au mieux les structures théoriques de leur art musical et veiller à ce que chaque instrument puisse, sans problème acoustique majeur, s'exprimer pleinement, aussi bien dans un lieu fermé que dans un lieu de plein air. Problème résolu pour chacun d'eux.

10) G.C.: Pensez-vous que les modes et les rythmes karnatiques ont eu un développement substantiel dans votre langage de la musique occidentale ?

J.C.: Je suis au début d'une découverte qui doit être sérieusement étudiée et réfléchie. Personnellement mes études m'ont permis d'échapper à deux dictatures dont ma génération était la victime.

La plus ancienne, la dictature tonale a une légitimité historique : celle d'avoir permis des combinaisons structurelles à l'origine des grands chefs d'œuvre musicaux de l'humanité.

Je considère la deuxième dictature comme musicalement illégitime. Il s'agit du dodécaphonisme qui amène la possibilité de la création sonore à un jeu intellectuel, plus ou moins virtuose selon une manipulation qui ne correspond à aucune nécessité de l'art de l'écoute. La gamme chromatique, n'ayant ni début ni fin elle est le segment d'une droite sonore qui va de « moins » l'infini à « plus » l'infini. Elle ne dispose que d'un seul intervalle : le demi-ton chromatique tempéré. Elle ne peut moduler mais, seulement se transposer.

C'est alors que brutalement, et ce fut mon premier choc violent, je découvre un trésor musical plusieurs fois millénaire de 72 modes de 7 sons (nous n'en possédons plus que 2) et, à partir de ces 72 bases, par la mise à disposition de procédés subtils, nous pouvons créer et maîtriser jusqu'à 34 .848 modes directement issus des 72 modes primaires...

Dans la même période au début de 1954, le Consul de France à Calcutta, reçoit de notre Ministère des Affaires Etrangères, un lot de disques 78 tours d'œuvres françaises. Ce fut mon deuxième choc.

Parmi ces disques il y avait 5 disques Columbia, étiquette rouge. C'était « trois petites liturgies de la présence divine » d'Olivier Messiaen avec Yvonne Loriod au piano, Ginette Martenot aux ondes Martenot, chœur et orchestre sous la direction de Marcel Couraud.

A l'époque et si loin de la France, je ne connaissais pas le nom de Messiaen. Je fus subjugué par cette œuvre, ne pouvant imaginer qu'une telle musique fut possible. C'est à ce moment-là que je pris la décision de me mettre à étudier les théories des musiques de l'Inde (nord et sud), par leur écoute attentive et ininterrompue et par l'étude d'ouvrages théoriques et techniques. Je pris la décision lors de mon retour en France, de rencontrer celui qui deviendra mon maître et mon ami Olivier Messiaen.

11) G.C.: Dans quelles autres de vos œuvres, à part vos études, avez-vous employé les modes et les rythmes karnatiques ?

J.C.: Après mon « Prélude pour la genèse » pour orchestre à cordes, créé à New York au Carnegie Hall en 1967 sous la direction de Paul Kuentz, et ma symphonie n°4 en hommage à Hector Villa Lobos que je j'ai créée au Conservatoire National Supérieur de Paris en 1973, toutes mes autres œuvres utilisent les modes karnatiques. Cependant je ne m'interdis pas certaines séries, même de 12 sons, certaines consonances, surtout dans l'utilisation des timbres et des durées.

Je n'ai aucune prétention à écrire de la musique classique indienne, les musiciens de l'Inde sont absolument les seuls capables de décider de l'orientation à donner à leur culture musicale. J'écris de la musique occidentale avec un matériau conçu il y a plusieurs millénaires dans le sud du sous-continent indien. Cela m'a libéré de la dictature dodécaphonique et de la fausse nécessité d'abandonner totalement les acquis du système tonal.

Sur le plan rythmique, j'utilise des figures originales, ou d'autres, souvent issues des déci- talas, avec parfois des variantes.

12) G.C.: Après tant d'années, qu'est- ce que vous conservez de précieux dans la pratique de la musique indienne ?

J.C.: Elle m'a sauvé de deux dictatures musicales vécues au XXème siècle.

1/ le dodécaphonisme pur et dur,

2/ la croyance en la disparition de la résonnance tonale.

Mon maitre Olivier Messiaen a échappé à ce désastre intellectuel par les chants d'oiseaux, par les modes à transpositions limités et grâce aux rythmes de l'Inde.

J'y échappe par les échelles des 72 modes karnatiques et des rythmes de l'Inde, ceux d'autres civilisations, et les miens propres.

J'ajoute que les 72 modes sont chacun le géniteur d'un nombre considérable de modes en modifiant le nombre des sons selon que le mode « Père » se présente dans une forme ascendante ou descendante.









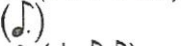





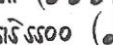
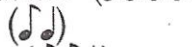
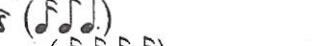






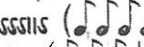









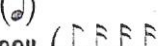


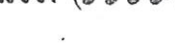




A.2

This appendix concerns a copy of the table of *deçî-tâlas* written in Western notation from *Encyclopédie de la Musique* (1921) by Lavignac.

TABLEAU DES 120 DEÇÎ-TÂLAS
D'APRÈS LE SYSTÈME DE ÇÂRNGADEVA

NOS D'ORDRE	NOMS DES TÂLAS	NOMBRE DES MÂTRIS	NOTATION
1	aditâla	1	1 (♩)
2	dvtiîya	2	001 (♩ ♩)
3	tritiîya	1 3/4	000 (♩ ♩ ♩)
4	caturthaka	2 1/2	110 (♩ ♩ ♩)
5	pañcama	1	00 (♩)
6	niḥṅkaḥila	11	ḥḥḥḥḥḥ (♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩)
7	darpana	3	005 (♩ ♩ ♩)
8	simhaviḥkrama	15	ḥḥḥḥḥḥḥḥḥḥḥḥḥ (♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩)
9	raṭiîla	6	1155 (♩ ♩ ♩ ♩ ♩ ♩)
10	simhaḥila	1 1/2	000 (♩ ♩ ♩)
11	kandarpa	6	00155 (♩ ♩ ♩ ♩ ♩ ♩)
12	vīravikrama	4	1005 (♩ ♩ ♩ ♩)
13	ranga	4	00005 (♩ ♩ ♩ ♩ ♩)
14	çiranga	8	11515 (♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩)
15	caccari	10	00°00°00°00°00°00°00° (♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩)
16	pratyanga	8	ḥḥḥḥḥḥ (♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩)
17	yatiîlagna	1 1/2	01 (♩ ♩)
18	gaḥaḥila	4 1/2	1111 (♩ ♩ ♩ ♩)
19	hamsaḥila	3	111 (♩ ♩ ♩)
20	varnaḥhinna	4	0015 (♩ ♩ ♩ ♩)
21	tribhinna	6	155 (♩ ♩ ♩)
22	râjacûdâmâni	8	001110015 (♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩)
23	rangodyota	10	ḥḥḥḥḥḥ (♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩)
24	rangaḥradipaka	10	ḥḥḥḥḥḥ (♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩)
25	râjatâla	12	ḥḥḥḥḥḥḥḥḥ (♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩)
26	tryasra varna	5	110011 (♩ ♩ ♩ ♩ ♩)
	miçra varna	14 3/4	0000°0000°0000°ḥḥḥḥḥḥḥḥḥ (♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩)
	caturasra varna	6	ḥḥḥḥḥḥ (♩ ♩ ♩ ♩ ♩ ♩)
27	simhaviḥkrîdita	24	ḥḥḥḥḥḥḥḥḥḥḥḥḥḥḥḥḥḥḥḥḥḥḥḥḥḥḥḥḥḥ (♩ ♩)
28	jaya	9	1511005 (♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩)
29	vanamâli	6	00001005 (♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩)
30	hamsanâda	8	15005 (♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩)
31	simhanâda	8	1555 (♩ ♩ ♩ ♩ ♩ ♩ ♩ ♩)
32	kudukka	3	0011 (♩ ♩ ♩)

N ^o D'ORDRE	NOMS DES TĀLAS	NOMBRE DES MĀTRĀS	NOTATION
33	turangalīla	2 1/2	o°o°oo (musical notation)
34	ṣarabhalīla	6	11000011 (musical notation)
35	simhanandana	30	15551500555151515X (musical notation)
36	tribhāngī	6	1515 (musical notation)
37	rangābharana	9	5515 (musical notation)
38	mantha (1 ^o)	8	1155X (musical notation)
	— (2 ^o)	8	515X (musical notation)
	— mudrita (3 ^o)	8	515X (musical notation)
	— (4 ^o)	8	11151 (musical notation)
	[6 autres formes de mantha, en tout 10.]		
39	kokilāpriya	6	515 (musical notation)
40	nihsāruka	3	11 (musical notation)
41	rājavidyādhara	4	1500 (musical notation)
42	jayamangala	8	11515 (musical notation)
43	mālikāmōda	4	110000 (musical notation)
44	vijāyānanda	8	11555 (musical notation)
45	kridā [et] candanihsāruka.	1 1/2	o°o° (musical notation)
46	jayaṣri	8	5515 (musical notation)
47	makaranda	4	00111 (musical notation)
48	kīrti	10	151515 (musical notation)
49	ṣrikīrti	6	1155 (musical notation)
50	pratītāla	2	100 (musical notation)
51	vijaya	8	555 (musical notation)
52	bindumālī	6	500005 (musical notation)
53	sama	3 1/2	110°o° (musical notation)
54	nandana	5	1005 (musical notation)
55	manthikā	5 1/2	505 (musical notation)
	— [ou]	1 1/4	o°o° (musical notation)
56	dīpaka	7	001155 (musical notation)
57	udikshana	4	115 (musical notation)
58	dhenki	5	515 (musical notation)
59	vishama	4 1/2	0000°0000° (musical notation)
60	varnamanthikā	5	1100100 (musical notation)
61	abhinanda	5	11005 (musical notation)
62	ananga	8	15115 (musical notation)
63	nāndī	8	1001155 (musical notation)
64	mālatāla	5 1/4	111100° (musical notation)
65	kankāla (1 ^o) pūrṇa	5	00005 (musical notation)
	— (2 ^o) khandā	5	0055 (musical notation)
	— (3 ^o) sama	5	551 (musical notation)
	— (4 ^o) vishama	5	551 (musical notation)

NON D'ORDRE	NOMS DES TÂLAS	NOMBRE DES MÂTRAS	NOTATION
66	kanduka	6	IIIS ()
67	ekatâli	1/2	o ()
68	kumuda	6	IOOIS ()
	— [ou]	5	IOOOOS ()
69	catustâla	3 1/2	SOOO ()
70	dombuli	3	îî ()
71	abhanga	4	îî ()
72	râyavankola	6	ISOO ()
73	vasanta	9	IISSS ()
74	laghuçekhara	1 1/2	î ()
75	pratâpaçekhara	4 1/4	îOO ()
76	jhampâ	2 1/2	o°oî ()
77	gajajhampa	3 3/4	SOOO ()
78	caturmukha	7	ISîî ()
79	madana	3	oos ()
80	pratimanthaka ou kollaka	8	IISSII ()
81	pârvalilocana	15	SSSîSSOO ()
82	rati	3	îî ()
83	lilâ	4 1/2	oîî ()
84	karanayati	2	OOOO ()
85	lalita	4	OOIS ()
86	gârugi	2 1/4	OOOO ()
87	râjanârâyana	7	OOIS ()
88	laksmiça	4 1/4	OOîî ()
89	lalitapriya	7	IISS ()
90	çrinandana	7	SIîî ()
91	janaka	14	IISSSIIIS ()
92	vardhana	5	OOîî ()
93	râgavardhana	4 3/4	OO°Oî ()
94	shattâla	3	OOOOOO ()
95	antarakridâ	1 3/4	OOO ()
96	hamsa	2 1/2	îî ()
97	utsava	4	îî ()
98	vilokita	6	SOOî ()
99	gaja	4	IIII ()
100	varnayati	3	IIOO ()
101	simha	4 1/2	IOIII ()
102	karuna	2	î ()
103	sârâsa	4 1/2	IOOOII ()
104	candatâla	3 1/2	OOOII ()
105	candrakalâ	16	SSSîSSîî ()

Interview with the Karnatic singer Sandeep Kalathimekkad

1) G.C: Could you describe with some adjectives the meaning and the atmosphere (*rasa*) of the following Karnatic modes from your culture?

S. K: In general, this whole Chakra and all its Ragas have melancholy vibes, hence the *rasa* prevailing is *shoka* (grief, sorrow), yet the sorrow they generate is of a higher plane, more like philosophizing the emotion of grief.

2) G.C.: Do you think that the Western English definition of each Karnatic mode on the following table corresponds to its real Sanskrit meaning? If not, could you integrate its description?

S.K: I think the meaning given is mostly correct.

Mode	Meaning	Atmosphere
<i>Gavambhodi</i> The teacher of the cows	One who makes cattle go silent and obedient	Serene peace with a tint of sadness
<i>Bhavaprya</i> The one dear to Bhava (Shiva)	'Bhava' is a root that means 'you', and in general context 'you' refers to Almighty, and in most schools of thought happen to be lord Shiva	Predominantly sorrowful and strongly melancholic.
<i>Shubhapantuvarali</i> The auspicious moon	'Shubha', the root means something auspicious	This is one raga which is broadcasted on national television played in Shehnai or Sitar when some former prime minister or President passes away; that explains its 'mourning' nature. Also every time art-movies have a strong tragic scene, Shubhapantuvarali is used as background score. Compositions like 'Ennalu Oorage' and 'Sree Satyanarayanam' in this raga are very philosophical too.
<i>Shadvidamargini</i> The one with the road to a hundred forms of knowledge	Shad=100; vida=types of; marga=path; margini= one with paths	Slightly different from the other ragas of this chakra, as with this raga even rasas like shringara (love) and athbhutha (wonder) can be generated
<i>Suvarnangi</i> The golden bodied on	With a body of gold	The 'rasa' is mostly shaanta (peaceful)
<i>Divyamani</i> The divine gem	Divine pearl	Very similar to peaceful but again has a sad overtone to it

3) G.C.: In improvising on Jacques Charpentier's etudes Cycle n.8, did you easily reproduce the Indian atmosphere of each mode on the Western piano timbre?

S.K.: The Cycle n.8 actually was a new experience of encountering these not-so-familiar ragas. Actually only *Shubhapantavarali* is a common raga from this chakra; the rest of them are part of performances very rarely, owing to the difficulty in rendition. During my experience with Charpentier's etudes, I had been able to evoke the atmosphere of these ragas rather neatly I presume, cannot say easy, but was possible.

4) G.C.: Could you follow the rhythmic patterns proposed by the composer who declared to be inspired by the Indian talas?

S.K.: Yes, even a *thanam*-style rendition along with that tala-scheme was attempted in the performances and came out successful.

5) G. C: Do you think that a Western pianist should embody the knowledge and the practice of Karnatic Music in performing this piece in a fairly authentic style?

S.K.: Absolutely, learning of the basic premises of how *ragas* are perceived in Karnatic music is a must. This is because every *raga* have some *jeeva swaras* (notes with life) and some specific phrases associated with it; also where a *Gamaka* (slight movement between two notes) and which note needs a *Gamaka* and how long can only be acquired by getting used to these ragas, at least by listening, if not practicing on piano regularly.

6) G.C.: Could you leave some impression on performing a Western/Karnatic piece?

S.K.: It was an altogether wonderful experience as the fusion of Western and Karnatic styles brought out a truly different sort of atmosphere and I found it at times difficult to visualize the emotional content in some parts of the lesser-known *ragas* like *Suvarnangi* and *Divyamani*; but overall the impression was that a multitude of possibilities lie in the performances of these Charpentier's etudes as they encompass a lot of varied emotions of the respective ragas in it.

Lab Report and Protocol

This appendix constitutes a retrospective diary that documents my experience as an artist researcher with technology (Motion Capture System, Elan and Physmo2) at IPEM Lab.

PURPOSE

Understanding how the aesthetic and interpretive skills acquired from a different background (Indian Music) influence the Western performer's intentional expressivity and musical gestures.

MATERIALS

- Previous video extracts of my performances.
- Optitrack Natural Point Data Recording (MoCap).

PARTICIPANT

Me as a pianist trained in Indian music

METHOD: performer-based analysis method

- 1) Score and video analysis (subjective top-down approach).
- 2) Semi-structured video stimulated interviews, i.e. recall and reflection as in the *thinking-aloud* procedure (Van den Haak & De Jong, 2003) before and after the motion capture experience.
- 3) MoCap data analysis through Physmo2 (objective bottom-up approach).

DATA INTERPRETATION

- Evaluation of the motion capture data extracted from Physmo2 (objective bottom-up approach) together with video and audio annotation data (subjective top-down approach) through ELAN.
- Comparative analysis of the results from the objective bottom-up approach and subjective top-down approach.

SCHEDULE

MARCH 2015

I began my first month at IPEM by giving a presentation of my research at the *Think Tank* on 6th March 2015. The presentation was a good starting point to illustrate my work to all the IPEM staff. From then on, constructive discussions with my colleagues and valid suggestions from my tutor, Dr. Luc Nijs, helped me to reflect and reset the weak parts in the protocol of my experiment.

From the second week of March, I focused on reading some articles regarding the experimentation on piano performance practice to have an idea on how to set up my research in terms of:

- lexical items to express the correlation between movements and musical intentions;
- score and video annotation to be used in ELAN;
- approach to the Motion Capture.

During the second half of March, I concentrated on score and video annotation. I had a workshop on ELAN software with Dr. Frank Desmet after which I started working on three fragments of two video recordings of my performances of the 8th cycle from the *72 Etudes Karnatiques* (Rome, 9th May 2012; Ghent, 26th April 2014). Comparing these two video fragments through the ELAN annotation, I could retrace in my last solo performance (“Indian-inspired approach”) the evolution of my musical gestures after two years working together with a dancer and an Indian singer.

My developed performance shows an amplification in my gestures that appeared more theatrical in function of my embodied intentions.

The video analysis procedure led me to focus on the salient movements retrieved from the Motion Capture recordings.

The literature I read on music expression together with the video annotation of the performances I made through ELAN brought me to consider for my analysis the

movements of the upper part of my body (head, hands, elbows) which manifest more evidently the performer's musical intentions and expressivity.

APRIL – MAY 2015

Since at that time I was a pianist researcher with no skills in using the motion capture system and it was the first time that a piano performance was captured by the Optitrack at IPEM, the setting up of the experiment required more time than I had expected. I spent a period of almost three months working on setting up my experiment under the guidance of Dr. Luc Nijs and with the help of Dr Frank Desmet and Ivan Schepers. In April I had a one-day workshop at the "Politecnico" in Milano under the supervision of Prof. Dr. Giandomenico Caruso, who applies the MoCap system in mechanical engineering.

I also followed a tutorial on:

<https://www.youtube.com/watch?v=4RMz1KVDsbA>

Working with the motion capture, I had to train myself on camera position, calibration, ground plane setup, definition of the rigid body sketch and trajectories of the movements.

Camera position and calibration

It was not easy for me as a pianist to start thinking of a piano performance in function of an excellent motion capture recording. At the beginning, I thought it could have been like any normal video recording, but it required an accurate preparation, instead.

First, I had to determine how to set the camera position in a way that it could be easily transported with all the structural materials in different recording rooms. A fixed bridge was built by Ivan Schepers to support the cameras. Since I had to capture the movement of the upper part of the body (head, both elbows and hands), under the suggestion of Dr. Luc Nijs, I began using a hexagonal configuration of camera setting. This configuration permitted to capture each part of the body from the right angulation. Therefore, two cameras were positioned on the bridge in front of the piano to capture from above the gestures of both hands and head while two cameras on the bridge in the back of the piano traced the movements of the shoulders. Two other cameras were positioned in both lateral sides to capture both elbows.



Figure A4.63 The cameras configuration on the bridge.

Second, I had to elaborate a system, which permitted to easily calibrate the cameras in capturing the performative space around the keyboard where the performer is seated. At the beginning, we thought to calibrate the empty space captured by the cameras by moving the piano backward. However, in calibrating the empty performance space, I noticed to have not delimited the boundaries of the keyboard inside the capturing space. For this reason, I tried to elaborate a systematic strategy to accurately calibrate the capturing performance space by starting indeed from the boundaries of the instrument where I placed four markers.



Figure A4.64 A moment of the Wand calibration procedure.

Looking at the first results of the calibration procedure, we changed many times the position of the cameras and their height to find the precise catching point. At first, we positioned them at 2m 10cm then at 2m 40cm to guarantee the intersection of each camera conic spectrum. Then, we noticed that not all cameras were at the same level so we put the lateral cameras (n. 3 and n. 6) in an upper position.



Figure A4.65 The final cameras configuration.

I tried many solutions to reach an *excellent* camera calibration by setting the data points at 300 minimum. I noticed that to have an excellent calibration, I had to start designing each key of the keyboard with the calibration wand. Then, slowly going to the upper part of the keyboard to capture the position of the head, I finally moved the calibration wand to the lateral sides in order to cover each point of the performance space. I discovered that it was not necessary to cover all the points on the screen but it was important to define the captured volume by drawing and “colouring” all the performance space.

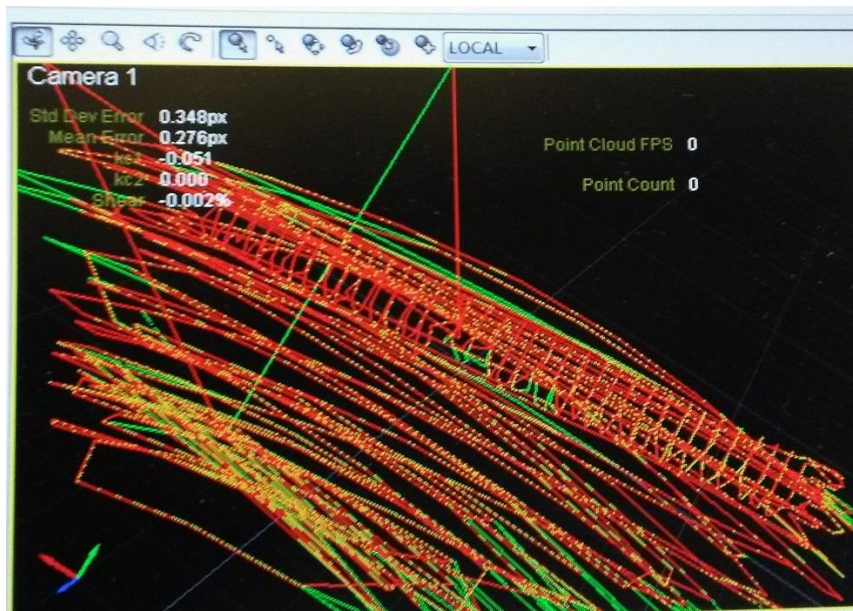


Figure A4.66 This figure shows one of the results of my Wand calibration made by the Optitrack system in which the sketch of the keyboard is drawn.

It was useful to place a screen in the front to see immediately the space covered while calibrating. Since the keyboard sometimes reflected the light, I had to operate “block all visible points”.



Figure A4.67 This screen shot shows all the visible points blocked (white dots).

In this way, the cameras could not carefully track all the movements around the areas of the visible points blocked. Therefore, we decided to perform the calibration with the piano covered by a black sheet.

Then, in order to define the origin of the three-dimensional space, we decided to set the L-shaped reference structure not on the floor but on the stool where the pianist is seated to better capture the movements of the upper part of the body.

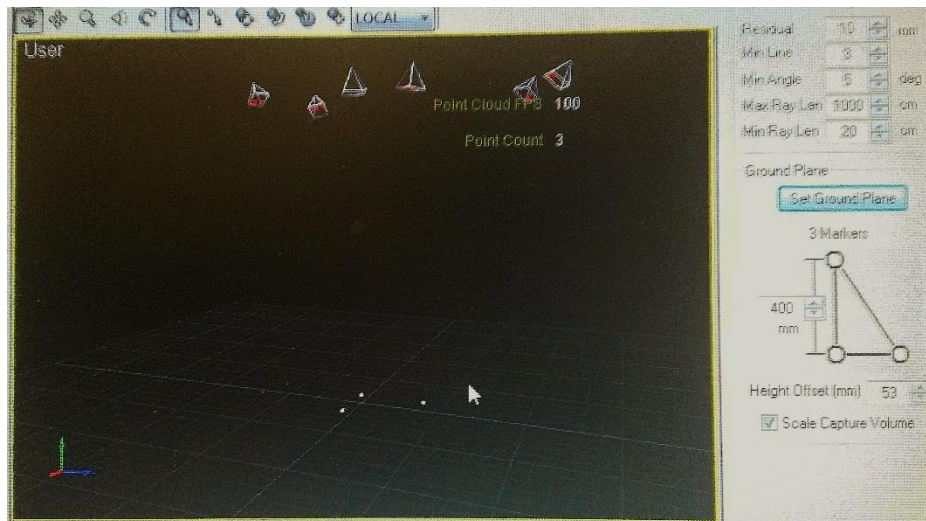


Figure A4.68 This screen shot shows the position of the L-shaped reference structure.

Following this procedure, the calibration was well performed by proving an excellent captured volume.

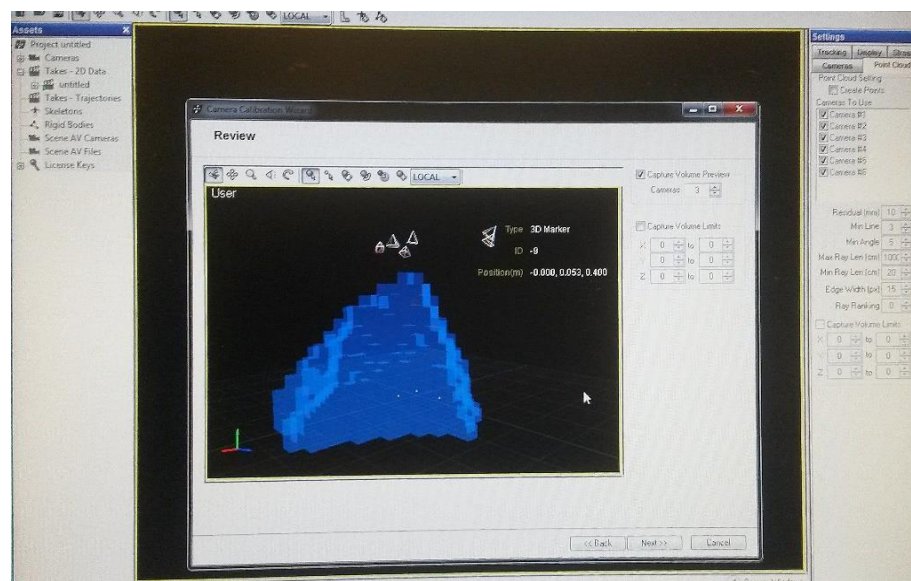


Figure A4.69 This screen shot shows the capture volume of one of my calibration with excellent result.

Rigid Body Configuration

To provide data regarding the 6 degree of freedom (6DOF), i.e. position and rotation of gestures, we decided to configure a rigid body of each upper part of the body to be captured. To fix the exact view of the body in all the cameras, I tried the markers on a puppet to find their correct position.



Figure A4.70 A puppet used for the markers position.

First, I decided to place three markers with a different configuration on my head, hands, shoulders, arms, forearms.



Figure A4.71 First markers configuration.

I placed the markers on my arms and forearms to trace the angulation of both elbows.



Figure A4.72 Configuration of markers on my arms and forearms to draw the elbow.

It was also necessary to fix the rigid body configuration of the piano to define the boundaries of the keyboard. For this, I used some non-reflective sticks on which I placed four reflective balls after the calibration. After having named each part of the body to be tracked (head-hands-arms-back) and the keyboard, I started a first capturing just by moving in the performance space without playing.

Second, I tried to record few musical sequences like scales, octaves, chords, to get used to perform with the markers on me. However, I avoided playing the Karnatic etudes not to influence my gestures later during my experiment. Infact, while recording these musical sequences, my rigid body configuration failed many times at the beginning because the system confused the many markers placed on my body too near to each other, even if they were placed in a different position.

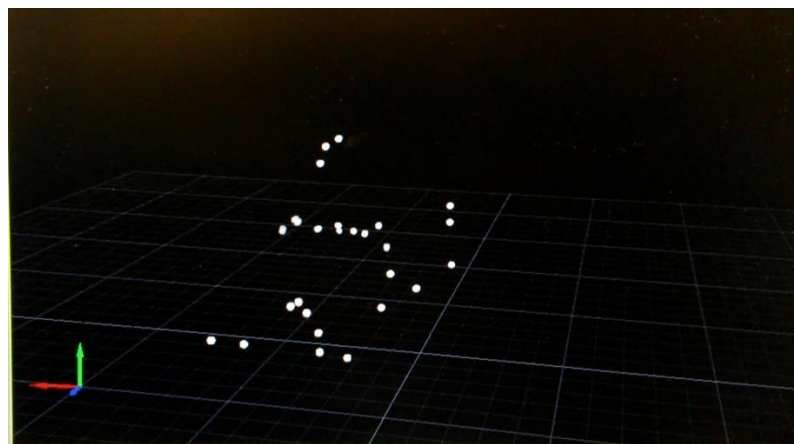


Figure A4.73 First rigid body captured.

For this reason, we redefined the rigid body configuration by positioning the markers directly on both elbows and not on the arms and forearms. Moreover, I used specific gloves that could give me a natural movement of my hands on the keyboard.



Figure A4.74 Final rigid body configuration

PHYSMO2

Once the video in Physmo2 was imported, it was necessary to calibrate first to a real distance and manually adjust time-based for high-speed cameras (30 frames per second). Then, the axis was set on one of the three markers from the MoCap video and the motion analysis was conducted frame-by-frame with multiple shortcut keys for ergonomics.

ELAN

Synchronization audio/video procedure

The audio recording was synchronized with the MoCap video recording using the sound and motion of a clapper. Based on the frame of the clap and the first and last frame of the selected motion capture fragment, the correct audio excerpt could be extracted from the complete recording of the experiment and imported in Elan.

A.5

Verbatim

The *verbatim* reports my *thinking-aloud* procedure made during my performative experiment. The verbal explanation and analysis regards my interpretative approach of three fragments selected from the 8th cycle of the 72 *Etudes Karnatiques* by the Jacques Charpentier.

FRAGMENT SECTION N. 1

I am reporting here an analysis of my performance of the first part form the 8th cycle of the 72 Etudes Karnatiques. I elaborated a music performance model to set up my performing practice procedure. The music performance model is based on three questions (what-how-why) which represents some steps that musicians often follow to prepare their performance.

The first question regards “what” the music score wants to represent (musical structures); the second is related to “how” to enact the score, i.e. how to perform a musical passage in terms of gestures (technical features); the third considers “why” to choose some approaches (and not any others) in respect to the musical intentions (interpretative cues).

This analysis implies to make a score annotation while practicing.

First, an analysis was made on the musical structures of the first fragment, which comprise seven bars divided into four sub-phrases plus one repetition. Its technical feature consists of broken chords on the whole register of the piano based on the Karnatic mode “gavambodi”. This musical passage presents accented notes and legato. My first bodily approach (motor strategy) was biased by the implicit knowledge I received from the score, which induced me to play those accents fortissimo and legato in a tempo “presque vive”. I decided to change the pedal on each bar to obtain a powerful timber. To obtain the legato, both hands and elbows remain mostly fixed and close to the keyboard like this (example played on the piano). In this way, the sound timbre results less vibrant.

After a meeting with the composer and after reading about Karnatic music, I realized that the 72 Etudes Karnatiques, which are divided into 12 cycles, are based exactly on the 12 cycles of the melakarta ragas system. In particular, the 8th cycle recalls the myth or legend of “Vasu”, which represents the eight elements of nature. The composer himself confirmed to me that he wrote this piece inspired by the idea of the creation of the universe and the concept of sound as vibrating energy. At this point, I understood how important is the effect of the resonance of each note of this initial passage. From my readings on Karnatic music and my talk with the composer, I gathered the necessary information (explicit knowledge) which made me rethink my approach over this fragment. Therefore, I decided to modify my fingerings and my body movements to reach a more powerful sound and a higher resonant timbre. I changed my fingering and I started moving my hands, elbows, and head in a different manner. I played not just the legato, but I accented more each note like this (example on the piano).

I increased the movements of my hands, elbows and head which involved all my body in accompanying those gestures. By giving more intensity to the sound, I felt even more freedom in all my body movements. This new motor strategy gave me a better way to interpret the idea of resonance that this musical passage should communicate.

FRAGMENT SECTION N.2

As a second fragment for this analysis, I chose the section after the introduction from the 8th cycle of 72 Etudes Karnatiques. Starting from my performance model, this fragment presents a musical structure based on a scale in semi-quivers from the lower to the upper register of the piano. Concerning its technical features, I applied a certain fingering to reproduce this scale in a fast tempo as indicated by the composer. Regarding the interpretative cues, the composer suggests to phrase this scale legato in crescendo with different dynamics each time: forte the first time, piano the second time and fortissimo the third time. The tempo is always very fast, the pedal should be held until the end of the scale. When I looked at this passage the first time, I just tried to be very precise in playing the scale as fast as possible while I did not give the right emphasis to some accents placed at the beginning of each four semi-quivers. I used a certain fingering like this (example on the piano). On discussing this passage with the composer, I noticed the importance of these accented notes that actually constitute the “gavambodi” mode. Therefore, I thought to change my fingering to reach a more powerful resonant sound in these accents and, consequently, I changed the motor strategies to emphasize the notes that recall the gavambodi mode. I increased the movement of my wrist on each note like this (example on the piano). My new approach to this passage was certainly determined by the explicit knowledge I had learned about the piece. I transferred

my intentions into my movements by changing the fingering and the movement of my wrist like this (example on the piano). This new motor strategy gives me the possibility to reach a more powerful sound where fortissimo is required.

FRAGMENT SECTION N.3

Referring to the musical structures of the performance model, the third fragment represents the most percussive part of the piece. We have two phrases based on a succession of seven groups of bi-chords with accents structured in a specific rhythmical pattern, a mirror-like rhythm, which recalls the Indian niççanka rhythm. Its technical features consist of two patterns of seven groups of bi-chords. I established the fingering from the first time I played the piece, but I changed the motor strategies of my body movements during my performance practice. The composer placed accents on the first bi-chords of each group and stated the use of sforzattissimo (dynamic sff) on each accent and then of mezzoforte. Therefore, this accent should be articulated and emphasized a lot.

My first interpretative approach to this fragment was to emphasize the bi-chords where one has to play the accent very loud just by pressing the keys harder, feeling sometimes pain in my hands and fingers.

My first motor strategy based on my intuitive approach implicit from the score was this one: (example on the piano)

During my performance practice, I conceived an artistic project called “Re-Orient” involving a Karnatic singer and an Indian dancer. The Indian dancer made a particular choreography to accompany this percussive part. It happened that, when we practiced together this section, on watching her movements, I started feeling and articulating differently this rhythmical pattern by synchronizing the music with her choreography. Therefore, I played this part not simply by emphasizing the accents but also by articulating and “acting out” the accents with my body movements. During the collaborative practice with the composer, I realized that this rhythm is also inspired by an Indian rhythm called niççanka. Therefore, my practical experience with the dancer and the information gathered from the composer are the explicit knowledge that biased my intentional way of performing this part. I noticed that I embodied a different motor strategy as I increased the expressivity in my gestures, by punctuating movements with my head, my arms and elbows.

Now I am going to play this fragment with this second approach biased by my practical experience and by the explicit knowledge I gathered: (example on the piano)

A.6

Portfolio

This appendix describes my artistic process done during each research year (2012–2017) according to the following activities:

- Piano lessons, masterclasses, rehearsals & meetings
- Presentations at International Conferences, Lecture-Recitals & Workshops
- Concerts (only the performances inherent to this research)
- Publications

The web pages related to my artistic research and concert activity are:

MEDIA-PORTFOLIO: <http://www.giusycaruso.wordpress.com/>

WEBSITE: <http://www.giusycaruso.com>

YOUTUBE CHANNEL: <https://www.youtube.com/user/carusogiusy>

FACEBOOK PAGE: <https://www.facebook.com/giusycarusopianist>

LINKED-IN: <https://www.linkedin.com/in/giusycaruso/>

IPEM GROUP:

<http://research.flw.ugent.be/en/giusy.caruso#overlay-context=en/giusy.caruso>

IPEM ART SCIENCE LAB:

<https://www.ugent.be/lw/kunstwetenschappen/en/research-groups/musicology/ipem/artsciencelab-ipem>

UGent BIBLIO: <https://biblio.ugent.be/person/802001489792>

A.6.1 Activities in 2012

A.6.1.1. Lessons, masterclasses, rehearsals & meetings

Lessons:

Academic year 2012 - Ghent. Piano lessons for the first year of my post-master in contemporary music (ManaMa) at the Royal Conservatory of Gent, under the guidance of Prof. Daan Vandewalle, in order to develop practical skills as a piano performer and acquire analytical views on the contemporary piano repertoire.

Academic year 2012 - Ghent. Improvisation course by Prof. Peter Van de Berge to improve piano skills as improviser.

Academic year 2012 - Ghent. Direction of ensemble course by Prof. Wim Belaen to improve gestures and interaction playing in ensemble.

08 -12/08/2012 - Hamburg. International Summer School in Systematic Musicology (ISSSM 2012) at the Institute of Musicology of the University of Hamburg.

There I attended workshops on Systematic Musicology method, MoCap technology, application of the tutorials ANOVA and MATLAB. This experience improved my skills as researcher and gave me more insights into the empirical approaches on how to conduct self-observation and self-description in artistic research on music performance analysis.

Rehearsals & meetings:

31/01 - 01/02 - /2012 - Ghent. Solo practicing of the 8th cycle from the *72 Etudes Karnatiques*

At the beginning, I had as point of reference two recordings of the piece: a first recording by the pianist Ann Gaels (1996) and the most recent one made by the pianist Michael Schäfer (2012). Searching on the literature and recordings available, I understood that I needed to acquire some expertise on Karnatic music and culture and their connection with the Western musical tradition to shape an interpretation of the piece in respect to the intentions of the composer and the Karnatic inflections (see section 6.2.1).

05/05/2012 - Carcassonne. Meeting with the composer Jacques Charpentier. The composer guided me to enrich my interpretation of his work. He encouraged me to start collaboration with Indian music experts to reorient my initial interpretation towards a developed interpretation.

3-5/10/2012 - Ghent. Conference meeting at the *ORCiM Research Festival 2012 Orpheus Institute of Ghent*. The themes of the research festival were essential in drawing up my artistic research project. The Festival focused on how to conduct an artistic research on music. This field matches with my interest as an artist researcher. During the Festival, I followed some presentations made, among the others, by Prof. Kathleen Coessens and Dr. Paulo De Assis that inspired my investigative discourse in interweaving the philosophical and scientific aspects inherent to artistic research.

29/10/2012 - Ghent. Meeting with Ayla Joncheere, a dancer trained in Indian music and PhD student at the Indology department of Ugent. In the first meeting with Ayla, I discovered many connections between Karnatic music and dance. I played for Ayla the 8th cycle and we started imagining a possible interaction of our gestures by performing the music as in an Indian performance. At that time, we had many questions to solve and we decided to start rehearsing as soon as possible.

A.6.1.2. Presentations at International Conferences in form of Lecture-Recitals & Workshops

09/05/2012 - Rome. Presentation of my research project “Western Embodiment of Karnatic Music” in form of *conference lecture-recital* at the European platform for Artistic Research in Music (EPARM) at the Academia Belgica and the Accademia Santa Cecilia in Rome.

09/08/2012 - Hamburg. Presentation of my research project “Western Embodiment of Karnatic Music” in form of *lecture-recital* at the International Summer School in Systematic Musicology at the Institute of Musicology of the University of Hamburg.

Abstract Title: Western embodiment of Karnatic Music: 72 Etudes Karnatiques by Jacques Charpentier (1933)

The interaction and relationship between Western and Indian classical music stimulated my interest, as a pianist and philosophy graduate, in building and deepening an artistic research project focused on Jacques Charpentier’s composing process and performance practice of his 72 Etudes Karnatiques. Since no relevant scholarly research has been done on Western embodiment of Karnatic music in the “classical” area and no analytical essay exists as yet on Charpentier’s 72 Etudes Karnatiques, a deep insight on this subject is needed to be able to perform his music.

The objective to be pursued in my artistic research aims at increasing the knowledge of Western embodiment of Karnatic Music, which is a field still to be well addressed, and at leaving a track of the French composer Jacques Charpentier and his works. Part of this research consists in my performing his 72 Etudes Karnatiques together with an analysis of the inherent musical gestures. Even if the Western scholars of Indian music have often employed methods used in ethnomusicology, I would apply to my artistic research a systematic methodology experimenting with empirical studies through my performance practice. I will combine a scholarly analysis of the sources to my performing. Empirical evaluation of the results will be supported by new technologies. I will present my artistic research in form of lecture-recital.

A.6.1.3. Concerts

27/12/2012 - Crotone. Auditorium del Liceo Musicale "Orfeo Stillo".

Piano recital h.20.00

Music by F. Chopin, C. Debussy, P. Boulez, J. Charpentier

A.6.2 Activities in 2013

A.6.2.1. Lessons, masterclasses, rehearsals & meetings

Lessons:

Academic year 2013 - Ghent. Piano lessons for the second year of my post-master in contemporary music (ManaMa) at the Royal Conservatory of Gent under the guidance of Prof. Daan Vandewalle, to develop practical skills as piano performer and analytical views on the contemporary piano repertoire.

Academic year 2013 - Ghent. Music Analysis course by Prof. Filip Rathè to improve music analysis skills.

Academic year 2013 - Ghent. Doctoral schools: - Course to improve writing skills and oral presentation as a performer-researcher.

Masterclasses:

25/02/2013 - Ghent. Piano masterclass with Jonathan Powells at the Royal Conservatory of Ghent. On performing the 8th cycle from the *72 Etudes Karnatiques* for Jonathan Powells I received advices on how the attack of the key in the numerous accented notes of the piece needed to be played with a precise gesture in order to obtain sharp timbres and create more contrasts in the dynamics. Other advices concerned how the irregular rhythmical pattern had to be performed with more precision and without running, and following the metronome markings placed by the composer at the beginning of the piece.

Rehearsals & meetings:

05/02/2013 - Ghent. Meeting with the Indian singer Sandeep Kalathimekkad

19/02/2013 - Ghent. Rehearsals with the Indian singer Sandeep Kalathimekkad

20/03/2013 - Ghent. Rehearsals with the Indian singer Sandeep Kalathimekkad and the dancer Ayla Joncheere to set up a short video.

A.6.2.2. Presentations at International Conferences in form of Lecture-Recitals & Workshops

9/02/2013 - London. Presentation of my research project “Western Embodiment of Karnatic Music” in form of conference lecture-recital at the International Piano Symposium, Royal College of Music. This Symposium was an important occasion to compare my artistic research with other artistic researches based on piano performance. During this international meeting, I was invited by Prof. Nicasio Gradaille, head of the piano department at Vigo Conservatory (Spain), to hold a lecture, a piano masterclass and a concert.

26/03/2013 - Ghent. Presentation of my research project “Western Embodiment of Karnatic Music” in form of lecture-recital at the Orpheus Institute during the conference “Experimental Affinities in Music-from Late Middle Ages”. The theme of the conference underlined how different disciplines (arts in general and knowledge) are related to music in a sort of synesthetic concept. I was one of the three PhD students invited to hold a ten minutes presentation of my artistic research which focused on the relation between music, philosophy and science.

28/03/2013 - Ghent. Presentation of my research project “Western Embodiment of Karnatic Music” in form of lecture-recital at the *IPEM 50*, a celebration of the 50th anniversary of the IPEM. I was invited as PhD student to hold a 15 minutes presentation before my recital.

Abstract Title: Western embodiment of Karnatic Music: 72 Etudes Karnatiques by Jacques Charpentier (1933)

The interaction and relationship between Western and Indian classical music stimulated my interest, as pianist and philosophy graduate, in building and deepening an artistic research project focused on Jacques Charpentier’s (1933) composing process and performance practice of his 72 Etudes Karnatiques for piano (1957-1985, Ed. Alphonse Leduc). The objective to be pursued in my artistic research aims at increasing the knowledge of Western embodiment of Karnatic Music, which is a field still to be well addressed, and at leaving in the history of music a significant track of the French composer Jacques Charpentier, one of the last pupils of Olivier Messiaen. Since no relevant scholarly research has been done on Western embodiment of Karnatic music in the contemporary classical music area and no analytical essay exists as yet on Charpentier I sorted out some theoretical/analytical questions as premises of my research: How could Western musical language reproduce the Indian atmosphere in using of Karnatic modes? In which way does Charpentier suit the Western harmonic rules with the Karnatic emphasis upon avoiding chord progressions and linear melodies? - In which way does he combine the specific rhythmic, melodic patterns from the West and the piano timbre to reproduce the typical and unique Indian sound? - How does he apply the Western etude form to the Indian performance concept and structures mostly improvised? Even if the Western scholars of Indian music have often employed methods used in ethnomusicology, I would apply to my artistic research a Systematic Methodology experimenting through my performance practice. Part of my artistic research thus consists in my performing all his 72 Etudes Karnatiques (three-hour-music) together with an analysis of the inherent musical gestures through the ELAN (EUDICO Linguistic Annotator) software, which is a tool for multi-level annotation of video and audio to explore scientific models of performance and new strategies to practice. I will present my artistic research in form of lecture-recital.

29/04/2013 - Vigo. Piano Masterclass for the students of the Conservatorio Superior de Musica.

30/04/2013 - Vigo. Presentation of my research project “Western Embodiment of Karnatic Music” in form of lecture at the Conservatorio Superior de Musica Vigo.

I had a very exciting experience at the Conservatory of Vigo. The students demonstrated a lively interest in the field of my research and my piano masterclass. Working directly with students through an interactive presentation of my artistic research and a piano masterclass, made me realize how important my artistic research is for spreading the horizon of Western music interpretation.

A.6.2.3. Concerts

28/03/2013 - Ghent. Museum voor Schone Kunsten.

Piano recital h. 20.30

Music by C. Debussy, E. Satie, O. Messiaen, M. Ohana, P. Boulez, J. Charpentier

06/04/2013 - Cosenza. Sala “G. Giacomantonio” - Biblioteca nazionale.

Piano recital h. 19.30

Percorsi Sonori tra Geometrie Variabili

Music by P. Boulez – Jacques Charpentier – Maurice Ohana

30/04/2013 - Vigo. Conservatorio Superior de Musica, Auditorium.

Piano recital h. 20.00

Music by P. Boulez – Jacques Charpentier – Maurice Ohana – G. Crumb

17/06/2013 - Ghent. Royal Conservatory of Ghent. Miry Zaal

Piano Marathon “Euphony” in two recitals

Part 1, h. 17.00 - 18.00

G. Scelsi – D. Anzaghi – S. Bussotti

Part 2, h. 18.30 - 19.30

M. Ohana – P. Boulez – J. Charpentier

07/09/2013 - Crotone. Associazione Beethoven A.C.A.M, Auditorium

Piano recital h 23.00

Music by G. Crumb and J. Charpentier

27/12/2013 - Cosenza. Teatro “Rendano”, Sala Quintieri.

Piano recital h. 17.00

Esprit en flammes à travers les danses du monde

Music by F. Chopin, I. Albeniz, M.Ravel, J.Charpentier, A.Ginastera, Rossini/Liszt,
A.Rendano

A.6.3 Activities in 2014

A.6.3.1. Lessons, masterclasses, rehearsals & meetings

Rehearsals & meetings:

10/02/2014 - Ghent. Rehearsal with the Indian singer Sandeep Kalathimekkad

12/02/2014 - Ghent. Rehearsal with the Indian singer Sandeep Kalathimekkad

24/04/2014 - Ghent. Rehearsal with the Indian singer Sandeep Kalathimekkad

25/04/2014 - Ghent. Rehearsal with the Indian singer Sandeep Kalathimekkad

26/04/2014 - Ghent. Rehearsal with the Indian singer Sandeep Kalathimekkad

11/09/2014 - Ghent. Meetings and Rehearsal with the dancer Ayla Joncheere

A.6.3.2. Presentations at International Conferences in form of Lecture-Recitals & Workshops

09/07/2014 - Bangkok. Piano Masterclass for the students at the “Yamaha Piano School”

10/07/2014 - Bangkok. Presentation of my research project *Western Embodiment of Karnatic Music* in form of lecture-recital at the Music Department of the Faculty of Fine Arts, Srinakharinwirot University.

05/09/2014 - Crotone. Presentation of my research project “Western Embodiment of Karnatic Music” in form of lecture-recital at the Società Beethoven A.C.A.M.

06/09/2014 - Crotone. Piano Masterclass for the students at the Società Beethoven A.C.A.M.

This year, I had the great opportunity to present in form of lecture-recital the first case study of my artistic research: *Re-Orient: Western embodiment of Karnatic music* in Thailand and Italy.

I organized my presentation in two parts: a first speech of 40 min. followed by my 15 minutes performance on the 8th cycle from the *72 Etudes Karnatiques* by Jacques Charpentier. Finally, a 15 minutes space for questions and feedbacks. Working directly with students through an interactive presentation of my artistic research and a piano masterclass, I pragmatically perceived how to disseminate my artistic research. The students demonstrated a lively interest in the field of my research and my piano masterclasses.

A.6.3.3. Concerts

08/02/2014 - Brussels. Salle de concert Pianos Maene

Piano recital h. 16.30

Esprit en flammes à travers les danses du monde

Music by I. Albeniz, M.Ravel, M.Ohana, J.Charpentier, A.Ginastera, Rossini/Liszt, A.Rendano

26/04/2014 - Brussels. Piano Maene Hall

Re-Orient project (piano and voice) h. 15.00

Music by G. Scelsi and J. Charpentier

Sandeep Kalathimekkad, vocalist

This first performance of the *Re-Orient* project with voice and piano gave me new insight in approaching Charpentier's music. In the audience, there was the Belgian composer Jan van Landeghem who reinforced my idea to reorient my practicing and interpretation of the *72 Etudes Karnatiques* with the aid of Indian Music experts. Jan Van Landeghem, who was conducting a research on the use of the Karnatic rhythm in Western composition, advised me to study Charpentier's pieces with some percussionists trained in Indian music in order to improve the precision in the execution of the Indian rhythms .

11/05/2014 - Catanzaro. Palazzo De Nobili

Piano recital h. 20.00

Esprit en flammes à travers les danses du monde

Music by F. Chopin, I. Albeniz, M.Ravel, J.Charpentier, A.Ginastera, Rossini/Liszt, A.Rendano

18/05/2014 - Milano. Pano City Festival

Piano recital h. 18.00

Esprit en flammes à travers les danses du monde

Music by F. Chopin, I. Albeniz, M.Ravel, J.Charpentier, A.Ginastera, Rossini/Liszt, A.Rendano

14/06/2014 - Cosenza (San Fili). Centro Italiano Femminile, Teatro Gambaro

Piano recital h. 18.00

Esprit en flammes à travers les danses du monde

Music by F. Chopin, I. Albeniz, M.Ravel, J.Charpentier, A.Ginastera, Rossini/Liszt, A.Rendano

A.6.3 Activities in 2015

A.6.3.1. Lessons, masterclasses, rehearsals & meetings

25/01/2015 - Carcassonne. Meeting with the composer Jacques Charpentier.

During this meeting, we discussed about the interpretation of some passages of the *72 Etudes Karnatiques* by focusing on rhythmical patterns. We also fixed the date of the live recording for the concert for the 26 November 2016 at the Auditorium of the Conservatory of Carcassonne.

27/01/2015 - Brussels. Meeting & Rehearsals with the percussionist Carlo Strazzante.

17/02/2015 - Brussels. Rehearsals with the percussionist Carlo Strazzante.

25/04/2015 - Brussels. Rehearsals with the percussionist Carlo Strazzante.

These meetings gave me an overview of the Indian rhythmical techniques as explained in section 6.2.2.2.

01/03/2015 - 30/07/2015 - Ghent. Rehearsals with Motion Capture (see the report in appendix A.4).

A.6.3.2. *Presentations at International Conferences in form of Lecture-Recitals & Workshops*

06/03/2015 - Ghent. Presentation of my project *Re-Orient: Western Embodiment of Karnatic Music* in form of lecture

Think Tank IPEM, University of Ghent, Department of Musicology, h. 14.00.

28/08/2015 - Crotone. Presentation of my project *Re-Orient: Western Embodiment of Karnatic Music* in form of lecture at Associazione Beethoven Acam.

14/10/2015 - Ghent. Presentation of my performative experiment in form of lecture for the master students of the Department of Musicology University of Ghent. IPEM Lab h 14.00

16/10/2015 - Ghent. Performative Experiment in form of lecture recital Royal Conservatory of Ghent - Miry Zaal h.10.00 – 18:00
(see chapters 3 and 4)

A.6.3.3. *Concerts*

04/02/2015 - Genova. Teatro della Tosse
Piano recital h. 20.00

Euphonia

Music by O. Messiaen, M. Ohana, P. Boulez, J. Charpentier

20/05/2015 - Buenos Aires. Teatro Colon, Experimentation Center-
Piano Recital h. 20.00

Music by O. Messiaen, J. Charpentier

A.6.3.4 *Publications*

First-author publication

Caruso, G. & Leman, M. (2015). Le patrimoine musical indien dans le répertoire pour piano d'Olivier Messiaen et de Jacques Charpentier. In *Cahiers internationaux de symbolisme*, (C. LEJEUNE, Ed.) 140-142 (Patrimoines), pp. 23–56 (see chapter 2).

A.6.4 Activities in 2016

A.6.4.1. Lessons, masterclasses, rehearsals & meetings

08/01/2016 - 24/11/2016 - Ghent. Piano lessons and solo practicing of the entire *72 Etudes Karnatiques*.

01/05/2016 - 15/12/2016 - Ghent. Regular meetings with Dr. Luc Nijs and Esther Coorevits for the data analysis from a performative experiment.

A.6.4.2. Presentations at International Conferences in form of Lecture-Recitals & Workshops

24-25/02/2016 - Ghent. Presentation of my project *My soul at my fingertips – My Avatar and Me* in form of lecture-recital during the international conference *Performance, Subjectivity and Experimentation in Artistic Research* at the Orpheus Instituut.

09/03/2016 - Rotterdam. Presentation of my project *My soul at my fingertips – My Avatar and Me* in form of lecture-recital during the *CRAFT Codarts International Artistic Research Festival*.

Title of the Abstract: Experimenting with subjectivity instantiated into gestures, “My soul at my fingertips”: My Avatar and Me

Recalling a sentence by the famous French pianist and pedagogue Marie Jaëll-Trautmann who said, “I will play with my soul at my fingertips”, I reflected on the role of performing gestures as an objectifiable aspect of the performer’s subjectivity. Music performance implies a union between soul/mind and body which instantiates the sound message as a felt experience. The energetic tension produced by the “soul” in the creative act of performing is spread at first throughout the entire body to reach finally the “fingertips”. Focusing on the primary role of the body in performance as a potential vehicle to capture subjectivism, I asked myself:

What would happen if I visualize my performing body by projecting it into a “body image”, an avatar? Can I use this pragmatic avatar of myself to look at my subjectivity from an outsider perspective? Can I identify my lived experience as instantiated in my gestures through the lens of self-objectification based on empirical data?

The assumptions concerning the body as an interface of the performer’s intentionality in terms of sound producing and expressivity inspired me to investigate on my subjectivity through a “performative experiment” combining self-

reflections and objective measurements of my bodily expressions during a performance.

My performative presentation wants to bring alive the dialectic relation between subjectivity and objectivity in piano performance practice by alternating my live piano performance with interactive reflections on my captured avatar projected on a screen as an objectification of myself. From this specific angle, my presentation aims at experimenting with subjectivity the creative act of performing instantiated into gestures as a tactile sensation expressing the soul's intentions. This approach constitutes a connection between gestures and intentionality in music performance and a mediation between scientific understanding and artistic concern.

15/03/2016 - Aveiro. Presentation of my project *Western Embodiment of Karnatic Music* in form of lecture for the master students at the Universidade de Aveiro “.

16/03/2016 - Aveiro. Presentation of my project *Western Embodiment of Karnatic Music* in form of lecture for the PhD students at the Universidade de Aveiro “.

17-19/03/2016 - Porto. Presentation of my project *Musical Gestures as the Interface of Cultural Identity in Music Performance: Western Embodiment of Karnatic Music* in form of lecture for the PhD students at the Universidade Católica de Porto.

25/11/2016 - Carcassonne. Presentation of my project *Western Embodiment of Karnatic Music*” in form of lecture at the Auditorium of Conservatoire La Fabrique des Arts de Carcassonne Agglo h. 19.00

Title of the Abstract: Intentionality and gestures: a case study of Western Embodiment of Karnatic Music in piano performance

Insights about the embodied nature of music cognition consider how the bodily engagement is determinant in musical performance. Accordingly, musical gestures consist in the articulation of the performer's subjectivity showing aspects of the explicit and tacit dimension of the signification process that constitutes musical interpretation. However, can the bodily gestures express the musical meanings embedded in the score? Can gestures be considered as the interface of the performers' cultural identity?

With the aim of studying gestures as an interface of intentions expressing musical and cultural meanings, I set up a “Performative Experiment” as a case study to empirically investigate on the music gestures involved in my performance practice of a Western piano work based on Karnatic music from South India - 72 Etudes

Karnatiques by the French composer J. Charpentier (1933). I explored the hypothesis that musical gestures interface the performer's expressive musical intentions and embodied musical skills acquired through his creative and deliberate practice linked to his own cultural background (enculturation) and other cultural environmental context (acculturation). By combining my subjective experience as a performer (= the top-down analysis) with the objective measurement and computational analysis of my bodily expressions (= the bottom-up analysis) acquired through the motion capture system, I objectified my bodily expressions into a "body image" in order to look at my performance from an outsider perspective through the lens of empirical data. This approach provided to study how musical gestures are vehicles of musical meanings also in terms of subjective intentions and expressions determined by different cultural and practical experiences.

A.6.3.3. Concerts

16/03/2016 - Aveiro. Auditorium - Universidade.

Piano Recital h. 18. 00

J. Charpentier *72 Etudes Karnatiques* (6 cycles)

26/11/2016 - Carcassonne. Auditorium - Conservatoire La Fabrique des Arts de Carcassonne Agglo

Piano Recital in three hours h 14-19

Hommage à Jacques Charpentier 72 Etudes Karnatiques – exécution intégrale (World Premiere)

A.6.3.4 Publications

First-author publication

Caruso, G., Coorevits, E., Nijs, L. & Leman, M. (2016). Gestures in contemporary music performance: a method to assist the performer's artistic process. In *Contemporary Music Review*, Volume 35, Issue 4-5: Gesture-Technology Interactions in Contemporary Music.

A.6.4 Activities in 2017

A.6.4.1. Lessons, masterclasses, rehearsals & meetings

01/02/2017-08/03/2017 – Ghent and Brussels. Regular rehearsals and meetings with the singer Sandeep Kalathimekkad, the dancer Ayla Joncheere and the percussionist Carlo Strazzante.

A.6.4.2. Presentations at International Conferences in form of Lecture-Recital & Workshops

22/03/2017 - London. Presentation of the paper *Gestures in Contemporary Music Performance* in form of lecture for the master students and professors.
Goldsmiths University of London Lecture theatre, Ben Pimlott Building h 14.00-

27/04/2017 - Milano. Presentation of my research project *L'implementazione della tecnologia nell'analisi del movimento performativo pianistico contemporaneo: un caso di studio sui 72 studi carnatici per pianoforte di Jacques Charpentier (1933)* in form of lecture for the master students and professors. Conservatory of Milano h. 17.00.

03/08/2017 - Ghent University. Poster Presentation
ESCOM 2017 Conference, University of Ghent.

08/07/2017 - Paterno (Cosenza). Presentation of my research project *L'implementazione della tecnologia nell'analisi del movimento performativo pianistico contemporaneo: un caso di studio sui 72 studi carnatici per pianoforte di Jacques Charpentier (1933-2017)* in form of lecture at the *Museo All'aperto Progetto Paterno*

30/09/2017 - Ghent. Presentations and Demos
Motion Capture of a piano performance
Art Science Lab – DE KROOK h. 15.00

08/10/2017 - Ghent. Presentation and Demos
Motion Capture of a piano performance and 3D surround sound
Art Science Lab – DE KROOK h. 13.00-17.00

20/10/2017 - Ghent. Workshop

Motion Capture of a piano performance and 3D surround sound

Art Science Lab – DE KROOK h. 14.00

16/11/2017 - Ghent. Workshop

Motion Capture of a piano performance and 3D surround sound

Art Science Lab – DE KROOK h. 14.00

A.6.4.3. Concerts

08/03/2017 - Ghent. Miry Zaal – Conservatoire Royal of Ghent

Re-Orient project h. 20.00

Sandeep Kalathimekkad, vocalist

Ayla Joncheere, dancer and choreographer

Carlo Strazzante, percussion

12/11/2017 - Brussels.

Art Base

Re-Orient Project h 20.00

Sandeep Kalathimekkad, vocalist

Carlo Strazzante & Francesco Magarò, percussion

A.6.4.4 Publications

Caruso, G. (2017). L'approche scientifique et l'interprétation musicale: la technologie comme miroir. (C. LEJEUNE, Ed.). In *Cahiers internationaux de symbolisme*, 146-147-148 (Sciences et littérature), pp. 29-44.

First-author publication

Caruso G., Nijs, L., Coorevits, E. & Leman, M. (2017). Mirroring the intentionality and gesture of a piano performance (in submission).

A.7

Re-Orient Project
Programme note

CONSERVATO
CONSERVATORIUM
CONSERVATORIUM
CONSERVATORIUM
CONSERVATORIUM

08.03
20:00

M

MIRY
CONCERTZAAL

MIRY HEDENDAAGS

ReOrient

Giusy Caruso,
Ayla Joncheere,
Sandeep
Kalathimekkad
& Carlo
Strazzante

HoGent

PROGRAMMA

PROGRAM

* *Alap* * (Indian music opening section)

J. Charpentier (1933)
– Duvalâmbheri



* *Vocal improvisation* *

J. Charpentier (1933)
– Kyravâni



* *Vocal improvisation* * (Konnakol)

J. Charpentier (1933)
– Varunaprya



– Râmaprya
with vocal improvisation



– Suryakanta



* *Vocal improvisation* *

– Mânavati



– Pâvanî

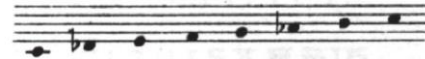


– Nâtabhairavi



J. Charpentier (1933)

– Mayamalavagaula
with vocal improvisation



– Gaurîmanohâri



– Çanhâradvani



– 8th cycle

with vocal improvisation

• Gavâmbodi



• Bhâvaprya



• Sâbhapantovarâlî



• Çadivedamangini



• Suvaranângi



• Dâvyamâni



* *Mangalam* *

(Karnatic music final section)



In samenwerking met IPEM

UITVOERDERS

PERFORMERS

Giusy Caruso
piano
Ayla Joncheere
choreografie en dans / choreography and dance
Sandeep Kalathimekkad
zang / vocals
Carlo Strazzante
percussie / percussion

INLEIDING

INTRODUCTION

NL Re-Orient is een experimentele performance die twee muzikale horizons met elkaar versmelt: de Westerse hedendaagse muziektraditie van Frankrijk en de Karnatische muziektraditie van Zuid-India. Het Westers repertoire die dit project inspireerde, is een selectie van de 72 Études Karnatiques pour piano (1957-1985) van de Franse componist Jacques Charpentier (1933). Als leerling van Olivier Messiaen verdeelt hij zijn werk in 12 cycli van 6 studies die elk gecomponeerd zijn op de 72 modi van de Karnatische Melakartha Ragas (een vast systeem van 72 toonschalen). Dit pianowerk stimuleerde pianiste Giusy Caruso om haar uitvoeringspraktijk te 'heroriënteren'. Het resultaat is een pan-culturele en multidisciplinaire performance waarin westers-hedendaagse pianowerken de ontmoeting aangaan met Karnatische vocale improvisaties, begeleid door Zuid-Indische percussie (zoals khanjira, udu, tabla, ghungroo, saggat enz.) en dans. Het Indische dansvocabulary wordt aangewend om de expressieve bewegingen te benadrukken die dit repertoire oproept door de interactie met de danser en de muzikanten. Indische hastamudras, de zogenoemde bloeiende lotus en de olifantenslurf, worden de bewegingsthema's van de performance waarop de danseres haar lichamelijke interactie en participatie voornamelijk met de pianiste vormgeeft. Bewegingen worden geluid, dat verderleeft in een wederzijdse expressieve invloed die de visuele belichaming representeert van de Karnatische muzikale traditie.

Meer info:
re-orient.wixsite.com/indiandream

EN *Re-Orient is an experimental performance that fuses two musical horizons: the western contemporary music tradition from France and the Karnatic music tradition from South India.*

The Western repertory, which inspired this project, is a selection from the 72 Etudes Karnatiques pour piano (1957-1985) by the French composer Jacques Charpentier (1933). A pupil of Olivier Messiaen, Charpentier divided his work into 12 cycles of 6 etudes each, written on the 72 modes from the Karnatic Melakartha Ragas (a fixed system of 72 scales). This piano work stimulated the pianist Giusy Caruso in 're-orient'-ing her approach to traditional, conventional performance practice of the West. The result is a pan-cultural and multidisciplinary performance in which western contemporary piano pieces meet Karnatic vocal improvisations, accompaniments by original South Indian percussion (such as khanjira, udu, tabla, ghungroo, saggat etc.), and choreography. The Indian dance vocabulary is used to emphasize the expressive gestures evoked by this repertory through the interaction between the dancer and the musicians. Indian hastamudras, such as the so-called flowering lotus and the elephant trunk, become the gestural themes of the performance on which the dancer shapes her corporeal interaction and empathy with the pianist in particular. Gestures become sound and the produced sound lives through gestures in a mutual expressive influence representing a visual embodiment of the Karnatic music tradition. The aim is, on the one hand, to grasp an 'authentic' interpretative approach to Karnatic music and, on the other hand, to explore and create new performative ways to introduce contemporary music to a larger audience.

Meer info:
re-orient.wixsite.com/indiandream

BIOGRAFIEËN

BIOGRAPHIES

Giusy Caruso

NL Giusy Caruso is geboren in Cosenza (Italië) en leeft momenteel in Brussel. Ze is een professionele concertpianiste en artistiek onderzoeker die cum laude afgestudeerd is in piano en filosofie. Haar veelvoud aan interesses (musicologie, theater, dans, improvisatie, yoga, oosterse culturen en muziektechnologie) maken van haar een polyvalent figuur. Gestimuleerd door een brede variatie aan ervaringen tonen haar performances, gebaseerd op een repertoire gaande van klassiek tot hedendaags, vaak interacties met visuele kunsten, theater en dans. Zo wordt de interesse van een breed publiek opgewekt en verhoogd. Getuige hiervan zijn reviews van gerenomeerde muziekcritici over de hele wereld. Met de steun van belangrijke instellingen trekt Giusy Caruso met haar

concerten en lezingen door Europa, Azië en Amerika. Momenteel werkt ze als artistiek onderzoeker bij IPEM (UGent), in aansluiting met het Koninklijk Conservatorium van de School of Arts in Gent. Giusy Caruso's artistiek onderzoeksproject Re-Orient heeft betrekking op een onderzoek naar haar pianistische uitvoeringspraktijk van Jacques Charpentiers 72 Etudes Karnatiques pour piano (1933). Tijdens dit onderzoek verdiept ze zich in het veld van de belichaamde muziek-cognitie, en meer specifiek de correlatie tussen intentionaliteit en muzikale gebaren. De uitdaging is om te onderzoeken hoe in muzikale interpretatie de culturele achtergrond en praktische ervaringen de intenties, expressieve gevoeligheden en bewegingen van de performer leiden. In deze studie wordt dit onderzocht door de implementatie van 'spiegel'-technologieën.

Meer info: www.giusycaruso.com

EN Born in Cosenza (Italy) and living in Brussels, Giusy Caruso is a professional concert pianist and artist researcher who graduated cum laude in piano and philosophy. Her multiple interests (musicology, theatre, dance, improvisation, yoga, eastern cultures and music technology) make her a polyvalent figure. Stimulated by a wide horizon of experiences, her performance projects, which are based on a repertory ranging from classical to contemporary music, often present interactions with visual arts, theatre, and dance to catch and increase the interest of a larger audience—as is witnessed by the reviews from distinguished music critics worldwide. Awarded by important institutions, Giusy Caruso carries on her concert activity and lectures throughout Europe, Asia, and America while working at present as artist researcher at IPEM at Ghent University, in affiliation with the School of Arts Ghent - Royal Conservatoire. Giusy Caruso's artistic research project Re-Orient involves an investigation of her performance practice of the 72 Etudes Karnatiques pour piano by French composer Jacques Charpentier (1933), while embracing the sphere of embodied music cognition, and more specifically the correlation between intentionality and musical gestures. The challenge is to examine how in musical interpretation the cultural background and the practical experiences lead the performer's intentions, expressive sensitivities, and gestures, assessed in this case study through the implementation of innovative 'mirror' technologies.

More info: www.giusycaruso.com

Ayla Joncheere

NL Ayla Joncheere (ayla.joncheere@ugent.be) behaalde een doctoraat in de Oosterse Talen en Culturen (Indisch) aan de Universiteit van Gent (2016). Haar onderzoek, dat tussen 2012 en 2016 werd gesteund door het Bijzonder Onderzoeksfonds van de UGent, droeg de titel Kālbelyās – Dancers, Gypsies or Snake Charmers: Staging of Authenticity and Dynamics of Identity. Ayla Joncheere begon haar opleiding in Kālbelya dans op haar twaalf jaar (2001) en heeft aanzienlijke tijd getoerd door Europa met Rajasthani artiesten. Sinds 2006 begon ze op regelmatige basis naar India te reizen om daar te werken met Kālbelya dansers en andere artistieke gemeenschappen in Rajasthan. In 2011 behaalde ze haar postgraduaat Cultureel Management aan de Artevelde Hogeschool. Momenteel werkt ze als onderwijsassistent Hindi en postdoctoraal onderzoeker voor het onderwijsprogramma Indische Talen en Culturen van de Universiteit Gent. Ze heeft in heel wat diverse dansprojecten opgetreden en is mede-stichter van het danscollectief Bollylicious.

EN Ayla Joncheere (ayla.joncheere@ugent.be) holds a PhD degree in Oriental Languages and Cultures (Indian) from Ghent University (2016). Her BOF-funded research project (2012 – 2016) was entitled Kālbelyās – Dancers, Gypsies or Snake Charmers: Staging of Authenticity and Dynamics of Identity. She began her training in Kālbelya dance at the age of twelve (2001), and spent considerable time touring in Europe with Rajasthani artists. Since 2006, she has been traveling to India on a regular basis to work with Kālbelya dancers and other artist communities in Rajasthan. Ayla Joncheere also holds a postgraduate in Cultural Management from Artevelde Hogeschool (2011). She currently works as a teaching assistant Hindi and postdoctoral researcher at the Indian Languages and Cultures educational program of Ghent University. She has been performing in multiple dance projects, and is the co-founder of the dance collective Bollylicious.

Sandeep Kalathimekkad

NL Sandeep Kalathimekkad (sndipk@gmail.com) is sinds 2009 bezig met een doctoraat in de Polymere Phototonica en Lasertechnologie-groep van het departement Elektronica en Informatie systemen aan de faculteit Ingenieurswetenschappen van de Universiteit Gent. Hij werkt op het onderwerp Integration of Optical

Structures into Low-cost Plastic Carrier Foils Aimed at Sensor Applications, en heeft een patent op optische fluor-gebaseerde chemische en biochemische sensoren en op het produceren van zulke sensoren. Naast zijn wetenschappelijke en technische carrière heeft hij ook twee poëziebundels uitgegeven: *The Sheer Echoes of Time* (Pranatha Books, 2005) en *The Complaints of a Selfish Soul* (Green Books, 2010). Bovendien levert hij regelmatig bijdrages voor verschillende poëziepublicaties in de wereld en online. Hij is ook een opgeleide zanger in de Indische klassieke muziek (Karnatische stijl) en in de Kathakali muziek. Hij trad reeds op in India, Duitsland, Verenigd Koninkrijk, Verenigde Staten van Amerika, Nederland en België. Sinds 2015 engageert hij zich in Zuid-India voor een project waarin poëzie en muziek gecombineerd worden om tot innovatieve onderwijsmethodes te komen voor universiteitsstudenten. Met zijn benadering doorkruist hij diverse domeinen van kunst en wetenschap. Met dit project heeft hij al verschillende universiteiten en ook speciale scholen voor stammen bezocht.

EN Sandeep Kalathimekkad (sndipk@gmail.com) pursues a PhD degree in the Polymer Photonics and Laser Technology group of Electronics and Information Systems department from the Faculty of Engineering at Ghent University (2009-). He works on the topic Integration of Optical Structures into Low-cost Plastic Carrier Foils Aimed at Sensor Applications, and holds a patent on optical fluorescence-based chemical and biochemical sensors and methods for fabricating such sensors. Apart from his scientific endeavors and technological career, he also has two published collections of poetry: The Sheer Echoes of Time (Pranatha Books, 2005) and 'The Complaints of a Selfish Soul' (Green Books, 2010), and is an avid contributor in several poetry journals across the world and the internet. He is also a trained vocalist in Indian classical music (Carnatic style) and Kathakali music who performed on several stages in India, Germany, the UK, US, Netherlands, and Belgium. Since 2015, he has been involved in South India in a project that combines poetry and music in finding innovative ways to learn, teach, experience, and inspire college students towards a well-rounded approach in education encompassing various fields of art and science. He has been touring several universities and special schools for tribals with this project.

Carlo Strazzante

NL Carlo Strazzante is geboren in België uit een Siciliaanse familie. Hij werd eerst gevormd in de klassieke westerse muziek en de jazz alvorens een diepgewortelde interesse te ontwikkelen voor andere belangrijke klassieke muzikale tradities van Indische, Arabische en Perzische oorsprong. Dankzij zijn constante onderzoek, zijn leerschool bij grote meesters die deze tradities eigen zijn, uitwisselingen en samenwerkingen met andere muzikanten in de kosmopolitische omgeving van Brussel, maar ook dankzij zijn artistieke reizen naar Azië en Europa kan hij thans verschillende percussieinstrumenten bespelen: de Indische tabla, de Iraanse tombak, de daf kurde, darbouka, bendir, alsook de riqq die gebruikt wordt in Noord-Afrika en het Midden-Oosten. In het bijzonder heeft de gesofisticeerde ritmische Indische grammatica, die uitgedrukt wordt tijdens het reciteren, hem een taal gegeven die hem toelaat om andere muzikale vormen te voorzien van een gesofisticeerde percussieve code. Meer recent, door het herontdekken van zijn eigen culturele roots, heeft hij de studie van de populaire Zuid-Italiaanse ritmes aangevat. Deze heeft hij gelinkt aan festiviteiten rond het karakteristieke Carnaval uit zijn geboortestreek.

EN Carlo Strazzante is born in Belgium in a Sicilian family. He was first educated western classical music and jazz before developing a deep-seated interest in other important classical musical traditions of Indian, Arabian, and Persian origins. Thanks to his constant research, his classes with great masters in these traditions, his exchanges and collaborations with other musicians in the cosmopolitan area of Brussels, but also thanks to his artistic travels to Asia and Europe, Carlo Strazzante is proficient on various percussion instruments: the Indian tabla, Iranian tombak, daf kurde, darbouka, bendir, and the riqq as used in North Africa and the Middle East. In particular, the sophisticated rhythmic Indian grammar, as expressed during recitation, provided him with a language allowing him to create sophisticated percussive codes for other musical forms. More recently, by rediscovering his own cultural roots, he started the study of the popular Southern Italian rhythms. These he linked with festivities surrounding the Carnival characteristic of his native region.