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Categorisations of physical gesture in piano teaching: a preliminary enquiry

Abstract

The significance of the 'physicality' involved in learning to play a musical instrument and the essential role of teachers are areas in need of research. This paper explores the role of gesture within teacher–student communicative interaction in one-to-one piano lessons. Three teachers were required to teach a pre-selected repertoire of two contrasting pieces to three students studying piano grade 1. The data was collected by video recordings of piano lessons and analysis based on the type and frequency of gestures employed by teachers in association to teaching behaviours specifying where gestures fit under (or evade) predefined classifications. Spontaneous co-musical gestures were observed in the process of piano tuition emerging with similar general communicative purposes as spontaneous co-verbal gestures and were essential for the process of musical communication between teachers and students. Observed frequencies of categorised gestures varied significantly between different teaching behaviours and between the three teachers. Parallels established between co-verbal and co-musical spontaneous gestures lead to an argument for extension of McNeill's (2005) ideas of imagery–language–dialectic to imagery–music–dialectic with relevant implications for piano pedagogy and fields of study invested in musical communication.

Context, aims and scope

The human experience of engagement with music listening, performing, teaching and learning would not be possible without a bodily interface, through which movement and music can be physically produced, experienced and understood. Physical gestures form a central part of the communication established between the dyad teacher–student relationship, and in the communication of symbolic and functional musical knowledge. However, a host of issues relating to teacher/student gestural interaction remain as absent chapters in the

music research literature. Factors such as gesture types (forms and meanings), their specific outcomes in the teaching and learning processes, and the efficacy of different gestures forms in development of performance skills have all been consistently overlooked. This lack seems to result from three inter-related factors.

Firstly, research on the one-to-one applied music studio instruction setting has focused on verbal communicative channels, denying due importance to the role of non-verbal communication for teaching and learning process (for a review see Kennell, 2002 and Parkes, 2009). The first study that solely examined non-verbal communication observed that successful voice teachers performed the following non-verbal behaviours during lessons: steady eye contact, forward posture, head nodding, smile and laughter, appropriate touch, animated facial expressions and the use of expressive gestures (Levasseur, 1994). These observations paved the way for the following findings: that verbal and non-verbal teaching behaviours are equally important (Wang, 2001); that non-verbal sensitivity plays a significant role in the teaching of music performance (Kurkul, 2007); and that piano teachers who performed more non-verbal behaviours are considered by students as most effective (Carlin, 1997).

Secondly, despite early work that would eventually contribute to the field that we now term 'gesture studies' (e.g. Efron 1949/1972; Kendon 1972, 1980; McNeill 1979, 1981), it was not until the 1990s that body movement was considered by academic research in the field of music performance through the seminal work of Davidson (1993). Research on body movement in music has since been extended in areas such as solo music performance (e.g. Price & Winter, 1991; Davidson, 1994, 1995, 2001, 2005, 2007; Davidson & Correia, 2002; Clarke & Davidson, 1998, Wanderley & Vines, 2006), ensemble performance (Yarbrough, 1975; Davidson & Good, 2002; Goebl & Palmer, 2009; Dahl & Friberg, 2007), and gestures used by orchestra/choir conductors (Decker & Kirk, 1988; Durrant, 1994; Boyes Braem &

Braem 2004; Poggi 2002, 2007, 2011; Wöllner 2008), which mostly focused on expert music performers. Relevant findings include Delalande's (1988, 1995) gesture types, each representing an expressive behaviour related to different body postures according with suggestions that gestures used for music performance tend to emphasise musical structure, and facilitate musical communication during performance (Williamon & Davidson, 2002; Davidson, 2007; Elsdon, 2006; Davidson, 2006; Chaffin & Login, 2006). Gesture research in the context of singing (Davidson 2001, 2005; Clayton 2005; Rahaim 2008) show that the singer's coordination and song narrative expression relies upon non-verbal codes similar to those used in speech (Davidson, 2005;Clayton, 2005). Gesture accompanies, augments and enhances sound forming crucial connections between performer(s) and audience(s). So how are these gestures learned and what is the significance of the environments in which they are attained? Davidson (2001, 2005) highlights that some gestures seemed to have been learned from teachers and Rahaim (2008) suggests that the gestural repertoire of each vocalist is idiosyncratic. Nevertheless, the uncertainty around this topic enforces Clayton's (2005) call for more research into instrumental music techniques of gestural analysis that borrows from the field of non-verbal communication while taking into account the multimodal character of gestures in musical communication (Davidson, 2005; Clayton 2005; Poggi 2007 & 2011), and by extension music educational practices.

Thirdly, whilst providing an account of gestures and their role for meaning formation in narrative philosophical terms (e.g. Merleau-Ponty, 1945; Hatten, 1994), extant musicological literature lacks a "concrete empirical understanding of gestures as a causal physical and biological phenomenon that is connected with experience" (Leman, 2010:126). Even within the large body of published literature on psychology of performance there is minimal reference to the physicality of music teaching and its contribution to musical meaning.

The present lack of research on this topic, coming from several different standpoints, provides impetus for a research focus on the role of teacher gestures in establishing and facilitating communication with their students in the process of student skill acquisition in instrumental music teaching/learning. For this article gesture is defined as a body movement in the pedagogical process of music making that carries an intention (Gritten & King, 2011) and/or a perceived meaning (Hatten, 2006). This definition constitutes an amalgamation of several ideas around gesture definition here used to account with the undoubtedly intentional and communicative context of teaching/learning to play a musical instrument. Focus is specifically on teachers' gesticulations here defined as spontaneous movements of the hands and arms that accompany speech (McNeill, 1992; 2005), music, or both, developed in interaction with their students in the one-to-one musical instrumental pedagogical setting.

Grounds for researching gestures in the music teaching instrumental context

As suggested by Dunne, "the most crucial clarification about teaching occurs at the level at which we decide what kind of interaction it is" (1997: 367). The recent musicological shift from text to an embodiment paradigm, in which "music is always received in a discursive context and … [that] it is through the interaction of music and interpreter, text and context that meaning is created" (Cook, 2001: 180) implies that the educational experience in instrumental music education constitutes a musical performance in an interactive discursive experience, through which meaning is constructed. Embedded in the educational context, this discursive and interactive element intimates that musical meaning cannot be dissociated from life, and therefore from the world. This was clearly evidenced in the philosophical dialectical teaching grounds of one of the most influential piano teachers of all time: Neuhaus (1888-1964). Neuhaus (1973: 41) stated that more than merely teaching piano, "the teacher must arouse the spiritual qualities of the pupil (…) he must make him feel, think and experience".

But how in this highly dynamic, interactively musical and communicational scenario, are music, emotions, conceptual thinking and knowledge communicated? Given the fact that communication in this context is carried out through verbal, musical and gestural channels, we can attempt to answer this question by considering the parallels between gesture and music, speech and music, and gesture and speech.

There are many similarities within the communicative parallels of gestures in speech and music. Both can be, for example: dependent upon a bodily interface and multimodal communication (facial, hands, etc.), on thought and intention to communicate; embedded and understood in a context-dependent basis (culturally understood); natural elements in everyday life, conveying information about culture, discourse, thought, intentionality, emotion and intersubjectivity; developed in close association to verbal language (e.g. singing); performed without a verbal language channel (i.e. mime and sign languages); and understood as visual symbols – music in the context of notation or visual imagery, for instance. Both, music and gesture are universal: all human beings produce both (Bohlman, 2000). Such similarities encourage understanding music experience as "inseparable from the sensation of movement" (Leman & Godoy, 2010: 3), in terms of the interaction between mind and physical environment. However, music can never be entirely reduced to gesture, any more than language can be.

The parallels between music and language have generated noteworthy research (Feld, 1974; Nattiez, 1977; Hatten, 1980; Lerdahl & Jackendoff, 1983; Johnson- Laird, 1988) and recently theorised by Cross (2005) as "opposite poles of a communicative continuum", sharing common origins in terms of evolution. Both evolved from a human mimetic and motor-modelling capacity built upon a social ontology based on gesture and preverbal spatio-temporal concepts (Tolbert 2001: 84) allied to an innate musicality which is socially and emotionally promoted (Trevarthen, 1999). In terms of parallels between gesture and speech,

McNeill (2005), elaborating from the ideas of Vygotsky (1978), refers to language as an imagery language dialectic, in which gestures provide imagery. He considers gesture as an integral component of language when synchronous and co-expressive with speech, creating the conditions for an imagery–language–dialectic that fuels thinking for speaking as it seeks resolution. A similar parallel can be theorised for an imagery–music–dialectic, in which gestures can be considered as integral spontaneous components of music when synchronous and co-expressive with music. Musical gesture not only represents a link between music as sound, but also an intersubjectively founded social and emotional content (Kuhl, 2011:123). However, drawing such parallels calls for a deeper understanding of research into spontaneous co-verbal gestures.

The study of spontaneous co-verbal gestures has revealed that these gestures can, at times, simultaneously assume the following functions: perform the same pragmatic functions as speech (Kendon, 1980; McNeill, 1992); emphasise information in an interlocutor speech, or add information not present in their speech (Goldin-Meadow et al, 2001); have a role in speakers' conceptual plan of speech (Alibali et al, 2001); be used for indicating a listener's active engagement in the conversation (de Fornel, 1992); retain turns in conversation (Duncan, 1972); have a role in indicating transition in language and cognitive development (Goldin-Meadow & Alibali, 1985); facilitate lexical retrieval (Morrel-Sammuels & Kraus, 1992) and reveal speech production difficulties (Feyereisen, 1987). There are several classification systems for spontaneous gestures (for a review see McNeill, 1992 and Kendon, 2004) but McNeill's spontaneous co-verbal gestures classification has provided the basis for much of the field of modern gesture studies, particularly in the fields of Psycholinguistics, Psychology and Education. He classifies spontaneous co-verbal gestures as 'iconic' (representing images of objects and/or actions); 'metaphoric' (expressing images of the abstract); 'beats' (stressing important words, characteristically: up–down movements,

manifesting pragmatic significance); and 'deictic' (pointing movements). Spontaneous gestures co-occur with verbal language, most likely manifesting at moments of high communicative dynamics. In contrast to emblems and sign languages, they are not regulated by conventions (McNeill, 1992).

Gesture studies in the context of instrumental pedagogy should consider the dialectical aspect of music education in which music is inseparable from life and from the world, as proposed by Neuhaus (1973). As such, gestures should not simply be viewed only from a functional perspective. It seems, therefore, important to verify how applicable musical gestures classifications, such as Jensenius, Wanderley, Godoy & Leman, 2010 (derived from the field of music performance), can be to instrumental musical teaching/learning contexts. These authors have distinguished between 'sound producing' (effectively produce sound); 'sound facilitating' (support sound production in various ways); and 'sound accompanying' (not involved in sound production, but follow the music). It appears important to approach gesture form/shape and meaning with sensitivity to their particular contexts, implying that perhaps what can work in the context of musical performance may or may not be applied to the music instrumental teaching/learning contexts. It can also not be assumed that communicative gestures associated with music are the same as ones associated with speech. It is evident that co-verbal gestures can have certain roles and functions when allied to music education, performance and reception, especially in instances in which there may be a close interplay between music and speech. However, if speech and music are "opposite poles of a communicative continuum" (Cross, 2005), another logical assumption relates to the place of gesture as a communicative channel. Closer attention must be paid to the music educational contexts to determine the frequency, form, and functional significance of gestures in relation to particular teaching behaviours.

Methodology

An exploratory case study was deemed appropriate to answer the research questions (below). It was assumed that a small population sample could provide initial material for planning further detailed investigations.

The research questions were:

1. What gestures are developed by teachers in one-to-one piano lessons while teaching beginner pupils classical music?

2. How adequate are McNeill's classification of spontaneous co-verbal gestures (1992, 2005) and Jensenius et al.'s. functional classification of musical gestures (2010), for use in this context?

3. Are the frequencies of use of different types of teaching behaviours the same or different with respect to each type of gesture?

4. Do different teachers use different types of teaching behaviours with different frequencies?

Answers to the first and second questions were sought through qualitative observation of video material and for the third and fourth research questions the following hypotheses were established:

1. The frequencies of use of different types of gestures would be different with respect to each type of teaching behaviour.

2. The use of different types of teaching behaviours would be different with respect to the three teachers.

The first hypothesis was based on literature dedicated to the relationship between verbal content and gestural production (Ishino & Stam, 2011), implying that different teaching behaviours may lead to different gestures as they involve communication of different information. The second hypothesis was grounded on findings that different teachers

may adopt different teaching styles (Zhukov, 2004), leading consequently to different teaching behaviours.

Participants

Participants were three experienced female piano teachers (teaching experience between 20 to 30 years, age range between 39 to 55 years old, one from Ireland and two from other European countries; two have a PhD and one a Master's degree in music and all have specific accreditation in piano teaching), each teaching one piano student of proficiency level equivalent to Grade 1. The three student participants were one girl and two boys with ages ranging between 8 to 10 years, engaged in piano tuition for a period of five months prior to this study.

Materials

The observation stimuli consisted of a total of 18 teaching sessions captured on video. In each session teachers worked with students on two pieces of set repertoire, chosen according to students' skill level (*Lullaby* by I. Philippe and *Study* by G. Humbert, both compiled and edited by A. Nikolaev, 1978). The recording equipment consisted of a Sony video high definition camera. The digital video was converted to windows media file, transcribed, and annotated using the Elan Software programme (Lausberg & Sloetjes, 2009).

Procedure

A total of six teaching sessions (each seven minutes), for each of the three teachers were observed capturing first stages of engagement with the set repertoire. The video recordings

were carried out in typical day-to-day pedagogical interaction and all participants were unaware of the focus on gesture.

Analysis

Qualitative observation. Each gesture was observed and classified according to shape/contour, contextual pedagogical meaning, function and for the simultaneous use of verbal, non-verbal and musical modalities (such as singing, marking the beat, playing piano, etc.). Repeated observations revealed that teachers used certain gestures for similar pedagogical and/or musical ends.

Categorisation.The data was categorised into two main areas: teaching behaviour (table 1) and teachers' gestures (table 2). It was not possible to code the observed material according to the functional classification of musical gestures from Jensenius et al., 2010 as initially intended given the fact that the great majority of gestures developed by the participants in the course of teaching piano could fit simultaneously in several different categories. Rather, the authors created new categories (see table 2) named after general music literature and here designated as spontaneous co-musical gestures, in analogy to McNeill's work

[tables 1 and 2 – Here]

After the observations and annotation the material was offered to two independent annotators (in accordance with Bakeman and Gottman's 1986 requisites for observational techniques). The annotators were experienced piano teachers for whom the processes of gestural identification were carefully explained. Cohen's (1960) Kappa agreement levels of at least .87 ($p < .05$) were achieved for both teachers' teaching behaviours and teachers gesture categories (see table 3).

[Table 3 - Here]

Statistical analysis. A cross-tabulation analysis was conducted in SPSS containing the frequencies of use of nine types of gesture (Conducting Style, Co-verbal Beats, Deictic, Iconic, Metaphoric, Mimic, Musical Beats, Playing Piano and Touch) by seven types of teaching behaviour (Demonstrating, Giving Feedback, Giving Information, Listening/Observing, Modelling, Giving Advice/Practice Suggestions and Asking Questions) observed among three teachers based on a total of 639 observations.

Pearson's Chi-Square tests were used to test the research hypotheses. The categorical data analysis assumed that (a) each category was mutually exclusive and (b) no other categories of behaviours or gestures were observed.   Two original categories that contained many zeroes (Giving Advice and Giving Practice Suggestions) were collapsed into one category (Giving Advice/Practice Suggestions) for the purposes of analysis.

Cramer's *V* coefficients were used to measure the correlations between the variables The conventional interpretation applied was that $V < 0.1$ indicated little, if any, correlation; $V = .1$ to $.3$ indicated a weak correlation; $V = .3$ to $.5$ indicated a moderately strong correlation and $V > 0.5$ indicated a very strong correlation (Agresti, 2007).

Results

Gesture types, meaning and functions

From the 639 gestures found used by the three teachers across a total of 18 teaching sessions, the most frequent were: Deictic (39%); Playing Piano (14%), Co-verbal Beats (12%); and Metaphoric (10%). The less frequent were gestures were: Iconic (7%); Mimics (6%); Musical Beats (5%); Touch (4%) and Conducting Style (3%) (see Figure 1). Teachers used Deictic and Playing Piano gesture quite consistently among each other but differed considerably in

the use of other gestures: Teacher 2 used considerably less Metaphoric and Iconic gestures when compared to Teachers 1 and 3; Teacher 2 used Co-verbal Beats much more frequently than the other two teachers; Teacher 1 used considerably more Conducting Style gestures and Mimics than the other two teachers; but the other two appeared to use Touch more often than Teacher 1 (see Figure 2).

[Figures 1 and 2 – Here]

Spontaneous co-verbal gestures

Deictic gestures were used to point at the musical score, the piano keys, or to student body parts such as fingers, hands or arms and mostly used in association with verbal modality. Roughly 20% were allied with musical modalities (such as singing, marking the beat, etc.). Deictic gestures appeared useful in relating teacher and student to the musical metaphorical environment showed at the score by the means of icons, for synchronising teacher and student and to show where notes were located on the piano. Metaphoric gestures were highly used in association with verbal language (89% of the cases) and used essentially as an aid to communication. A great majority of the Iconic gestures consisted of gestural descriptions of musical signs (particularly legato and staccato signs). In such cases, Iconic gestures were used to trace the shape of the musical symbols in the air, a process sometimes performed whilst pointing at these elements at the score, as if taking these signs 'out of score' to a physically performative arena. Co-verbal Beats served essentially communicative functions in association with verbal language.

Spontaneous co-musical gestures

Musical Beats assumed functions such as entrainment and synchronisation. Used regularly before starting the musical performance with the goal of setting the initial tempo, they

appeared to function as a platform for synchrony between the musical interaction of teachers and their students. In terms of modalities: 42% of Musical Beats were associated with other musical modalities; 43% with verbal modality; and 15% with non-verbal. The essentially communicative nature of Conducting Style gestures related to specific musical functions, such as: facilitating sound production when preparing to start and/or end the sound producing gesture and promoting synchronisation between teacher, student and the musical piece. In 90% of the Conducting Style gestures, there were other musical modalities involved. In just 22% of Piano Playing gestures, teachers only played piano. The remaining 78% of Playing Piano gestures were performed in a highly communicative environment of playing piano alongside verbal explanations, often involving other musical modalities such as singing, marking the beat and was associated with Demonstrating, Giving Information, and Modelling teaching behaviours. Mimicking was shown to have specific musical functions such as facilitating sound production in terms of rectifying sound production gestures and/or movements with a view to improving performance and to promote imitative behaviour by the student (sometimes without giving a direct verbal indication for imitation). This was observed in instances of preparing to start and/or end sound producing gestures. This gesture was used quite consistently across musical modalities (30%), verbal (36%) and non-verbal modalities (34%). Touch appeared to be used for communicative purposes such as establishing a communicative channel, maintaining/recalling students' attention and specific musical functions, such as communicating: the weight of the hand to be used to press keys, the type of movement and physical posture of the hand, fingers and body to be used, the kinaesthetic sensation that should be felt and applied to the piano keys in order to produce the desired tone and preparing to start and/or end the sound producing gesture. Touch was mostly used alongside verbal modality (59%) with high metaphorical verbal content, but it

was also employed in conjunction with musical modalities (34%), and in 7% of the cases with non-verbal.

Relationship between teaching behaviours and gesture types

The third research question (are the frequencies of use of different types of teaching gesture the same or different with respect to each type of teaching behaviour?) was addressed using the cross-tabulation in Table 4. The null hypothesis that the frequencies in the columns of the cross-tabulation would not be significantly associated with the frequencies in the rows was rejected at the 5% level of significance, indicated by Pearson's χ^2 (48, $N = 639$) = 376.36, p <.001. The correlation between behaviours and gestures was moderately strong, indicated by Cramer's $V = .313$. The main reason for this correlation was that the teaching behaviours were not equitably distributed across the gestures. On Table 4 it can be observed that: Modelling behaviour mostly included Co-verbal Beats (71.4%), Conducting Style (89.5%) and Touch (74.1%); Deictic gestures were mainly observed during Giving Information (39.9%) and Modelling (34.3%); Iconic gestures occurred mainly while Giving Advice/Practice Suggestions (26.7%) and Giving Information (37.8%); A wide variety of behaviours, including Asking Questions (14.1%) Giving Information (32.8%) and Modelling (17.2%) were associated with Metaphoric gestures; Modelling behaviour was mainly associated with the gestures classified as Mimic (57.9%) and Musical Beats (62.5%). The gesture of Playing Piano was observed mainly during Demonstrating (56.2%) and Modelling (29.2%).

[Table 4 – Here]

Teaching behaviours across teachers

The fourth research question (do different teachers use different types of teaching behaviours with different frequencies?) was addressed using the cross-tabulation in Table 5. The null hypothesis that the frequencies in the columns of the cross-tabulation would not be significantly associated with the frequencies in the rows was rejected at the 5% level of significance, indicated by Pearson's χ^2 (12, N = 639) = 52.65, p <.001. The correlation between teaching behaviours and the three teachers was however, relatively weak, indicated by Cramer's V = .203. Inspection of Table 5 shows that the main reason for the correlation was that the teaching behaviours were not equitably distributed across all three teachers. The frequencies of Demonstrating (16.9%) Giving Advice/Practice Suggestions (7.5%) Giving Feedback (10.0%) were consistently higher in T3 than in both T1 and T2, whereas the frequencies of Listening/Observing (2.5%) and Modelling (30.0%) were consistently lower in T3 than in both T1 and T2. The most frequent behaviours of T1 were Giving Information (32.0%) and Modelling (32.0%) whereas the most frequent behaviour of T2 was Modelling (55.1%).

[Table 5 – Here]

Discussion

Parallels between spontaneous co-verbal gestures and spontaneous co-musical gestures

The fact that Jensenius et al. (2010), musical gesture classification could not be applied to this context and that McNeill (1992, 2005) could only be applied to spontaneous co-verbal gestures reveals that the context of musical performance is quite different from the instrumental music teaching setting, each requiring different research approaches. The findings demonstrate that the communication of musical knowledge encompasses a communicational atmosphere in which verbal and musical behaviours both operate simultaneously and independently.

Several key parallels can be established between the spontaneous co-musical and co-verbal gestures (McNeill, 1992, 2005). Spontaneous co-verbal gestures accompany and are synchronous with speech. In the context of this study, spontaneous co-musical gestures accompanied an intentional musical experience, in the form of teaching to play a musical instrument. These gestures were synchronous both to the music and to the experience of music making. Whilst spontaneous co-verbal gestures are "idiosyncratic spontaneous movements of the hands and arms accompanying speech" (McNeill, 1992:41) generally occurring in highly dynamic communicative contexts (Ishino and Stam, 2011), the spontaneous musical gestures here observed were idiosyncratic and synchronous with the activity of music making. In the same way that verbal content can, in many instances, determine the type of gestures being used, musical content guided teachers' use of gestures. There were many occasions in which spontaneous co-musical gestures appeared to represent features of the musical content in the same manner that spontaneous co-verbal gestures "can represent features in the speech, complement it, or represent an aspect present in the speakers' thought but not expressed through speech" (Ishino & Stam, 2011: 4). This was particularly evident in cases where spontaneous musical gestures represented features in the musical score, such as the musical beat or expressive features. These gestures facilitated teaching attempts to represent material in the musical score, helping to make it more accessible to the student, enabling teachers to project their ideas in ways unavailable to them through speech alone. While spontaneous co-verbal gestures only accompany speech and other speech related activities, such as singing (simultaneously a speech-related and music-related activity), spontaneous co-musical gestures accompanied either: speech and music making at the same time, or only music making. Spontaneous co-musical gestures differ from their co-verbal equivalents in terms of form/shape and the nature of their communicative function. While it can be argued that the Conducting Style and Musical Beats gestures are

musically guided by specific norms and may therefore be ruled out as emblems (in opposition to spontaneous co-verbal gestures, it was observed that Musical Beats were used in this study in a relatively free and spontaneous manner, determined by the rhythmical perceptual needs of the students and Conducting Style gesture did not obey rigid conducting norms.

These findings suggest that McNeill's (2005) imagery–language–dialectic ideas can be extended to the field of music as imagery–music–dialectic. He considers gesture as an integral component of language when synchronous and co-expressive with speech, arguing that the synchrony of speech forms and gestures creates the conditions for an imagery–language–dialectic that fuels thinking for speaking as it seeks resolution. As such, Deictic and Iconic gestures (such as when teachers gesture by means of physically tracing musical symbols in the air) may assume an iconic referential that, in the context of instrumental music education has an ultimate pedagogical goal of meaning creation.   Additionally, it can be argued that the Playing Piano gesture, which assumed in many instances a demonstrative function of what a teacher sought in terms of student musical performance, provided a musical–imagery–dialectic that fuelled student willingness to imitate the teachers' actions. Imitating can constitute much more than simply copying a teacher's actions providing an empathetic understanding of music in itself as a way of communicating feelings, motivations and intentions (Tolbert 2001:89; Rizzolatti & Arbi, 1998; Overy & Molnar Szakacs, 2009). Mimics in this study, contributed to teaching the functional aspects related to learning to play and how to play piano promoting a students' creation of a symbolic and abstract repertoire of gestural memories (Tolbert, 2001) and an imagery–music–dialectic between teacher, student and the musical work in development.

Towards a categorisation of physical gesture in piano teaching

The findings of this study not only call for a categorisation of physical gesture for this specific context, but also reveal important aspects to take into account in doing so. The prevalence of Deictic gesture in the overall gestures frequency in this study requires a closer consideration of this gesture type in the context of instrumental music teaching. Deictic gestures occurring without verbal language and allied to a strictly musical behaviour could be considered as spontaneous co-musical deictic gestures and as such, not limited to the use of verbal language. It was clear from the results that Deictic gestures have an important role in terms of ascribing meaning to the icons/symbols in the score and their translation to a self-functional experience, engaging mind and body. Although Conducting Style gestures are studied from the point of view of orchestra/choir direction and co-performers communication, only minimal reference is made to it in the music instrumental pedagogical literature (i.e. Neuhaus, 1973). The 3% figure of usage by teachers in the overall gestures frequency suggests that teachers may not be aware of potential benefits of using this gesture in this context. In addition, recent research asserts that in a musician's synchronisation with a conductor, the synchroniser's previous experience is the most important factor (Luck, 2011). This makes it possible to infer that individuals participating in instrumental lessons, in which teachers conduct during the lesson, may be better equipped to musical ensemble playing than students of teachers who do not conduct. The Playing Piano gesture results from a process of translation of the symbols/icons from the musical score to sound, through a physical and corporeal experience. The musical conventions are nevertheless always individually interpreted. As such, it is possible to argue that playing piano has as much of iconic as metaphoric status in terms of experience against claims that a gesture cannot assume such duplicity (e.g. McNeill, 1992). In terms of teaching students to use their body for playing piano, the Mimics gesture appeared relevant as teachers used it for explaining movement principles (in agreement with both students' health and safety and in alignment with the best

interests of the work of music). However, there seems to be a contradiction between claims that the quality of a musical performance is directly related to how efficiently we use our bodies as musicians and the relatively low frequency of Mimics gesture as performed by the teachers in this context (only 6% of total gestures). Whilst there is a considerable amount of literature dedicated to piano touch and tone recognising the importance of piano touch for sound and tone quality from the early stages of learning (see Dogantan-Dack, 2011), there are no specific instructions to teachers (except for the use of verbal metaphor) on how to practically teach a student how to touch the piano keys in order to produce desired tones. In this study, Touch amounted to only 4% of all gestures; however, as used by the teachers in this study (strictly when necessary) it proved to be an important tool for the context of piano teaching. A balance needs therefore to be achieved between pedagogical aims on tone and the reality that some students are very sensitive to being touched (Levasseur, 1994).

The moderately strong significant correlation found between teaching behaviours and gestures, by the three teachers and the uneven distribution of gesture types between teaching behaviours would suggest that certain gestures have emerged in the teachers' approach as being more effective for communicating particular kinds of musical knowledge to the students. For example, Co-verbal Beats, Touch and Conducting Style were observed more often during Modelling than during other teaching behaviours, while Iconic gestures occurred more during Giving Information and Giving Practice Suggestions/Advice. However, the distribution of observed teaching behaviours was different across the three teachers and can be attributed to differences in teaching style (Zhukov, 2004). It would be interesting to investigate if similar results would be found with novice teachers and whether there is a genuine difference between the effectiveness of certain gesture types within different teaching behaviours, or if this is simply a matter of preference or style of the teacher. The association of spontaneous co-musical gestures with Modelling teaching behaviour suggests

that these gestures are relevant and specifically used for communicating musical knowledge during the teaching/learning process. Viewing the data from the perspective of students and their gestures as part of music-making can also provide wide ranging information for areas such as music psychology, education and performance. The framework used in this study can be extended to other types of one-to-one music instrumental teaching/learning scenarios such as woodwind, string, brass, vocal teaching as well as expanded to encompass coaching of small ensembles and comparisons with conductors of small/large ensembles. It is clear that the intense communicative scenario of teaching to play a musical instrument paired with the dual symbolic and functional aspect of gestures requires a specialised gestural analysis taking gesture types (form/shape and meaning) and functions into account. Moreover, this intricate dual functionality cannot easily be disassociated.

The current investigation has a number of limitations. Firstly, the small population sample: only three teachers and three students. Secondly, the student population is relatively young and less experienced (8-10 years old engaged in piano grade 1). It is possible that a different focus would be given by teachers to gesture and musical embodiment when teaching students that are more fluent at decoding the musical score. And thirdly, the focus on teachers' gestures in a piano teaching/learning context implies that specific contextual adaptations may be required when applying the spontaneous co-musical gestures classification to other contexts of instrumental music teaching/learning.

Conclusion

The findings of this study revealed that the instrumental teaching context not only makes use of spontaneous co-verbal gestures but also avails from a set of gestures, that in analogy to co-verbal gestures have here been termed spontaneous co-musical gestures. Whilst McNeill's (1992; 2005) spontaneous co-verbal gestures provide a relevant conceptual basis for

theorising the interactional communication between teacher and student, spontaneous co-musical gestures were ubiquitous and an essential element in the process of musical communication between teachers and students. Moreover, teachers were observed as employing both spontaneous Co-Verbal and co-musical gestures simultaneously and in some cases independently for the achievement of specific music instrumental pedagogical ends.

The strongly significant and moderate effect size of the correlation between teaching behaviour and gesture types suggests that there is a relationship between the didactic intention of the teacher and the forms of gesture they use to communicate information to the student. The nature and effectiveness of this relationship should be a subject of further investigation. Such a step might help in the development of teaching strategies alongside factors such as students' ages and skill levels.

The communicative parallels established between co-verbal and co-musical spontaneous gestures can have important implications for piano pedagogy and fields of study invested in musical communication by instigating new lines of enquiry, promoting empirically based practical and useful knowledge for practitioners. These findings are specific to the context of the western classical music tradition and considerations of other musical cultures in which music notation may be regarded differently demand their own specific contextual approaches.

Ethical Approval

Ethical approval for this project was given by XXXXXX [ref number xxxxx].

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TABLES:

Table 1. Teaching behaviour categorisation in use for this study

	Types	Definition
	Giving Information	Teacher providing general and/or specific conceptual information
	Giving Advice	Giving a specific opinion or recommendation to guide the student's action towards the achievement of certain specific musical aims, without demonstration or modelling
	Giving Practice Suggestions	Providing suggestions of ways to practise a particular passage or discussing a practising schedule
(Adopted and adapted from Carlin 1997 and Zhukov 2004)	Asking Questions	Enquiring
	Giving Feedback	Teacher evaluation of a student's applied and/or conceptual knowledge)
	Demonstrating	Instances where teachers were showing the student how a particular action should be performed, without actively engaging the student in the action and in which the student was mostly listening and observing
	Modelling	Instances where teachers actively engaged the student in performing actions alongside teachers' explanations
(Present authors)	Listening/Observing	Teacher presents physical stillness while internally processing the material presented/played by students in order to diagnose student needs, and establish a teaching plan of action suited to the student

Table 2. Gesture categorisation in use for this study

	Types	Definition
Spontaneous co-verbal gestures	Deictic	Pointing

(McNeill 1992, 2005)	Iconic	express images of actual objects or actions
	Metaphoric	express images of the abstract
	Co-verbal Beats	Up and down movements of hand, arms and/or head with the purpose of highlighting information that is external to the gesture in itself, occurring at the meta-level of discourse.
Spontaneous co-musical gestures (present authors)	Musical Beats	Up and down movements of hand, arms and/or head that only denote the tempo or speed at which the music should be played without providing expressive musical information
	Conducting Style	Up and down movements of hand and arms, that assume generally a rounder shape providing temporal information and expressive information about the music
	Playing Piano	Instances where teachers were intentionally and actively engaged with music making in the form of piano playing
	Mimics	Instances where teachers appeared to mimic a certain mental image of a gesture that they considered appropriate to perform a particular musical sound producing action while expecting the student to imitate the gesture shown.
	Touch	Instances where teachers have made intentional physical contact with the student in the course of instrumental music teaching.

Table 3. Cohen's Kappa inter-annotators agreement

Categories	Number of references	Annotators 1-2	annotators 1-3	annotators 2-3
Teachers' teaching behaviours	314	.93*	.87*	.93*
Teachers' gestures	639	.91*	.88*	.87*

*$p < .05$

Table 4. Cross-tabulation of behaviours versus gestures

	Behaviours	Total

Gestures		Asking Questions	Demonstrating	Giving Advice/ Practice Suggestions	Giving Feedback	Giving Information	Listening/ Observing	Modelling	
Co-verbal Beats	Frequency	3	2	1	5	4	7	55	77
	% by Gesture	3.9%	2.6%	1.3%	6.5%	5.2%	9.1%	71.4%	100.0%
	% by Behaviour	7.7%	2.3%	2.9%	17.9%	2.4%	30.4%	21.2%	12.1%
Conducting Style	Frequency	0	0	0	0	2	0	17	19
	% by Gesture	.0%	.0%	.0%	.0%	10.5%	.0%	89.5%	100.0%
	% by Behaviour	.0%	.0%	.0%	.0%	1.2%	.0%	6.5%	3.0%
Deictic	Frequency	20	14	10	9	99	11	85	248
	% by Gesture	8.1%	5.6%	4.0%	3.6%	39.9%	4.4%	34.3%	100.0%
	% by Behaviour	51.3%	15.9%	28.6%	32.1%	59.6%	47.8%	32.7%	38.8%
Iconic	Frequency	6	3	12	3	17	0	4	45
	% by Gesture	13.3%	6.7%	26.7%	6.7%	37.8%	.0%	8.9%	100.0%
	% by Behaviour	15.4%	3.4%	34.3%	10.7%	10.2%	.0%	1.5%	7.0%
Metaphoric	Frequency	9	7	8	8	21	0	11	64
	% by Gesture	14.1%	10.9%	12.5%	12.5%	32.8%	.0%	17.2%	100.0%
	% by Behaviour	23.1%	8.0%	22.9%	28.6%	12.7%	.0%	4.2%	10.0%
Mimic	Frequency	0	6	0	2	7	1	22	38
	% by Gesture	.0%	15.8%	.0%	5.3%	18.4%	2.6%	57.9%	100.0%
	% by Behaviour	.0%	6.8%	.0%	7.1%	4.2%	4.3%	8.5%	5.9%
Musical Beats	Frequency	0	5	0	0	3	4	20	32
	% by Gesture	.0%	15.6%	.0%	.0%	9.4%	12.5%	62.5%	100.0%
	% by Behaviour	.0%	5.7%	.0%	.0%	1.8%	17.4%	7.7%	5.0%
Playing Piano	Frequency	1	50	3	1	8	0	26	89
	% by Gesture	1.1%	56.2%	3.4%	1.1%	9.0%	.0%	29.2%	100.0%
	% by Behaviour	2.6%	56.8%	8.6%	3.6%	4.8%	.0%	10.0%	13.9%
Touch	Frequency	0	1	1	0	5	0	20	27
	% by Gesture	.0%	3.7%	3.7%	.0%	18.5%	.0%	74.1%	100.0%
	% by Behaviour	.0%	1.1%	2.9%	.0%	3.0%	.0%	7.7%	4.2%
Total	Frequency	39	88	35	28	166	23	260	639
	% by Gesture	6.1%	13.8%	5.5%	4.4%	26.0%	3.6%	40.7%	100.0%
	% by Behaviour	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: 35, 55.6% of cells have expected frequencies < 5; Pearson's χ^2 (48, $N = 639$) = 376.36, p <.001; Cramer's V = .313

Table 5. Cross-tabulation of behaviours versus teachers

	Teacher			Total

Behaviour		T1	T2	T3	
Asking Questions	Frequency	16	14	9	39
	% by Behaviour	41.0%	35.9%	23.1%	100.0%
	% by Teacher	7.1%	5.5%	5.6%	6.1%
Demonstrating	Frequency	33	28	27	88
	% by Behaviour	37.5%	31.8%	30.7%	100.0%
	% by Teacher	14.7%	11.0%	16.9%	13.8%
Giving Advice/Practice Suggestions	Frequency	14	9	12	35
	% by Behaviour	40.0%	25.7%	34.3%	100.0%
	% by Teacher	6.2%	3.5%	7.5%	5.5%
Giving Feedback	Frequency	7	5	16	28
	% by Behaviour	25.0%	17.9%	57.1%	100.0%
	% by Teacher	3.1%	2.0%	10.0%	4.4%
Giving Information	Frequency	72	50	44	166
	% by Behaviour	43.4%	30.1%	26.5%	100.0%
	% by Teacher	32.0%	19.7%	27.5%	26.0%
Listening/Observing	Frequency	11	8	4	23
	% by Behaviour	47.8%	34.8%	17.4%	100.0%
	% by Teacher	4.9%	3.1%	2.5%	3.6%
Modelling	Frequency	72	140	48	260
	% by Behaviour	27.7%	53.8%	18.5%	100.0%
	% by Teacher	32.0%	55.1%	30.0%	40.7%
Total	Frequency	225	254	160	639
	% by Behaviour	35.2%	39.7%	25.0%	100.0%
	% by Teacher	100.0%	100.0%	100.0%	100.0%

Note: No cells have frequencies < 5; Pearson's χ^2 (12, $N = 639$) = 52.65, $p < .001$; Cramer's V = .203
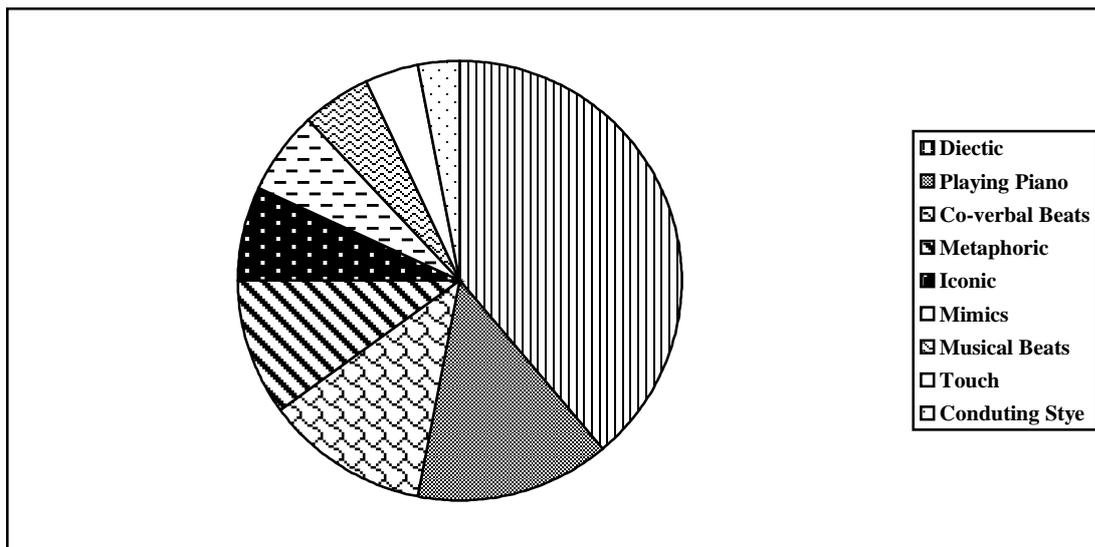
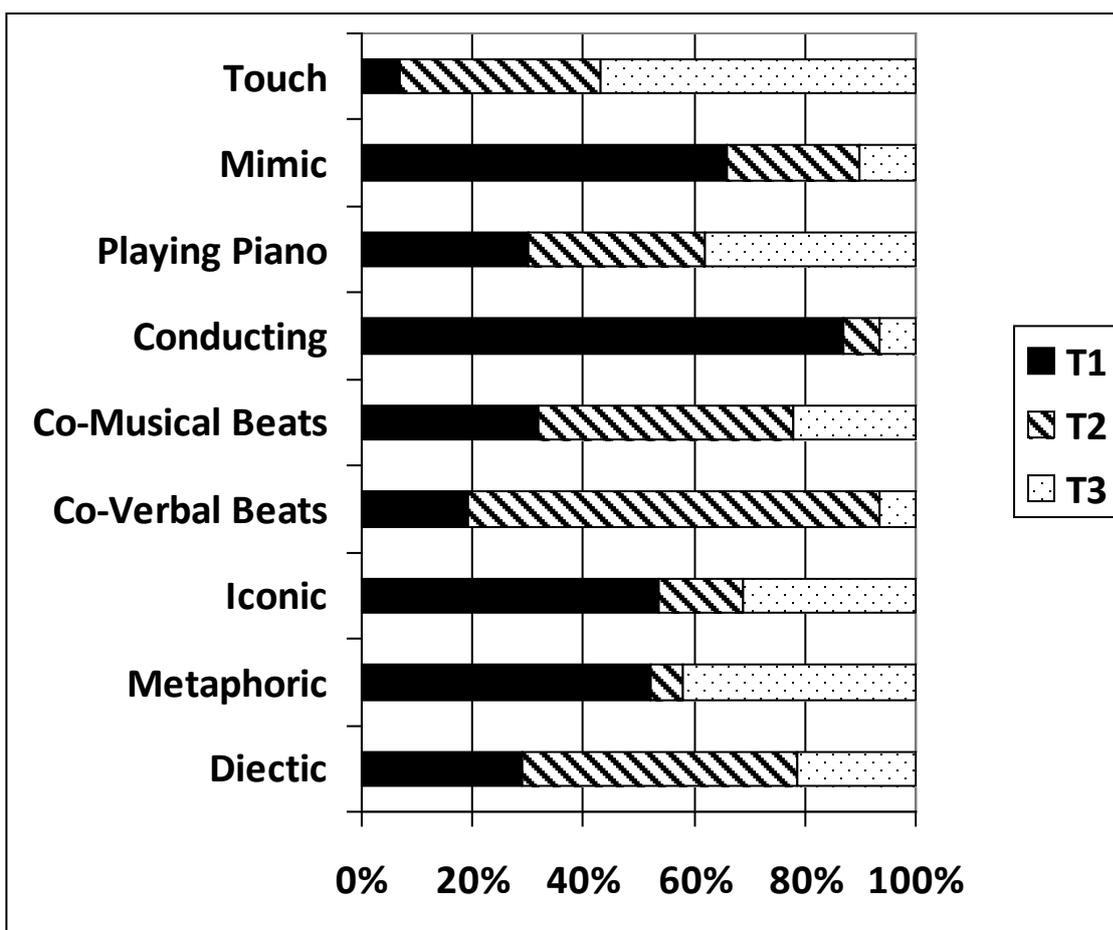**FIGURES**

Figure 1. Gesture types used by the totality of teachers.

Figure 2. Gesture types individually used by teachers.