

New Thoughts on Piano Performance (2016) is a London International Piano Symposium publication, which presents interdisciplinary research, the overarching goal of which is to expand the frontiers of knowledge in the field of piano performance, by exploring the interface between skilled artistry and scientific research. It is a work of central importance to those musicians who are seeking to achieve elite performance, as well as researchers, pedagogues, clinicians, and all those who are passionate about the piano and its future development.

In this collection of fifteen essays by distinguished international researchers and performers, issues which have rarely been addressed, and which should be a vital part of the education of pedagogues and performers are presented here. Among these issues are: that the value of musical training, is a powerful source of intellectual stimulation and cognitive development in children; that the role of the body is foremost in the production of sound at the piano, yet remains the most neglected issue in the education of performers; that obsessive practice is not the way forward; that the memory may be enhanced by developing a mental map in the course of preparing a work for public performance; showing that recordings can exert particular influence as salient historical documents of performance practice; that understanding the correlation between a particular musical work and the visual art that inspired it, may bring greater understanding of the meaning of, and deeper insight into the work for the pianist who is preparing to perform the piece; defining issues such as sound, touch and timbre, which are a phenomenon with both a subjective as well as physical dimensions; that musical performance is shaped more by the mind and body behind the instrument than by the score in front of the person; and last, but not least, ways in which technology can be used to increase our understanding of the body as the instrument, and the conveyor of expression.

NEW THOUGHTS
ON
PIANO PERFORMANCE

NEW THOUGHTS ON PIANO PERFORMANCE

Research at the Interface Between
Science and the Art of
Piano Performance

COMPILED AND EDITED BY
CRISTINE MACKIE

DIRECTOR OF THE LONDON INTERNATIONAL PIANO SYMPOSIUM

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ROGER CHAFFIN is Professor Emeritus of Psychology at the University of Connecticut. His research on performance memory appears in journals such as *Psychological Science*, *Music Perception*, and *Music Psychology*, in the co-authored book, *Practicing perfection: Memory and piano performance* and in recent co-authored articles in *Frontiers in Psychology* on "a dynamical theory of body movement in musical performance" and on "recording thoughts while memorizing music". His earlier work on memory and language appears in journals such as *Journal of Experimental Psychology: Learning, Memory, and Cognition*. He is co-editor of *Memory in Historical Perspective* (1988) and co-author of *Cognitive and Psychometric Analysis of Analogical Problem Solving* (1991). He recently moved to Santa Cruz CA, where he sings with the Santa Cruz Chorale and practices surfing.

ELAINE CHEW is a pianist and operations researcher, who uses mathematical and computational models to represent music and analyse performances and compositions, and creates boundary-crossing concerts that challenge the ways we think about music. Recipient of a PECASE award and Radcliffe Institute for Advanced Study Fellowship, she has been featured on Los Angeles Philharmonic's Inside the Music series and recorded Peter Child's music on Albany and Neuma Records. She is Professor of Digital Media at Queen Mary, University of London.

ZÉLIA CHUEKE is a pianist/researcher, and dedicates most of her concerts, conferences and publications between Europe and the Americas, to music of the 20th and 21st centuries. Elected Member of the Pi Kappa Lambda National Honor Society in the US, she carries a Master of Music Degree from The Mannes College of Music, New York, and a Doctor of Musical Arts Degree with Academic Merit from University of Miami. In 2002 she moved to Paris to develop post doctoral research

with the OMF (*Observatoire Musical ; Français*) at *Université Paris-Sorbonne*, where she was engaged as permanent researcher, Founder and Head of the GRMB (*Groupe de recherche des musiques brésiliennes*) and of the project International Exchanges on Music Theory and Performance (IEMTP). In 2014 she was elected Associate Member of IReMus (*Institut de recherche en Musicologie/CNRS, Paris-Sorbonne, BnF & MCC*). In Brazil, she is Associate Professor at the Universidade Federal do Paraná, where she is Founder and Head of the research group for studies and practice of 20th and 21st centuries Music, Director of Music Graduate Program (2015–2016) and appointed Editor-in-Chief of the program's periodical *Musica em Perspectiva*. (www.zeliachueke.com).

DIANA DURLAVWALLA is currently an Assistant Professor at Florida State University's College of Music, and a member of the Royal Conservatory of Music's College of Examiners. She obtained her Doctor of Musical Arts Performance degree at the University of Toronto, and studied the piano with James Parker and piano pedagogy with Midori Koga. She has studied also with Yonty Solomon, Agnes Olsheski, Virginia Blaha, Heather Taves, and Logan Skelton. As a soloist and chamber musician, Diana has performed in North America, Europe and Australia. Her research interests include piano pedagogy, music assessment, Spanish music and Canadian music. She has presented lecture recitals and papers at the World Piano Pedagogy Conference (Phoenix), National Conference on Keyboard Pedagogy (Chicago), John Weinzweig Symposium (Toronto), Australasian Piano Pedagogy Conference, (Queensland) and the London International Piano Symposium. Her articles have been published in *Piano Professional* (EPTA, UK) and the *Bulletin* for the Association of Canadian Women Composers. Her numerous awards include prizes at the Royal College of Music Contemporary Piano Music Competition and the NUMUS Pan-Am Chamber Music Competition. She was nationally recognized when she received the Marusia Yaworska Scholarship and the Elizabeth Massey Award from the Canadian Federation of University Women.

CRISTINA CAPPARELLI GERLING, MM, DMA, is Professor of Music at Universidade Federal do Rio Grande do Sul in Porto Alegre Brazil. A dedicated pianist, teacher and scholar, she publishes on music, cognition, Schenkerian analysis and Latin-American piano music. A leading figure in the musical circles of her native Brazil, Cristina Capparelli Gerling appears frequently as soloist, recitalist, chamber musician, guest teacher, and lecturer in the United States, Canada, England, France, and Portugal. Her former students have won several prizes at national and international piano competitions and have gone on to study and hold faculty positions in renowned music schools throughout North and South America. Her performances have taken her to prominent venues across the world, including Boston's Jordan Hall and London's Wigmore Hall. Committed to playing all styles of piano music, she has recorded the music of past and present Brazilian composers, including the complete

works of Camargo Guarnieri for cello and piano with cellist Tania Lisboa for Meridian Records. Her ongoing project on Latin American piano music brought her third Fulbright award, the Indiana Chair at the Latin American Music Center at Indiana University-Jacobs Music School. Dr. Gerling is also actively researching on musical memory and musical anxiety amongst other performance performance practices related subjects. She holds a Master's Degree with honors from New England Conservatory, and a Doctor of Musical Arts from the Boston University School of the Arts.

RICHARD HOADLEY lives in Cambridge and in recent years has composed using his own systems of physical computing and algorithmic generation which together make original compositions in real-time. He has developed a number of devices which investigate and facilitate physical interactions with musically expressive algorithms for installations, performances (including dance) and therapeutic environments. 'Calder's Violin' included methods for the live presentation of algorithmically generated music notation. In 'Semaphore' physical movement and algorithms combine with live notation in simultaneous performances of cross-domain expression, while in 'How To Play the Piano', he combines live text and live music notation in an exploration of the areas between interpretation and improvisation. He is currently extending these systems to make use of live graphics and dance notations in the pieces 'Edge Violations' for clarinet and computer and 'Choreograms', a music-dance-text piece linking music, dance and poetry. <http://rheadley.net>

ELEANOR HODGKINSON teaches piano performance at Royal Holloway, University of London and the Junior Royal Academy of Music. In 2013, Eleanor obtained an Masters degree in Music Psychology at the University of Sheffield. She is also an examiner for the Associated Board of the Royal Schools of Music, and Leeds College of Music. She is an established pianist and chamber musician, regularly performing at major venues in the UK and Europe. Her versatility as a musician has led to numerous multi-arts collaborations, as well as being an experienced lecture-recitalist. Eleanor has also written and directed several education projects. Eleanor studied piano and piano accompaniment at the Royal Northern College of Music, subsequently becoming a piano accompaniment scholar at the Royal Academy of Music; her professors included Carole Presland and Malcolm Martineau. www.eleanorhodgkinson.co.uk

ZUBIN KANGA is a London-based Australian pianist, A Masters and PhD graduate of the Royal Academy of Music, London. He is currently a Leverhulme Research Fellow at Royal Holloway, University of London, as well as an Honorary Research Fellow at the Royal Academy of Music, London and the Sydney Conservatorium of Music. From 2014–2016, he was a postdoctoral researcher at the University of Nice and IRCAM, Paris. He has performed at the BBC Proms, the Metropolis New Music Festival (Australia), the Manifeste Festival (France) and Borealis Festival

(Norway), as well as appearing as a soloist with the London Sinfonietta and the Melbourne Symphony Orchestra. Zubin has collaborated also with many of the world's leading composers including Thomas Adès, Michael Finnissy, George Benjamin Steve Reich, Liza Lim and Ross Edwards and commissioned more than 50 new works. He is a member of Ensemble Offspring, one of Australia's leading contemporary music ensembles, and has performed piano duos with Rolf Hind and Thomas Adès.

Zubin has won many prizes for his performances, including the Australian Art Music Award for 'Performance of the Year (NSW)', the Michael Kieran Harvey Scholarship, the ABC Limelight Award for Best Newcomer and the Greta Parkinson Prize from the Royal Academy of Music. His recent recordings include *Not Music Yet* for Hospital Recordings, Orfordness for Metier (UK) and *Piano Inside Out* for Move Records www.zubinkanga.com

CRISTINE MACKIE AGSM, M.MUS is a musicologist and a pianist. A college research student scholarship at Royal Holloway, the University of London enabled her to develop her interest in a hitherto little-explored area of piano performance, which reflects some of the most important trends in the study of musical performance. These include the relationship between performance and analysis on the one hand, and the human movement sciences on the other. Her forthcoming book entitled *Rethinking Piano Performance: A mind body approach* is the result of this research. She is the founder and director also of the recently established *London International Piano Symposium (LIPS)*, in association with Steinway Hall, hosted by the Royal College of Music, London, and is currently compiling and editing the forthcoming book: *New Thoughts on Piano Performance* – a London International Piano Symposium publication – which comprises of 15 essays, by distinguished researchers and performers whose common aim is to expand the frontiers of knowledge in the field of piano performance, by exploring the interface between scientific research and skilled artistry. She has given recitals in the UK, broadcast on both radio and television, as well as concerts and master classes throughout the West Indies sponsored by the British Council. Cristine is acknowledged as one of the foremost leading advocates in the UK of the mind/body approach to piano performance (Music Teacher, April 2014), and has given illustrated lectures at the Royal College of Music, and at the 'Year of the Piano' lecture series hosted by Royal Holloway, University of London in association with Steinway & Sons. For full details of publications go to: www.pianoperformance.co.uk.

RAENELDA MACKIE (1947 – 2012) AGSM, M.Mus, was both a Senior Lecturer – her special interest being performance practice – and the Head of Performance Studies at the University of Middlesex; she was also a piano performance tutor at Morley College, London. As a performer she specialized in Spanish Romantic music. The essay in this book was the basis for a doctoral thesis by the author, (under the supervision of Professor Richard Langham Smith at the Royal College of Music,

London). The present section is dated 26th March 2010, but was not completed because of her death in December 2012. Her CD recording of the *Variations on a Theme of Chopin*, by the Catalan composer, Frederico Mompou was to have accompanied her dissertation. It was recorded by the Vestry Studio, University of the Thames Valley, and may be found in the library at the Royal College of Music. The publication of this chapter in essay form has been undertaken and edited by Cristine MacKie, and proof read and co-edited by Laurin MacKie.

JOSIAS MATSCHULAT, MM, DMA, earned his graduate and post graduate degrees at Universidade Federal do Rio Grande do Sul. A winner of several national and international piano competitions, he currently serves on the Faculty of Music at Universidade da Integração Latino Americana, Foz do Iguassú, Brazil.

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VICTORIA TZOTZKOVA is currently a Teaching Fellow at Harvard University. She received her doctorate in Music Theory from Columbia University, with Professor George E. Lewis as her principal advisor. Her research draws on ethnographic methods, psycho-acoustics, embodied theories of cognition, and personal performance experience, and focuses on sound production at the piano, seen as a form of improvisation in the performance of classical music. A complementary interest is keyboard harmony and preluding practices. Performance credits include Weill Recital Hall at Carnegie Hall, Steinway Hall, the Miller Theatre in New York, and appearances in France, Switzerland, Germany, the UK, and her native Bulgaria.

FELIPE VERDUGO holds a Doctor in Musical Arts degree from the Université de Montréal, a teaching position at the McGill Conservatory, and is a member of the Laboratoire de recherche sur le geste musicien (LRGM), directed by musicologist Caroline Traube. After graduating from the Universidad Católica de Chile under the renowned Chilean pianist María Iris Radrigán, he was awarded full scholarship to pursue a Masters degree at the Université de Montréal under the guidance of acclaimed pianist and pedagogue Marc Durand with whom he studied for seven years. As a soloist, he was invited to perform with the Orchestre de l'Université

Preface

de Montréal (OUM) under the baton of Jean-François Rivest after winning first prize at the 2014 OUM Concerto Competition. As a researcher, Felipe is interested in the gesture-sound relationship of a holistic approach to piano performance. With the support of grants from the Observatoire interdisciplinaire de création et de recherche en musique (OICRM) and the Conseil des arts et des lettres du Québec (CALQ), among others, he has presented his work at several international events such as the Porto International Conference on Musical Gesture as Creative Interface (Portugal) and the London International Piano Symposium (U.K.). Felipe's research interests also include culture, sustainable development, and cultural policy, subjects that he currently explores in the context of his Master's thesis in political science directed by Christian Deblock and Michèle Rioux at the Université du Québec à Montréal.

GEORGIA VOLIOTI is a lecturer in music at the University of Surrey. Her research revolves around musical performance, with a special focus on the music of Edvard Grieg, and encompasses areas such as performance practice, analysis of performance and recordings, nationalism, cultural memory, and listening practices. Her research combines empirical approaches, both quantitative and qualitative methods, with more traditional performance historiography and aesthetic criticism. Her research has been published in *Journal of Musicological Research*, *Musicae Scientiae*, *The Musical Quarterly*, and more publications are forthcoming. Current projects include a monograph on interpreting Grieg's piano music from historical and modern recordings.

XIAO XIAO received both a bachelor's degree in computer science with a minor in architecture, and a master's degree in media arts and sciences, from MIT. She is a Chinese-Born, American technologist, interaction designer and artist who recently received a PhD from the the Tangible Media Group of the MIT Media Lab. A life-long pianist, she applies insights from the art of piano playing to human-computer interaction, with designs that elegantly bridge the digital and the physical. Her research has been presented at various academic conferences (NIME, TEI, CHI, ITS) as well as featured on television programs in the United States and across Asia. She has spoken and performed at events including TEDxBoston, TEDxSanDiego, Aspen Ideas Festival, and Tokyo Designers Week.

The body is foremost in the production of sound at the piano, yet remains the most neglected issue in the education of performers and pedagogues. In this first chapter, the 'Biomechanical and Physiological Aspects of a Holistic Approach to Piano Technique', Felipe Verdugo writes that 'piano technique is a complex subject that integrates physical, psychomotor and psychoacoustical phenomena'. He goes on to suggest that an effective technical approach must encompass all of the aspects aforementioned in a coherent way. This chapter focuses on the basic biomechanical and physiological aspects of Professor Durand's approach to piano technique. It intends to present effective and healthy principles and gestures, involving mainly the pelvic and the lumbar spine regions that can be applied to the vast variety of musical and technical challenges that pianists face. The first section introduces some general principles of posture and alignment. The second section presents basic technical movements intended to employ both the structures close to the centre of the body and the whole upper limbs in an ergonomic way. Finally, the third section discusses the links between the practical recommendations exposed in Parts one and two and recent scientific literature concerning piano performance. Marc Durand is one of the most recognized piano pedagogues in Canada and a prominent figure on the international piano scene. He has developed a research-informed, holistic and healthy approach to piano technique that integrates contemporary advances in the fields of physiology, psychology and pedagogy, among others.

Eleanor Hodgkinson explores whether or not acquiring improvisational skills will reduce performance anxiety levels amongst musicians of different genres. First, this chapter (Chapter 2) 'Can Improvisation Alleviate Performance Anxiety? An Exploration Amongst Musicians of Different Genres' looks at what is meant by performance anxiety and by improvisation. Next, it presents data from Hodgkinson (2013) which comprise: some of the findings of a questionnaire which exposes commonly held beliefs about performance anxiety by musicians in different genres; extracts from nine interviews which reveal the similarities and differences which exist between players of different genres, and explores the ways in which improvisation and creativity can affect performance mindset. Finally, the chapter discusses the implications of the study for performing pianists.

This essay (Chapter 3), by Xiao Xiao 'Beyond Obsessive Practice: Technologies

Past and Future’, examines a vitally important issue in piano performance today, which is the obsession among today’s classical pianists for literal correctness from a technology design perspective. The first half peers into the past and traces how the current culture of classical performance came about. We discuss how music came to be conceived of as an idealized manifestation of a composer’s thoughts as disembodied sound based on the elimination of the performer’s physical presence in technologies for music dissemination. The second half gazes into the future and reflects on how new technologies may capture and reconstruct the physical presence of the pianist. We introduce our own project, *MirrorFugue*, which presents recorded pianists as virtual reflections playing the physical piano.

In Chapter 4, ‘Historical Recordings as Creative Resources of Piano Performance’, Georgia Volioti offers a fascinating aural window into the past, revealing approaches to performance interpretation that may no longer be part of modern practice. With more historical recordings re-issued and made available digitally, listening to past performances by legendary interpreters is easier now than ever before. This chapter explores historical piano recordings as creative resources for informing performance interpretation. Using the recordings of Edvard Grieg as a case study, she illustrates a performer’s analysis of the music inflected by listening, and discusses how the encounter with recordings is akin to a creative dialogue that can enrich stylistic knowledge and awareness of what performers do and why.

In Chapter 5 ‘Exploring Real Time Sonic Adjustment in the Performance of Notated Music: Audio-Haptics, Space Acoustics, and the Variable Timbre of Piano Sound’, Victoria Toztkova addresses the issues of sound production in piano performance – or tone, touch, colour, and sonority, to name some common ways of referring to its qualitative characteristics of sound. While this is an important issue in the education of performers and pedagogues, in music scholarship it has remained elusive and largely unaddressed. Yet a considerable body of research exploring sound produced at the piano does exist in physics and other related fields. Often with a focus on instrument design, such research offers a wealth of information on piano sound in terms of the dynamics between the action mechanism, the string vibrations, and the soundboard behaviour. The perceived qualities of musical sound, however, are a phenomenon with both subjective as well as physical dimensions.

In classical piano performance (Chapter 6), Michel Bernays writes that it behoves the pianist to convey the essence of a classical composition through the prism of their own creative expression. To address this issue, Bernays presents a study entitled ‘Expressive Performance Parameters in the Production of Piano Timbres’, which explores the piano performance patterns involved in the production of specific, pianist-controlled timbral nuances. Performances of four short pieces, by four pianists, with five different timbral intentions (bright, dark, dry, round, and velvety), were recorded with the high-accuracy Bösendorfer CEUS key-tracking system. Fine-grained performance features were extracted. A PCA performance space and detailed descriptive portraits revealed common, steady performance patterns characteristic of each timbral nuance in terms of dynamics, attack touch, articulation,

and pedalling. These results confirm that different piano timbre nuances, as abstract notions conveyed by specific verbal descriptors, correspond to reliable patterns of performance technique.

Elaine Chew writes in ‘From Sound to Structure: Synchronizing Prosodic and Structural Information to Reveal the Thinking Behind Performance’ (Chapter 7) that explains what musicians do, how we do it, and why; making concrete conceptualized structures and expressive, or prosodic decisions that shape musical communications using mathematical models, computational methods, and scientific visualisations. Musical prosody is the manipulation of timing, loudness, articulation, and timbre that a performer adds to an abstract conceptualisation of music (such as that notated in a score) in order to communicate ideas of grouping and prominence. Prosodic choice can often be explained as the result of desired parsing, subject to the structural constraints of the abstract music, and the acoustic properties of the musical instrument. Decisions of grouping and prominence, and of musical prosody form the crux of the art of interpretation, but it remains one of the most elusive elements in music pedagogy.

In Chapter 8, ‘Mirror Neurons: Imitation and Emulation in Piano Performance’, Cristine MacKie presents a pilot study based, in part, upon the research of neuroscientist Rizzolatti (2006), amongst others, which shows that mirror neurons in the brain respond not only when a subject performs a given action, but – more significantly – also when the subject observes someone else performing the same action. The study is designed as a preliminary test of the relevance of this idea to musical performance. In it, a music analyst, a pianist, a choreographer, and two dancers from the Royal Ballet, Covent Garden, collaborate in assisting the pianist to control the pacing of the temporal flow of *Clair de lune*, from one section to the next through imitation and emulation of the dancers’ movements.

Chapter 9, Chopin’s ‘Barcarolle Op. 60 and the Realization of Ornaments: Searching for Patterns, Models and References’ presents a longitudinal study by Christina Carparlli Girling, and Josias Matschulat. It was initiated in 2008, and focus’s on the Barcarolle Op. 60 by Chopin. In the study, 12 winners of the Warsaw International Chopin Piano Competition (1955–2010) were selected in order to compare their interpretation of the ornamentation in each performance. The aim is to describe some of the main features of ‘Chopin’s Barcarolle Op. 60 and the Realization of Ornaments: the recorded performances by looking for commonalities and deviations, and trying to establish patterns, models and references. Results of recording comparison show a variety of solutions. In addition, the research revealed that some competition winners play the same ornaments following the same sets of rules, while others create endless variations. The benefit for performers and teachers is to understand how to find differences where they are not expected, to listen to fine nuances, to understand that there are infinite ways of dealing with each ornament, and to decide what one’s own choice is going to be.

In this essay (Chapter 10) on ‘Mompou’s Theory of Sonority: Expression for Interpretation at the Piano (l’Expressio per a l’ Interpretatio al Piano)’, Raenelda

MacKie examines the writings, of the Catalan composer, Federico Mompou who engaged with that branch of aesthetics established in the 18th-century, which explores sensory experience coupled with feeling and which, it was argued, provided a different type of knowledge from the abstract ideas studied by logic. Although much has been written about expression in music and the communication of emotion, which is often viewed as the most elusive area of performance, it remains, nevertheless, an ongoing focus of discussion and musicological study.

In 'Finding Goya in the Goyescas: A Love Duet in Six Movments' (Chapter 11), Diana Dumlavwalla highlights the correlation between a particular musical work by Granados, and the visual art of Goya that inspired it. She proposes that the resulting insights can bring greater understanding of the meaning of, and deeper insight into the work for the pianist who is preparing to perform the piece. Additionally, focusing on the connection between music and visual art can benefit the listening audience as well as by increasing their understanding of the piece.

In this essay on 'Music Training and Cognitive Development: A Study With Music and Non-Music Students', (Chapter 12), Carlos dos Santos-Luiz writes that 'music instruction is, undeniably, a powerful source of intellectual stimulation and regardless of its effects on general intelligence, it provides children with the opportunity to develop their musical cognitive abilities' (Costa-Giomi 2012a: 28).

In our study, the associations were between music training, general intelligence and non-musical cognitive abilities, particularly with spatial, numerical, abstract and verbal reasoning. Among these types of reasoning, music students stood out in spatial reasoning, especially the piano students in the 7th grade. A literature review by Schellenberg and Weiss (2013) states that the research conducted so far indicates an association between music training and spatial ability that may be a consequence of music lessons, emphasizing that results are stronger if lessons begin in early childhood.

The study in Part 9, Chapter 13, by Zelia Cheule and Roger Chaffin entitled 'Performance Cues for Music "with no plan": A Case-study of Preparing Schoenberg's Op. 11, No. 3' is one of a series documenting how experienced concert soloists are able to perform challenging works from memory, reliably, on the concert stage. In these studies, the musicians recorded their practice and, in some cases, their public performances. After a public performance, they reported the *performance cues* (PCs) that they had paid attention to during the performance. PCs guide the performer through the piece by providing the musician with a series of landmarks in a mental map of the piece. By keeping this narrative thread clearly in mind, the performer ensures that the musical material flows smoothly from one musical event to the next. PCs are established by repeatedly paying attention to particular features of the music during practice, ensuring thus that musical ideas accessed through the score come to mind automatically and effortlessly as the music unfolds. is one of a series documenting how experienced concert soloists are able to perform challenging works from memory, reliably, on the concert stage. In these studies, the musicians recorded their practice and, in some cases, their

public performances. After a public performance, they reported the performance cues (PCs) that they had paid attention to during the performance. PCs guide the performer through the piece by providing the musician with a series of landmarks in a mental map of the piece. By keeping this narrative thread clearly in mind, the performer ensures that the musical material flows smoothly from one musical event to the next. PCs are established by repeatedly paying attention to particular features of the music during practice, ensuring thus that musical ideas accessed through the score come to mind automatically and effortlessly as the music unfolds.

In this penultimate chapter, 'The Pianist's Body as Instrument: Performer-Controlled Electronics as a Callaborative Catalyst in Patrick Nunn's *Morphosis* (2014)', Zubin Kanga's discusses his collaboration (as a pianist) with British composer Patrick Nunn on his work for piano, 3D sensors and live electronics: *Morphosis*. By documenting the entire collaboration process, Kanga was able to examine the development of the unique gestural language of the work and its genesis in shared workshops. The case-study also facilitates an examination of the role of the sensors and electronics as a catalyst for shaping our collaboration and the musical outcomes.

In the final Chapter 15, 'How to Play the Piano: Dynamic Cross-Domain Expression, Notation, Technology and Performance', Richard Hoadley, describes investigations, creative experiments and performances undertaken by the author in collaboration with composer and writer Katharine Norman and pianist Philip Mead in the development of the composition 'How To Play the Piano'. The composition forms part of research into methods of translation of expression between musical, textual and performance domains, and, the technological and aesthetic implementation of these methods. The chapter also investigates the roles of notation, interpretation and improvisation in this process. These implementations are designed to form part of the process of creating dynamic, expressive environments rather than musical instruments or software tools for general use. The research is about creating and investigating stimulating experiences where connections between one domain and another are perceivable and where this connection itself provides an aesthetic experience. Also, within a particular composition, which of these connections should be fixed and permanent, which might be liable to change, and how might decisions be made?