‘Empirical methods in the study of music performance: An interdisciplinary history’

Martin Clayton

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1. Introduction

The editors of this volume ask whether the approaches of ethnomusicology and historical musicology to investigating musical performance can be brought together. In order to answer that question and assess future prospects, it is necessary to look in more detail at the approaches taken within the two disciplines and their historical trajectories. The aim of the present chapter is to make such a comparison, addressing in particular the place of 'empirical' methodologies (intended as those involving the analysis of quantitative performance data describing for instance timing, pitch, loudness or movement) in both disciplines.

For some researchers in both ethnomusicology and historical musicology, the empirical investigation of performance has long been an essential element of the serious study of music. For others, such investigations have been at best an optional extra, if not actively resisted, an attitude associated with a conception of each discipline as exclusively humanistic. While the trajectories of empirical methodologies in the two disciplines have much in common, interactions between them have been rare. Eric Clarke's 2004 overview of empirical research in historical musicology, for example, makes no reference to research on non-Western music, nor does Caroline Palmer's chapter on music performance in Diana Deutsch's *The Psychology of Music* (Palmer 2013). Although Alf Gabrielsson's extensive account in an earlier edition of the same work (1999) mentions ethnomusicologist John Baily's work on motor patterns in instrumental performance (e.g. 1985), and Jane Davidson (2009) adds to this an acknowledgement of the seminal work of John Blacking (1977), it is hard not to conclude that ethnomusicology has been of marginal interest to music psychology, while empirical approaches in historical musicology have tended to align with this pattern. A similar charge could perhaps be levelled in reverse at ethnomusicologists such as Charles Keil, who developed his own distinctive theory of performance timing with little reference to the history of psychological research on the topic (1987, 1995). The general rule seems to have been that historical musicology and ethnomusicology have behaved as if the other did not exist.

The next two sections outline brief histories of empirical methods in historical musicology and ethnomusicology respectively; in both cases I go into more detail on a selection of sources relating to rhythm and timing, which help to highlight some of the reasons for the disciplinary divergence. This is also a particularly promising area of current and future cooperation, as recent work on entrainment by this author and colleagues may demonstrate (Clayton et al 2005). The last section briefly addresses some of the critiques that have been levelled against these methods within the two music disciplines, before discussing some common ground and arguing that a degree of convergence in recent years raises the possibility, albeit not the certainty, of a future marked by productive interdisciplinary convergence.

2. Trajectories: Musicology, psychology and performance

Recent histories of empirical musicology cite a seminal study carried out in the Sorbonne's experimental psychology laboratory by Alfred Binet and J. Courtier (1895), in which the authors describe a mechanical apparatus for recording the keypresses of a pianist. Their primary interest was movement control – the same authors had published a paper two years earlier analysing upper-limb movement in drawing (Binet and Courtier 1893) – and their focus was on the regularity of force and timing under specific biomechanical constraints, rather than the contribution of this control to

musical expression. Building on this and a handful of other studies of timing – some using a 'tapping' paradigm that continues to be applied to this day – the American psychologist Charles H. Sears attempted detailed studies of musical performance for the first time in 1902. For this investigation a reed organ rather than a piano was used, with timing information collected by means of electrical contacts attached to the underside of the keys, the signal from the highest (soprano) part being traced on a kymograph drum (see Brock-Nannestad 2014 for a description of this technology). Four musicians were asked to play a selection of hymns on the organ, and Sears calculated the differences between individual interpretations, including their overall tempo and regularity. As Sears put it, "How far the trained musician accomplishes what the notes set before him indicate and what he sets out to do is an interesting question not only to the psychologist, but also to the musician" (1902: 28). Thus, while the inspiration was psychological, for the first time the implications of such empirical work for musical practice and pedagogy began to be considered.

The next major landmark is surely provided by the body of work conducted by Carl Seashore and colleagues. Carl Seashore's 1919 monograph *The Psychology of Musical Talent* focuses on perceptual and productive capacities, developing methods of measuring musical talent and thus assisting pedagogy. He writes of his aim that "it may serve as a somewhat intensive presentation of a specific subject for the student of educational psychology, child-study, vocational and industrial selection, or vocational and avocational guidance." (1919: vii). Over the 1920s and 30s however, his attentions turned more to the measurement of expert musical performance, striving alongside his original aims to empirically identify the qualities of Western art music well performed. His University of Iowa laboratory, then, had a more musicological focus than most of its precursors.

The later work is conveniently collected in Carl Seashore's 1938 volume *Psychology of Music*. Among many other topics can be found those based on audio recordings (for example, investigating vibrato), and studies of piano playing using the 'Iowa piano camera', another in what has proved a long line of devices for capturing keyboard performance (1938:233ff). Indeed, he begins his introduction to the 1936 collection *Objective Analysis of Musical Performance* by enthusiastically acknowledging the impact on academic research of technological advances in sound and film recording, telephony, and broadcasting (1936: 5). Sound recording had been enthusiastically adopted by music researchers ever since J. Walter Fewkes made the first 'field recording' on wax cylinder in 1890, soon after Thomas Edison's invention became commercially available in 1888. While comparative musicology settled on manual transcription from sound recordings as its core method, psychologists experimented with methods of automatic graphical representation – approaches that only occasionally impacted on musicological research.

Despite the fact that motor control had been a concern of psychologists studying music performance from Binet and Courtier onwards, little work was done on bodily movement – and technology may have been a factor here in a more negative sense. Doing so from film would have been an even greater challenge than working from sound recordings or from the kind of data produced by piano recording devices. In Seashore's chapter on "Primitive music" he nonetheless expresses great enthusiasm for the potential of sound film as a research tool (1938: 346). His material for this chapter is all derived from comparative musicologist Milton Metfessel's 1928 study of "Negro songs", which makes extensive use of photography, but as a way of recording aspects of the auditory signal, not bodily movement (so-called 'phonophotography').

Until this point there had been little acknowledgement of comparative musicology in studies of Western music performance. In Seashore's introduction to Metfessel's volume, though, he notes the history of investigating 'primitive music' from sound recordings, suggesting that new techniques now allowed for the photographic recording of sound (1928:7, credited to a paper first read in 1924). He closes his introduction with a familiar plea to study and preserve 'native' songs from around the world before these diverse styles were 'obliterated' by culture contact (1928: 16). Metfessel's study puts Seashore's proposal into practice through a series of meticulous analyses. It is nonetheless striking that eight years later, all Seashore could muster for his *Psychology of Music* collection was a summary of the same findings — in practice they had not served as the inspiration to others that he had apparently hoped.

Little progress seems to have been made in the four decades following Seashore's 1938 book, until Dirk-Jan Povel's 1977 study of rhythm in the performance of a section of Bach's Well-tempered Clavier. This study introduces an apparently new methodology, namely the extraction of event onset times from audio recordings – a complicated procedure at that time, involving the filtering of tape recordings of harpsichord performance. Four years later, L. H. Shaffer's study introduced photovoltaic cells to a grand piano, an update of Seashore's approach, but now storing and manipulating the data on a computer. It is worth noting that Shaffer's study goes into significant detail on theories of motor control, once again the main area of psychological interest (1981). The same apparatus is referred to in Eric Clarke's 1985 study of the performances of Eric Satie's piano music, but by 1990 Clarke and Carol Krumhansl were reporting the use of MIDI to record timing directly to the computer. One thing that has remained consistent since 1895 has been the prominent place given to the study of keyboard performance: in his 2004 overview, in fact, Clarke focuses almost exclusively on this topic. The nature of the instrument and the technologies available for extracting data means that rather than pitch — which appeared to be of great interest to Seashore — studies have since focused increasingly on timing, and to a lesser extent on dynamic contours. This is not to say that the empirical study of Western art music has actually focused exclusively on keyboard performance since the 1970s – witness for example studies of movement and gesture in singers and instrumental soloists (e.g. Davidson 1993, Wanderley et al 2005). Nonetheless, Clarke will have had little concern over his characterisation of the field.

Such has been the explosion of empirical study of musical performance since the 1980s that it is not possible to give a comprehensive overview here. Rather, it will be more productive to consider the role and the extent to which these 'empirical' methods have been integrated into the mainstream of historical musicology. Particular mention should be made here of the CHARM[1] and CMCPC[2] projects which brought together some of the UK's most distinguished musicologists: Eric Clarke (a pioneer in the application of empirical methodologies and psychological perspectives, already cited above), Nicholas Cook, John Rink, Daniel Leech-Wilkinson and others. These projects should be considered also in the context of another scholarly trajectory that owes its existence to technology: the qualitative and interpretive study of historical sound recordings, as pioneered by Robert Philip (1992, 2004). The CHARM initiative, in a sense, brought together the qualitative historical approach of Philip with the quantitative and psychologically informed approach of Clarke, with the aim of establishing a more secure empirical basis for musicology. As Cook and Clarke explain in the

[1] The AHRC Research Centre for the History and Analysis of Recorded Music, 2004-2009.
[2] The AHRC Research Centre for Musical Performance as Creative Practice, 2009-2014.

introduction to their *Empirical Musicology* volume, "Empirical musicology… can be thought of as musicology that embodies a principled awareness of both the potential to engage with large bodies of relevant data, and the appropriate methods for achieving this; adopting this term draws attention to the potential of a range of empirical approaches to music that is, as yet, not widely disseminated within the discipline." (2004: 5).

Whether one agrees with Cook and Clarke that where data is available and hypotheses can be tested, musicologists should be willing to do so, or whether one is invested in the idea of musicology as an exclusively humanistic discipline that avoids quantitative data, CHARM and its successor surely achieved the objective of drawing attention to empirical methods. One of the achievements of this project was to establish the method of analysing sound recordings within the mainstream of musicology, either to compare multiple performances of the same work (Cook 2007) or to explore some of the finer details of individual musicians' styles. In the latter case, Leech-Wilkinson manages to incorporate aspects of empirical analysis in support of a fundamentally humanistic, musicological argument, albeit framed in his Preface as the outcome of empirical analysis: "Nothing comes across more clearly from this work in musical science than that the performer is the source of all the most specific musical meaning" (2009).

It is equally true that many musicologists have simply ignored the application of such approaches. As Georgina Born writes, this work offers a radical challenge to prevailing modes of musicological discourse: "While [CHARM] is a welcome development, it indicates the profound dislocation that has existed between the philological orientation of score-based musicology and the aural-oral nature of recording … the terms of the detente remain uncertain: cognitivist and positivistic, or hermeneutic and cultural-theoretical?" (Born 2010: 235-6). Whether the term 'positivistic' is a fair description of CHARM is a question worth considering at more length than is possible here, but the point is that it has sometimes been perceived as such. Empirical methods cannot simply be regarded as add-ons, but rather profoundly challenge aspects of prevailing musicological paradigms.

3. Trajectories: Ethnomusicology, psychology and performance

Despite the seminal studies of Binet and Courtier, Sears and others around the turn of the last century, the empirical study of musical performance and the integration of musicological and psychological perspectives would seem to have barely begun before Seashore. In the field of comparative musicology that also emerged in the late 19th century – and was to evolve into ethnomusicology – the possibility for scientific study of audio recordings created a significant volume of work from much earlier. Sound recording, it was thought, offered scholars who struggled to render unfamiliar music into standard Western notation an extremely convenient shortcut: it enabled music to be studied at leisure in the laboratory, and allowed the establishment of a research model where recordings could be made by non-specialists and transported to centres including Berlin, Vienna, and Cambridge for analysis.[3]

[3] Myers was one of the few to give a dispassionate account of the possibilities of sound recording in the early period. While pointing out the phonograph's limitations in the reproduction of timbre, for example, he remained enthusiastic about its ability to reproduce pitch and rhythm, suggesting the research focus on these

This model was consistent with the "armchair" approach still prevalent in anthropology at the time: it is more than coincidence that the prominent early British comparative musicologist Charles Myers was a Cambridge colleague of the great armchair anthropologist James Frazer, with whose wife Elizabeth Myers coordinated field recording activity (Clayton 1996). Comparative musicology was allied even more closely with the emerging discipline of experimental psychology than it was with anthropology, but the practical difficulties of either conducting field experiments, or inviting participants from different cultures to European laboratories, made the laboratory study of audio recordings an attractive option from the psychological perspective too. The 'Berlin school' work of Carl Stumpf and Erich M. von Hornbostel in particular displays an interest in psychological issues such as pitch perception, but their philosophical interests led them to develop this in the direction of comparing diverse populations rather than isolating the perceptual abilities required of a musician in the Western tradition. For Stumpf, for instance, recordings provided the data on which to base an apparently empirically-grounded theory of the origins of music (2012 [1911]).

A considerable amount of material was recorded during this period, largely on wax cylinders: some of this was analysed in the laboratories of Berlin, Cambridge and elsewhere, furnishing data on topics such as the variety of musical scales (much less attention was paid at that time to timing and rhythm). Only a proportion of these recordings was made in the field by researchers themselves, and this together with the fact that few portable resources were readily available beyond sound recording apparatus itself, mean that little empirical field research can be identified before Metfessel's application of 'phonophotography' in the 1920s (see above). An early exception to these trends however – using technology beyond sound recording, in the field, to address issues of rhythm – is provided by British comparative musicologist and psychologist Charles Myers.

In one of the earliest examples of empirical research on the rhythm of non-Western musical styles, Myers writes: "During a visit to Borneo I had the opportunity of investigating some exceptionally complicated methods of gong-beating which are in vogue among the Sarawak Malays"(1905: 397). This occasion was in fact associated with the famous Cambridge anthropological expedition to the Torres Straits Islands in 1898-9, on which occasion Myers combined psychological research on topics such as visual and auditory perception with sound recordings of musical performances.[4] The particular occasion he refers to was a side trip to Borneo on the journey home, a journey which also furnished research resources. Faced with an apparently unintelligible rhythmic phenomenon and limited opportunity, Myers improvised a technological solution employing the kymograph.

> *"I endeavoured to investigate the peculiar methods of sounding the* tawak [gong]*… by allowing a Malay to tap upon a Morse key just as if he were beating the* tawak*, while the other instruments were being played as usual. The taps thus made were recorded upon the travelling surface of a smoked drum by means of an electrically-driven time-signal... I hoped that a leisured visual study of these intervals would lead to an understanding of this curious performance which to the*

aspects does not simply reproduce an existing musicological hierarchy, but reflects a hierarchy of what could be accurately reproduced (1905:122-3).

[4] Myers writes of "My interests in anthropology and psychology" influencing his acceptance of the invitation to join the expedition: he summarized his work as devoted "chiefly to the study of the hearing, smell, taste, reaction times, rhythm, and music of the peoples in Torres Straits and Borneo" (1936: 218).

European ear appeared so completely devoid of system, defying every attempt at rhythmization." (1905: 398).

Myers' final interpretation of the 'exceptionally complicated' patterns of time intervals was that the musician was producing an asymmetrical grouping of strokes, using durations of approximately 750 and 500 ms. In retrospect he had too little information on which to base a convincing explanation of the rhythm he was investigating, and he perhaps fell into the twin trap of fetishizing both the musical difference of the Malay musicians and his own technological prowess. Nonetheless the analysis and its motivation are worthy of examination. His motivation in carrying out this analysis could be described as curiosity in the face of unexpected opportunity. His conclusion contradicted the assumption that 'primitive' music should be simple, undermining a widely shared prejudicial assumption of the time. While Myers no doubt shared Binet's interest in the fundamentals of motor control, here his concerns were more anthropological and implicitly concerned with the theory of cultural evolution.

A rather more elaborate attempt at empirical study of rhythm can be found in the physicist Dayton Miller's appendix to comparative musicologist Frances Densmore's *Northern Ute Music* (1922: 206-210 plus plates). Miller analysed Densmore's phonograph recordings with the help of his 'phonodeik' instrument, which allowed the photographic recording of waveforms. Coincidentally the analysis includes an example of rhythmic intervals in a 3:2 ratio, as had Myers' example reported in 1905. Miller compared his graphs with Densmore's transcriptions and praised the latter for their accuracy, while adding detail on the precise time intervals performed. Despite the novelty and the precise timing measurements the method allowed, however, as with Myers' 1905 study this did not herald a rush to apply this approach to other examples, and the application of onset detection and measurement of inter-onset intervals was effectively reinvented by Povel in 1977.

A late example of empirical rhythm research in the comparative musicology tradition is provided by Mieczyslaw Kolinski's 1959 article 'The evaluation of tempo'. Kolinski had served as Hornbostel's assistant in Berlin (1926-33), moving to the United States and finally settling in Canada in the 1960s. 'The evaluation of tempo' is a comparative study dating from his period in the US and drawing on long experience of transcribing sound recordings. His motivation was to find an objective measure which would serve as a point of comparison between cultures. The measure he used was 'tempo', defined here as the number of events per minute.

Kolinski's analyses appear to be consistent with some simple hypotheses about historical relationships between cultures. For instance, he shows that the distribution of tempi of a corpus of songs from Dahomey is similar to that of a corpus from Surinam (i.e. between an African population and a group of African origin in the Americas), whereas the distributions of both are quite different from those of Indian (i.e. Native American) songs. This piece of writing is quite innovative in its focus on a comparative study of rhythm. What might perhaps have proved an inspiration for a new generation of empirical research in ethnomusicology did not however do so: Kolinski's status as one of the last of the comparative musicologists exposed him to criticism from a new generation committed to an ethnographic paradigm. A well-known example is Marcia Herndon's critique on his methods in the pages of *Ethnomusicology* (1974). Herndon's problem was not with the focus on the empirical data offered by sound recording, however. Indeed, her proposed alternative was a cognitive approach, the object of which "would concern not only the music itself, but how sound

phenomena are organized in people's minds" (p. 248). This proposal for the remaking of ethnomusicological analysis brings together a materialist concern for recorded performance data with a central role for ethnographic enquiry.

> *"What I am advocating… is a return to the data – in this case, sound as the manifestation of interlocking cognitive maps. This is the logical place to begin. In working with any system of musical sound, the discovery of native categories would become a primary goal. This discovery accomplished, the meta-language would arise out of the second, or analytic, level." (1974: 250).*

It is unfortunate that this proposal was undermined to some extent by weaknesses in her critique of others' methods, which led Kolinski to correct her mistakes in the same journal (1976). This argument – which ran to a further round of increasingly bad-tempered comments published in 1977 – unfortunately overshadowed more positive aspects of Herndon's intervention. This nonetheless has echoes in some subsequent work, even if 'cognitive ethnomusicology' remains a somewhat marginal pursuit.

The empirical impulse which held sway in early comparative musicology and gave rise to such curiosities as the projects of Myers, Densmore, Metfessel and Kolinski may have become unfashionable, but has never completely died out in ethnomusicology. Sound recording created the means by which musical performance could be measured more easily and extensively than ever before: whatever the philosophical problems this generated the genie could not be put back in the bottle. This may be more apparent in the pitch domain, where we have seen a generation of melographic instruments — designed to turn the pitch dimension of musical performance into a graphical representation – attract sustained, if minority interest (see e.g. Hood 1970). Nor is Kolinski the last ethnomusicologist to have pursued the empirical study of musical time and rhythm. Thirty years later a small but significant body of empirical literature was inspired by Charles Keil's theory of participatory discrepancies (1987, 1995). Keil wrote that "It is the little discrepancies within a jazz drummers' beat, between bass and drums, between rhythm section and soloists, that create 'swing' and invite us to participate" (1987:277). His approach was inspired by anthropological theory as well as his intuition that the really important aspects of many musical styles (other than Western art music) were being missed by contemporary analytical approaches. Much of this impulse was sociological, the term 'participation' suggesting a Durkheimian approach to sociality applied via Lucien Levy-Bruhl and Owen Barfield (1987: 275-6).

The logical response to his theoretical speculation was to carry out empirical studies of timing in performance, specifically of the relationship between the timing of different individuals. As he suggested, perhaps rhetorically, in his prospectus: "Can we wire up the contact points on fingers and drumsticks? Can we graph very precisely the acoustical phenomena and measure the actual discrepancies in time and pitch?" (Keil 1987: 279). Some of the studies that responded to this logic are collected in a special issue of *Ethnomusicology* from 1995, where studies by Josef Prögler and Olavo Alén interpret such timing 'discrepancies' (Alén 1995, Prögler 1995). These studies certainly demonstrate the existence of timing differences between musicians in an ensemble. Whether they demonstrate that their significance is that claimed by Keil is another matter, but it is more important here to acknowledge the significance of his intuition: that much was to be learned from studying timing asynchronies in performance. Although Keil could be criticised for failing to engage with the

extant literature on musical timing in psychology and musicology, on the other hand those disciplines were not at all concerned with timing as a way to study *relationships* and *interactions* between individuals. The two academic traditions were apparently too far apart at the time to allow fruitful exchange.

What I believe this trajectory shows is that despite a fundamental disciplinary realignment coinciding with the abandonment of the name comparative musicology, ethnomusicology has retained an empirical base not only in the sense that its knowledge production is based on the empirical evidence of fieldwork observation and participation. The urge to explore empiricism, in the form of quantification of pitch and time information in particular, continually raises its head. The motivations behind such study vary constantly, from the desire to better understand historical processes of culture contact, to an interest in the embodied nature of performance, to sheer fascination with apparently complex (which could simply mean 'unfamiliar') phenomena. The empiricist urge, driven by recording, is a recurrent feature of the discipline. At different stages, and perhaps for the same reasons, the disciplines have been drawn back into contact with the psychology of music: comparative musicology was born alongside experimental psychology; in Metfessel and Seashore they briefly crossed over once again; and once again in recent times empirically-minded ethnomusicologists are re-engaging with psychologists tired of a paradigm skewed heavily by its dependence on Western college students as participants.

As noted at various points above, empirical approaches to musical performance have not been uncontroversial, and this is true in both historical musicology and ethnomusicology. Despite a long history of empirical research and of entanglement with the development of psychological research methods, ethnomusicology has more typically in recent decades been aligned with a humanistic and qualitative paradigm. An extreme version of this position rejects any form of quantitative study as reductionist and scientistic, and regards scientific enquiry as inherently ideologically suspect; in some cases this view is supported with reference to poststructuralist philosophy. Some of these trends are embodied, for example, in Michelle Kisliuk's trenchant criticism of Keil's approach:

> *"Keil's desire to measure the 'grooviness' of 'prime cultures' is reminiscent of Alan Lomax, who also applied a quantitative… methodology to the anthropology of music… [S]ome of the most current ethnomusicology still echoes a will to authority embedded in the patriarchal history of Western scholarship – using grand theories and key metaphors to typify, quantify or circumscribe 'culture'."*
> *(1995)*

Stumpf, remembered as one of the founders of both comparative musicology and music psychology, had been fully conscious of the epistemological implications of the new focus that he championed on the hard data offered by sound recording. As David Trippett writes, this "materialist turn" (2012: 27) reverberates to this day in works such as Clarke and Cook's *Empirical Musicology* (2004). The weakness of Stumpf's paradigm was not so much his faith in recording technology as his failure to challenge other epistemological assumptions, such as the idea that one could trace the evolution of human culture by studying 'primitive' peoples. Less surprising is the absence from comparative musicology of the kind of political critique which became familiar much later in the twentieth century, which saw the gathering of 'objective' knowledge of colonial subjects as an integral part of the imperialist project. The question of whether such a paradigm is an inescapable condition of

empiricism – whether it is possible to conduct data rich, quantitative and comparative study of musical performance without implying an urge to control others by forcing diverse practices into the straitjacket of a common frame of reference – is not something that can be resolved in these pages. It is relevant to this discussion, nonetheless, to point out that Kisliuk is not alone in taking such a view. Recording created the conditions required for empirical musicology that graphing and measuring devices amplified, but the intellectual and political context of their deployment create associations that cause unease: the to and fro between empiricism and its critique seems, consequently, likely to continue.

4. Discussion: Trajectories, critiques and intersections

I have presented a brief account of the development of empirical methods for the analysis of musical performances over the last 125 years, focusing on the areas of timing and rhythm. Factors shared between the disciplines include a common set of technological developments from sound recording to personal computers, as well as significant overlap in research objectives, while sceptics have also engaged in critiques of empirical methods in the two musicological disciplines. Shifts in the alignment of the musical disciplines, especially as they engaged with psychology and (in the case of ethnomusicology) with anthropology, have had an important role. Comparative musicology started out in close alignment with experimental psychology but lost a lot of its impetus after the First World War. A new approach to music psychology then took hold that was more closely aligned to the interests of Western music pedagogy than it was interested in global comparisons. When after something of a lull the empirical study of Western art music picked up in the 1980s, ethnomusicology had become much more closely aligned with anthropology and largely turned its back on both psychology and comparativism, even if some important figures within the field were laying the groundwork for a later rapprochement, for example by raising issues about interaction and movement while interest in these topics was largely dormant in historical musicology.

It is worth pausing a moment to reflect further on the motivations underlying empirical investigations into music performance in the different academic fields considered here. In psychology, we see a clear focus from the beginning on motor control and auditory perception, both of which feed into Seashore's tests of musical talent and link up (at least in principle) with the development of musical pedagogy. For the psychologists who conducted the greater part of early comparative musicological research, the parameters of human auditory perception were something that could be fruitfully studied across different populations, while the comparative study of scale and melody was another window on to the same human diversity. Comparative musicologists, working with unfamiliar musical styles, were perhaps more aware of the limitations of their own hearing: they needed to measure when they were unable to categorise pitch or time. As this paradigm gave way to ethnomusicology in the 1950s, much of this framework of measurement and comparison was abandoned, but Keil's interest in participation brought it back once again, this time in the service of a Durkheimian theory of social interaction.

Empirical work in what we have come to know as historical musicology could be argued to come into its own only from the 1980s – that is, if Binet, Sears, Seashore and their colleagues are considered to be operating within a psychological paradigm and affecting musicological thought only tangentially. With the empirical timing studies of Povel, Shaffer, Clarke and others we see the spark of a new

interest in what this psychological mode might tell us about the way music is put together and how it achieves its effects. For Leech-Wilkinson, this empirical investigation offers a window onto the historical development of music as a history of *performance*, and a challenge to the orthodoxy that composers and scores are what count.

This review suggests that for long stretches of the last 125 years, the empirical study of musical performance has followed rather different trajectories in comparative musicology/ ethnomusicology and in historical musicology, even when they responded to the same technological developments and addressed common points of interest such as the production and perception of rhythm and melody. Comparative musicologists paid little attention to the expert performance of Western art music, where early developments in the empirical measurement of piano performance had begun before the end of the 19th century. Nonetheless, the former field was the more productive in terms of empirical study of performances. Much of the energy had left comparative musicology by the 1920s, but Metfessel's 1928 monograph was an important example of its continuation as well as a rare example of dialogue between music psychology, empirical musicology and comparative musicology as they attempted to apply common methods both to Western art music and to other forms of musical expression.

With the decline in paradigms of comparative musicology — Kolinski's efforts are some of the last that were traceable directly to the Berlin school — the empirical urge took different forms in the recently re-named field of ethnomusicology. Alan Lomax revived the idea of large-scale comparison, albeit analysing the ratings of researchers rather than performances themselves (1968). Herndon, while appearing to attack the legacy of comparative musicology, reinvented one of its core features, in the alignment between systematic musical analysis and psychology, while placing this nexus in an ethnographic context that Stumpf had lacked. Blacking stressed the importance of bodily movement and interaction, but carried out no empirical studies of his own. Keil went as far as proposing a radical theory about musical performance that could be tested using empirical performance data: as noted above, the disconnection between this and timing studies in Western music was a lost opportunity on both sides.

Recent years have nonetheless seen increasing signs of convergence between music psychology, historical musicology and ethnomusicology. This can be seen in a number of areas, one of which is the study of rhythm and timing. The empirical study of musical rhythm was rather a niche area when Myers wrote his 1905 paper, and remained so when Kolinski wrote his 1959 article on tempo: research was focused more on other phenomena such as scale and melody. The possibilities of this field were recognised earlier in music psychology as researchers were able to develop apparatus capable of capturing the timing of piano performance, and the capturing process became successively easier with each generation. The study of musical rhythm was able to build on work in movement timing, and this connection has been fruitful from the 1980s until the present day. If ethnomusicologists were relatively slow to pick up on these possibilities, this may be partly due to the fact that a keyboard-specific technology was of little value to the field. Nonetheless comparative musicology had been greatly interested in transcribing music from sound recordings: Myers' and Densmore's studies indicate that the measurement of time intervals was possible, but the motivation was perhaps lacking to implement this on a larger scale. If empirical study of timing was slow to develop, however, what ethnomusicology could offer later on was a body of theoretical speculation on the significance of musical timing and bodily movement that would sit much more

comfortably with the new paradigm of embodied cognition than it did with the psychological frameworks of the 1970s and 80s.

Some of this author's own collaborative contributions to these trajectories, in both the study of embodiment and of entrainment (timing coordination) perhaps demonstrate that disciplinary divergence need not continue indefinitely (see e.g. Clayton et al 2005, Clayton et al 2013). Our interventions have been made possible by a number of circumstances including advances in the ease of use of digital video. On the one hand, as paradigms embracing embodiment and interaction have taken hold in psychology, a larger area of common ground has opened up, and with it mutual benefits in collaboration: from psychology the experience in empirical investigation, from ethnomusicology a deeper understanding of the social processes around music-making. At the same time historical musicology has had to come to terms with a much more diverse academic environment, and its practitioners have had to find ways to work alongside those specialising in ethnomusicology, popular music studies and other disciplines. The idea that analytical insights from the study of what would once have been dismissed as 'primitive' and have served only as material for the study of evolutionary origins, is now more widely appreciated by historical musicologists.

What our focus on entrainment brings to the table is a framework for thinking about interaction and timing coordination between individuals in a musical setting: a fundamental aspect of music-making that was for a long time off the radar of a psychology that focused on the capacities of individual brains. Thanks to collaboration both interdisciplinary (between ethnomusicologists, psychologists and engineers) and cross-cultural (between ethnomusicologists working in different parts of the world), we are now able for the first time to begin to compare the ways in which individual musicians synchronise with each other in performance. This promises a completely new opportunity to explore the relationship between entrainment as a universal human capacity on the one hand, and localised expressions of that capacity on the other: in other words, to explore the relationship between a potentially universal aspect of music making and cultural variability.[5]

Signs of disciplinary convergence in recent years do not necessarily presage wholesale disciplinary realignment: they could yet prove to be little more than a historical blip. Nonetheless I have argued that the conditions now exist that create possibilities for fruitful interactions between historical musicologists, ethnomusicologists, and psychologists. There is no reason why the full range of technological and analytical tools now available cannot be applied across a very broad range of musical expressions. With that possibility comes the chance to drive research agendas that are more focused on commonalities between different forms of human musicality and less tailored to specific repertories. On the other hand ideological objections to empirical research in humanistic disciplines have not faded away: it is no doubt healthy for empirical musicologists to be reminded of the potential dangers of their approach, but equally it is unrealistic of the critics to suppose that after 125 years, empirical methods are going to be abandoned at a point in history when technological possibilities are increasing exponentially. It would also be naïve to suppose that the fundamentally different agendas of historical musicology and ethnomusicology would allow this disciplinary distinction to disappear altogether in the foreseeable future. That is clearly not on the cards: what I am suggesting here is that within these different research traditions, each side has a great deal to

[5] See musicscience.net/projects/iemp.

gain from interdisciplinary collaboration. Only time will tell how much energy we are prepared to commit to such an endeavour and how fruitful the results might be.

References

Alén, Olavo (1995) 'Rhythm as Duration of Sounds in Tumba Francesca', *Ethnomusicology*, 39(1), pp. 55–71.

Binet, Alfred & Courtier, J. (1893) 'Sur la vitesse des gestes graphiques', *Revue Philosophique*, 35, pp. 664-671.

Binet, Alfred & Courtier, J. (1895) 'Recherches graphiques sur la musique', *L'année Psychologique*, 2, pp. 201-222

Baily, John (1985) 'Music Structure and Human Movement', in: Howell, Peter, Cross, Ian & West, Robert, (eds) *Musical Structure and Cognition*, London, Academic Press, pp. 237-258.

Blacking, John, ed. (1977) *The Anthropology of the Body*, London: Academic Press.

Born, Georgina (2010) 'For a Relational Musicology: Music and Interdisciplinarity, Beyond the Practice Turn: The 2007 Dent Medal Address', *Journal of the Royal Musical Association*, 135(2), pp. 205-243.

Brock-Nannestad, George (2014) 'The Mechanization of Performance Studies'. *Early Music*, 42(4), pp. 623-630.

Clarke, Eric F. (1985) 'Some Aspects of Rhythm and Expression in Performances of Erik Satie's "Gnossienne no. 5"', *Music Perception*, 2, pp. 299-328.

Clarke, Eric F. (2004) 'Empirical Methods in the Study of Performance', in: Clarke, Eric & Cook, Nicholas, *Empirical Musicology: Aims, Methods, Prospects*. New York: Oxford University Press, pp. 77-102.

Clarke, Eric F. & Krumhansl, Carol L. (1990) 'Perceiving Musical Time', *Music Perception*, 7(3), pp. 213-252.

Clayton, Martin (1996) 'Ethnographic Wax Cylinders at the British Library National Sound Archive: A Brief History and Description of the Collection', *British Journal of Ethnomusicology*, 5, pp. 67-92.

Clayton, Martin, Dueck, Byron & Leante, Laura (2013) *Experience and Meaning in Music Performance*. New York: Oxford University Press.

Clayton, Martin, Sager, Rebecca & Will, Udo (2005) 'In Time with the Music: The Concept of Entrainment and its Significance for Ethnomusicology'. *European Meetings in Ethnomusicology* 11 (ESEM Counterpoint 1), pp. 3-75.

Cook, Nicholas (2007) 'Performance Analysis and Chopin's Mazurkas', *Musicae Scientiae*, 11, pp. 183-207.

Cook, Nicholas & Clarke, Eric (2004) 'Introduction: What is Empirical Musicology', in: Clarke, Eric & Cook, Nicholas, *Empirical Musicology: Aims, Methods, Prospects*. New York: Oxford University Press, pp. 3-14.

Davidson, Jane W. (1993) 'Visual Perception of Performance Manner in the Movements of Solo Musicians', *Psychology of Music*, 21, pp. 103-113.

Davidson, Jane W. (2009) 'Movement and Collaboration in Musical Performance', in: Hallam, Susan, Cross, Ian & Thaut, Michael (eds) *Oxford Handbook of Music Psychology*, Oxford: Oxford University Press. pp. 364-376.

Densmore, Frances (1922) 'Northern Ute music', *Smithsonian Institution Bureau of American Ethnology Bulletin* 75, Washington DC: G. P. O.

Gabrielsson, Alf (1999) 'The Performance of Music', in: Deutsch, Diana (ed), *The Psychology of Music*, 2nd edition, San Diego: Academic Press, pp. 501-602.

Herndon, Marcia (1974) 'Analysis: The Herding of Sacred Cows?' *Ethnomusicology*, 18(2), pp. 219-262

Hood, Mantle (1970) *The Ethnomusicologist*. New York: McGraw-Hill.

Keil, Charles (1987) 'Participatory Discrepancies and the Power of Music', *Cultural Anthropology*, 3(2), pp. 275-283.

Keil, Charles (1995) 'The Theory of Participatory Discrepancies: A Progress Report', *Ethnomusicology*, 39(1), 1-19.

Kisliuk, Michelle (1995) 'Response to Keil', *Ethnomusicology*, 39(1), pp. 79-80.

Kolinski, Mieczyslaw (1959) 'The Evaluation of Tempo', *Ethnomusicology* 3(2), pp. 45-57.

Kolinski, Mieczyslaw (1976) 'Herndon's Verdict on Analysis: Tabula Rasa'. *Ethnomusicology*, 20(1), pp. 1-22.

Leech-Wilkinson, Daniel (2009) *The Changing Sound of Music: Approaches to Studying Recorded Musical Performance* (London: CHARM) [www.charm.rhul.ac.uk/studies/chapters/intro.html]

Lomax, Alan (1968) *Folk Song Style and Culture*. New Brunswick, Canada: American Association for the Advancement of Science.

Metfessel, Milton (1928) *Phonophotography in Folk Music. American Negro Songs in New Notation* Chapel Hill: The University of North Carolina Press.

Myers, Charles S. (1905) 'A Study of Rhythm in Primitive Music' *British Journal of Psychology* 1(4), pp. 397-406.

Myers, Charies S. (1912) 'The Study of Primitive Music', *The Musical Antiquary*, 4 (1912-13), pp. 121-141.

Myers, Charies S. (1936) 'Charles Samuel Myers' in: Murchison, Carl, ed. *A History of Psychology in Autobiography, Vol. III*. Worcester, Mass.: Clark University Press. Pp. 215-230.

Palmer, Caroline (2013) 'Music Performance: Movement and Coordination'. In Deutsch, Diana (ed), *The Psychology of Music*, 3rd edition, San Diego: Elsevier, pp. 405-422.

Philip, Robert (1992) *Early Recordings and Musical Style. Changing Tastes in Instrumental Performance, 1900–1950*. Cambridge: Cambridge University Press.

Philip, Robert (2004) *Performing Music in the Age of Recording*. New Haven, USA: Yale University Press.

Povel, Dirk-Jan (1977) 'Temporal structure of performed music. Some preliminary observations'. *Acta Psychologica*, 41, pp. 309-320.

Prögler, J. A. (1995) 'Searching for Swing' *Ethnomusicology*, 39(1), pp. 21-54.

Schneider, Albrecht (2010) 'Music and Gestures: A Historical Introduction and Survey of Earlier Research', in: Godøy, Rolf Inge & Leman, Marc, eds. (2010) *Musical Gestures: Sound, Movement, and Meaning*. New York: Routledge, pp. 69-100.

Sears, Charles H. (1902) 'A Contribution to the Psychology of Rhythm'. *The American Journal of Psychology*, 13(1), pp. 28-61

Seashore, Carl E. (1919) The *Psychology of Musical Talent*. Boston: Silver, Burdett and Company.

Seashore, Carl E. ed. (1936) *Objective Analysis of Musical Performance*. University of Iowa Studies: Studies in the Psychology of Music Volume IV. Iowa: The University Press.

Seashore, Carl E. (1967 [1938]) *Psychology of Music*. New York: Dover.

Shaffer, L. H. (1981) 'Performances of Chopin, Bach and Bartok: Studies in Motor Programming'. *Cognitive Psychology*, 13, pp. 326-376.

Stumpf, Carl (2012 [1911]) *The Origins of Music*, ed. and trans. Trippett, David. Oxford: Oxford University Press

Trippett, David (2012) 'Carl Stumpf: A Reluctant Revolutionary', in: Stumpf, Carl (2012 [1911]) *The Origins of Music*, ed. and trans. Trippett, David. Oxford: Oxford University Press, pp. 17-29.

Wanderley, Marcelo, Vines, Bradley W. Middleton, Neil & Hatch, Wesley (2005) 'The Musical Significance of Clarinetists' Ancillary Gestures: An Exploration of the Field', *Journal of New Music Research*, 34(1), pp. 97-113.