Expressivity and musical performance: Practice strategies for pianists

Alfonso Benetti Jr.
Aveiro University (Portugal)
Inet-MD (Institute for Ethnomusicology, Music and Dance)
FCT (Foundation for Science and Technology)
Email: alfonsobenetti@ua.pt

This study addresses the approach of expressivity by professional pianists and their practical strategies, in order to collect information that may contribute to identifying patterns and pointing out study strategies for an expressive performance. The research addressed the following questions:

- How to organize decisions that lead to an expressive performance?
- What are the strategies applied in daily practice?
- How do pianists describe expressivity?
- What are the elements and characteristics of expressivity mentioned by pianists?

Twenty professional pianists were chosen from 7 different countries, 21 to 70 years old. All subjects were interviewed on issues such as expressivity, its definition and practical application. The purpose of the interviews was to collect information that would characterize their patterns of study and performance in terms of expressive objectives, linking interpretive aspects of the work and self-perceived physiological approach to the instrument. The interviewees were asked about the application of expressive elements to a piece or specific passages, identifying deficiencies and possible solutions to issues such as the relationship between expressivity and tempo, *rubato*, phrasing, dynamics, choice of fingering, articulations, pedal, and the influence of extra-musical information.

1 – Introduction

Non-empirical approaches by Cortot (1928), Lhevinne (1972), Neuhaus (1973), Hofmann (1976) to piano performance have long regarded expressivity as one of the main elements in musical interpretation, and pioneering empirical approaches have been conducted by Seashore (1932) and Bengtsson (1967), respectively related to performer's behaviour and aspects of rhythm. However, according to Gabrielsson (2003), it was from the 1970s that the number of studies related to music expressivity has grown considerably, mainly based on measurements of performance parameters, such as tempo and dynamics. Most studies relate expressivity to discrepancies between

performance data and the musical text, and these discrepancies were named expressive *deviations* (Sundberg and Verrillo 1980, Todd 1985, Repp 1990, Todd 1992, Drake and Palmer 1993, Todd 1995, Clynes 1995, De Poli 1998, Sundberg 1991, Hazan and Ramirez 2006). This concept originated one of the most important categories of study on expressivity, the computational models (Sundberg et al. 1983, Todd 1985, Clynes 1986, Clarke 1988, Todd 1989, Johnson 1991, Todd 1992, Mazzola 1994, Todd 1995, Aono 1997, Arcos 1997, Bresin 1998, Camurri 2000, Juslin 2002, Mazzola 2002, Widmer 2002, Widmer and Tubodic 2003, Friberg 2006, Hashida 2006, Windsor 2006, Livingstone 2007) based on expressive deviations from the score and used to determine generative rules applied to expressivity. Recent studies have tried to demystify the expressivity concept as something that is not taught and not learned (Hudson 1994, Sloboda 1996, Woody 1999, Williamon 2004), and even if the concept of expressive deviation is currently accepted by researchers, new studies tend to involve multidimensional aspects in the study of expressivity, such as semiotics (Clarke 1995) and psychology (Juslin 2003).

Preliminary steps of the current study also provided important results regarding expressivity conceptualization and instrumental practice: Benetti (2009) conducted a study with three pianists in different levels of formation, recorded their practice sessions, and concluded that the expressive practice strategies that they adopted applied common patterns, independently from the type of repertoire and individual objectives during practice. Benetti (2011) also conducted an analysis of reports, interviews and documentaries about expressivity by professional pianists such as Leschetizky, Lhevinne, Neuhaus, Hofmann, Cortot, Rubinstein, Brendel, Baremboim, Argerich, and Freire, and distinguished four main recurring topics prevailing in their approach to the concept: sonority, character of the work, emotion in performance, and unpredictability.

Even though the number of studies and the interest of researchers in expressivity have grown considerably in the last years, results from empirical research are not particularly attractive to musicians in general. The empirical methodology can be partly responsible for this negative outlook: the tendency to work with isolated parameters (which ultimately provide more answers about the parameter itself than about expressivity), the difficulty in integrating findings in order to accomplish performance requirements and the lack of subjective parameters for the evaluation of expressivity are some of the aspects to be considered. The general disinterest of performers in taking

part in empirical studies represents a challenge to researchers and reflects the scepticism about the applied methods. This could be related to the following reasons:

1) According to Juslin, "Matters of expression have largely been reduced to tables or graphs of acoustic data, whereas the question of what this data actually tells us about the origins of musical expression is somehow been lost" (Juslin 2003, 275);
2) Results obtained from most researches do not point out practical approaches to musicians, and in many cases they configure specificities related to basic principles of instrumental playing;
3) Scientific language is limited as a support to musical language, which embraces a wide range of objective and subjective information, and communicates efficiently with the musician;
4) The difficulty of empirical methods in explaining and conceptualizing expressivity favours the permanence of preconceptions about the subject.

Interdisciplinary studies involving music performance represent a current approach and have consistently informed areas such as medicine, psychology, and anthropology. Relevant results require working in an integrated and multidimensional manner with parameters involved in performance, in order to provide wider responses to performers about the phenomenon. However, in my view as a musician, the research of concrete strategies for improving the expressive skills of expert performers is still limited and a subject to be explored in a way that informs instrumentalists. The current study intends to fill these gaps and provide practical information about improving expressivity qualities to musicians in search of excellence.

2 – Method

In order to obtain consistent data, interviews were conducted with renowned active professionals, with frequent performances in recitals and concerts as soloists, recordings, and in accordance with excellence skills pointed out by recent studies on performance expertise. Most of these criteria are related to the amount of accumulated practice in hours: according to Ericsson (1993) ten thousand hours are needed, for Krämpe (1997) sixty thousand hours are needed, for Sloboda (1996) two thousand and five hundred hours are needed at thirteen years old, six thousand at seventeen, and ten thousand at twenty-one years old. However, studies conducted by Williamon (2000) and Chaffin (2004) concluded that not only the amount of hours is important, but also the

quality of practice. Based on these criteria, I decided to choose musicians professionally active for more than ten years and older than twenty-one years, which means that they have probably accumulated more than ten thousand hours of effective practice in high-level quality activities. Characteristics of the pianists' gender and nationality are displayed in table 1.

Table 1 – Characteristics of the interviewed pianists according to gender and nationality

Gender	Male				Female		
	15				5		
Nationality	Portugal	Brazil	Russia	Poland	Romania	EUA	Germany
	5	9	2	1	1	1	1

A semi-structured interview was applied in order to obtain data related to the following topics: expressivity concept (how interviewees define expressivity), and study strategies (what are the practice mechanisms for improving expressivity used by the pianists). Within the topic of concept, the interview structure addressed: meaning (what is expressivity) and content (components of expressivity mentioned by interviewees). Within the topic of study strategies, a large number of issues were discussed, addressing the following aspects: the piece (e.g. harmony, articulations, analysis of the work and musical structure), practice mechanisms and patterns (e.g. fingerings, gestures and movements, and application of specific touches), organization of practice, instrumental resources (e.g. pedals), execution parameters (e.g. timing and dynamic variations, rhythm, *rubato*, phrasing) and extra-musical resources. Subsequently, the data was qualitatively analysed with the support of *NVivo* software, following the Bardin model (1977): pre-analysis, material exploration, processing and interpretation of results.

3 – Results

3.1 – Concept

3.1.1 – Meaning

According to the collected data, similarities pointed out by the answers to the question "what is expressivity in music for you?" included the following results:

1) 60% of the pianists pointed out expressivity as a communication tool between performer and listener, which occurs in the following manners:

general communication (15%), communication of musical message (10%), communication of musical structure (10%), communication of emotion (10%), performer's ability to communicate (5%), communication of musical character (5%), and communication of a musical intention (5%);

2) 30% of the pianists referred to expressivity as a freedom space for the performer, related to three aspects: aesthetic (15% - which indicates limitations of the expressive mechanisms to be applied), intellectual (15% - freedom increases along with an increased knowledge of the piece), and sound (10% - freedom is related to the sound conception);
3) 20% of the pianists related expressivity to the meaning provided by the understanding of the musical text;
4) 15% of the pianists equated expressivity with the "musicality" of the performer, which consists in the ability to combine elements to produce specific results;
5) 15% of the pianists related expressivity to cultural phenomena;
6) 5% of the pianists related expressivity to the following:
   - An "interior physical sensation" which links the performer and the sound;
   - The musical imagination of the performer;
   - Musical "declamation" during performance (related to singing and cantabile);
   - Musical intuition of the performer;
   - Individual characteristics of the work;
   - All the elements of sound production during playing.

3.1.2 – Components

Components of expressivity were identified by analysis of direct answers on this subject and by complementary discussion of others subjects, and pointed out sixty-nine elements. The most relevant were related to musical parameters (articulation, character and phrasing), musical piece (style, musical text and structure), instrument (pedal and its mechanics), interpretation (meaning and understanding, imagination and period trends), performer (technique and personality), performance (communication), sound (sonority and contrasts), and human aspects (feeling, emotion and culture).

3.1.3 – Extra-musical elements

Analysis showed that 75% of the pianists normally rely on extra musical elements while practicing a piece. These elements establish relationships between the context of the work, communication of musical message, interaction between different kinds of information, and interpretation. These elements were the following: literature (25%), visual arts (25%), dance (20%), historic and cultural context (20%), images (not necessarily visual – 10%), human knowledge (10%), architecture (5%), moods (5%), meditative states and spirituality (5%), and scenic arts (5%).

3.1.4 – Tendencies

Analysis of the interviews showed some current tendencies related to expressivity:

1) Most of the pianists (65%) considered that the works from the Romantic period present more expressive possibilities than works from other periods. This is justified by their emotive and intimate character;
2) 60% of the pianists related the increase of expressivity to the execution of works or movements in slow tempos;
3) According to 55% of the pianists, expressivity changes according to trends that determine expressive "fashion" at specific periods. 25% of the pianists pointed out that these "fashion" periods last about fifty years, followed by changes in patterns;
4) 45% of the pianists stated that contemporary music offers less expressive possibilities than other repertoires. They related this to the lack of freedom for the interpreter, and difficulties in understanding this music;
5) 35% of the pianists related expressivity and increased contrasts during performance;
6) 20% of the pianists considered rational approaches less expressive than instinctive ones.

3.2 – Study Strategies

This section addresses the four most relevant mechanisms related to expressivity pointed out by the interviewed pianists: articulation, *rubato*, pedal, and phrasing.

3.2.1 – Articulation

Analysis showed that 80% of the pianists relate expressivity and musical articulation. However, according to the interviewees, working on this aspect demands the understanding of the musical context, and attention to specific characteristics of the passages. Most mentioned criteria can be divided into two aspects: musical parameters and execution elements. According to the interviewees, the musical parameters associated with articulation are: character (articulations must underline the character of the work or the passage), tempo speed, and the work style (which informs articulation-related possibilities). The execution elements mentioned were: the sustaining pedal (auxiliary element), and fingerings. Furthermore, two pianists mentioned that playing other instruments helped improving the understanding about articulations. Table 2 presents a synthesis of the approach to articulation by pianists that were interviewed:

Table 2 – Results regarding articulation

Articulation plays a central role on expressivity	**80%**
Articulations depend mainly on the musical character	30%
Articulation execution depends on tempo pulsation	25%
Pedal is mentioned as an auxiliary element	15%
Fingerings help a better execution of articulations	10%
Playing others instruments is recommended	10%
The work style plays a central role on articulation possibilities	5%

3.2.2 – *Rubato*

75% of the pianists state that *rubato* enhances expressive qualities. Conceptually, some pianists believe that *rubato* consists in “freedom points” where the performer can “bring out” some notes above others. Furthermore, *rubato* playing is commonly related to the style of the work and melodic phrasing. The work’s style was addressed as an element that suggests the amplitude of the applied *rubato*, allowing for more freedom in the Romantic repertoire and more limitations in works from the Baroque period. Furthermore, post-war repertoire was mentioned by one of pianists mainly as a “metronomic” composition style, which also limits the *rubato*. In the

context of phrasing, *rubato* was addressed as an efficient mechanism to underline the melodic line. In this way, *rubato* application is guided by phrase structure, culminant points, and harmonic direction. Table 3 shows that, besides style and phrasing, other important elements related to *rubato* were pointed out by interviewees:

Table 3 – Results regarding r*ubato*

***Rubato* enhances expressive qualities**	**75%**
Rubato playing is commonly related to the style of the work	35%
Rubato playing is commonly related to the melodic phrasing	30%
The Work's character provides orientation to the *rubato*	20%
The Amplitude of *rubato* application requires coherence in order to underline expressivity and not to disfigure the work	20%
The Musical structure is a guide to *rubato* points of application	15%
Dynamics underline the amplitude of *rubato*	5%
Rubato establishes a musical-discourse hierarchy, and is used to manipulate the listener's expectation	5%

3.2.3 – Sustaining Pedal

70% of the interviewees consider the sustaining pedal as one of the main expressive elements during performance. According to them, this is a mechanism that enhances the expressive qualities of a piece and that can be improved not only by practice, but also by watching other pianist during concerts. According to the data collected, the use of this pedal is related to some elements; the most referred were harmony, tempo, articulations, and work style.

For most pianists, harmony determines the pedal changing points, and tempo determines the manner of pedal application (e.g. full pedal, half pedal, or vibrato pedal), since it changes the global effect for a specific passage. Pedal use does not interfere with the clear execution of articulations, and the work's style limits pedal application in Baroque repertoire, by opposition to the Romantic repertoire. Furthermore, flexibility in the use of pedal is required because of the need to adapt to different hall acoustics. Analysis found some recurrent topics regarding pedal application, namely the need to work "by ear", the application of specific gradations (full, half, quarter), and traditional

approaches to syncopated pedal (changing pedal after playing the note) and *a tempo* pedal (together with playing the note). Table 4 shows some results regarding this subject:

Table 4 – Results regarding the sustaining pedal

Sustaining pedal is one of the main expressive elements during performance	**70%**
Controls the pedal by harmony, by ear, and uses specific gradations of application	20%
Controls the pedal according to tempo, articulations, and work style	15%
Controls the pedal mainly based on acoustic hall characteristics and uses "a tempo" and "syncopated" pedal	10%
Controls the pedal according to the musical texture	5%

3.2.4 – Phrasing

Phrasing elements were considered by 70% of pianists to be related to expressive qualities. According to one of the pianists, the fast decay of each note and the impossibility to make a crescendo in one note represent a limitation of the instrument, and because of this, phrasing represents a challenge for pianists. According to the interviewees, the use of contrasts between notes and internal organization of the phrase are the main points related to phrasing.

The use of contrasts is generally related to dynamics and applied according to harmony, melodic notes function, tensions, interval relations, cadenzas, and articulations. One of pianists also described expressivity as the dynamic melodic movement. Internal organization of the phrase is based on the leading of melody according to its culminant points that determine beginning, middle and end. In this sense, the entrance and exit from the culminant point, and the finalization of phrase inform the expressivity approach of the performer. Table 5 displays also other important aspects mentioned by interviewees on this subject:

Table 5 – Results regarding phrasing

Phrasing elements are related with expressive qualities	**70%**
Phrasing is related to use of contrasts	35%
Phrasing is related to the internal organization of the phrase	30%
Phrasing is related to the structural engagement of the phrase in the work context	20%
Phasing is related to articulations: more articulated phrases are more precise in expressive terms	20%
Phrasing is related to *cantabile*	15%
Phasing is related to the work style	5%
Phasing is related to the work or passage character	5%
Phasing is related to the listening accuracy	5%

4 – Conclusions

The study concluded that, even though the performers found it difficult to conceptualize expressivity, they used clearly defined practical strategies, such as 1) specific procedures for melody shaping: expressive phrasing was generally related to emphasis on climaxes and search for "sound quality", as influenced by the piece's character and clear performance of articulations; 2) structural rules for the application of *rubato*, and 3) implementation of large amplitudes of dynamic contrasts. The study also demonstrated that performers generally conceptualize expressivity as related to aesthetic trends, and that the Romantic repertoire remains the most referred to by musicians as the richest example of expressive aesthetics. Interviewees also believe that personal growth through extra-musical knowledge can improve personal qualities and help the performer build his/her own expressive identity.

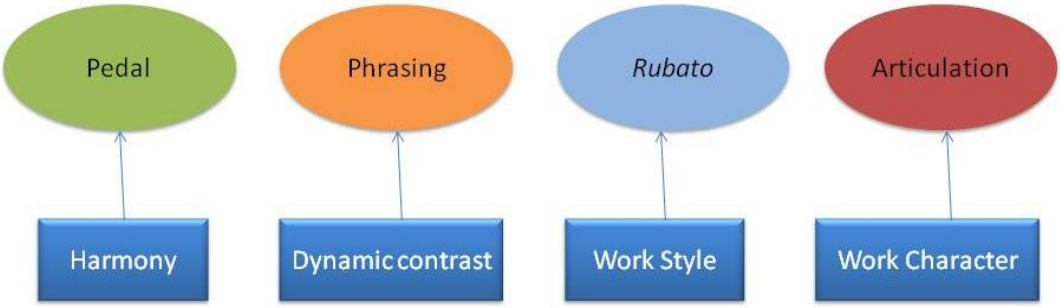
According to the interviewees, expressivity consists mainly of a communication phenomenon related to the ability of the performer in transmitting the message, structure, character, musical intention and emotion through mechanisms that involve a wide range of elements, from physical to aesthetical. Expressivity develops mainly on the "freedom space" of the performer, related to the knowledge acquired by the musician and limited by specific aesthetic patterns.

The complexity of the phenomena is obvious; if we take into account that as many as sixty-nine expressivity-related components were mentioned by the pianists. The most referred components were articulation, character, phrasing, sonority, and contrasts. Furthermore, (a) expressivity changes according to aesthetic trends that determinate the "fashion" of a specific period, (b) Romantic repertoire is associated with more expressive possibilities than other repertoire, and (c) expressivity is commonly related with the execution of pieces or movements in slow tempo.

According to the elements analysed, articulations, *rubato*, pedal and phrasing, 3 recurring points are particularly important:

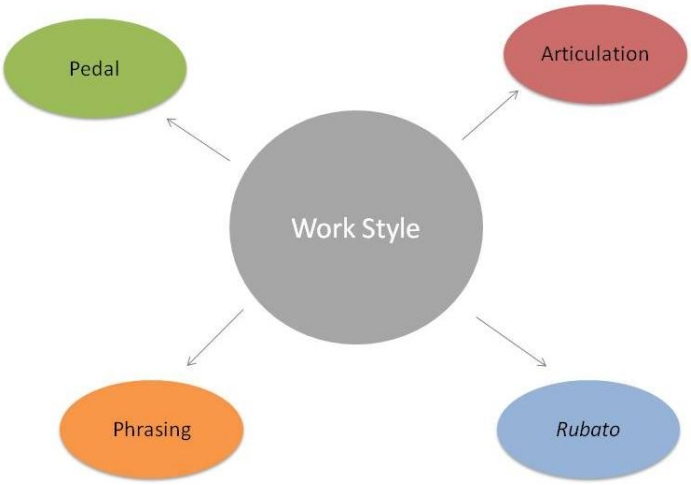
1) The presence of one main element in each evaluated parameter: harmony is related to the use of pedal, the piece's style to *rubato* playing , dynamics contrasts to phrasing, and character of the work to articulation (Figure 1);

Figure 1 – Main elements related to pedal, phrasing, *rubato*, and articulation



2) The influence of the work style above all evaluated subjects, representing the only recurrent element on all parameters (Figure 2);

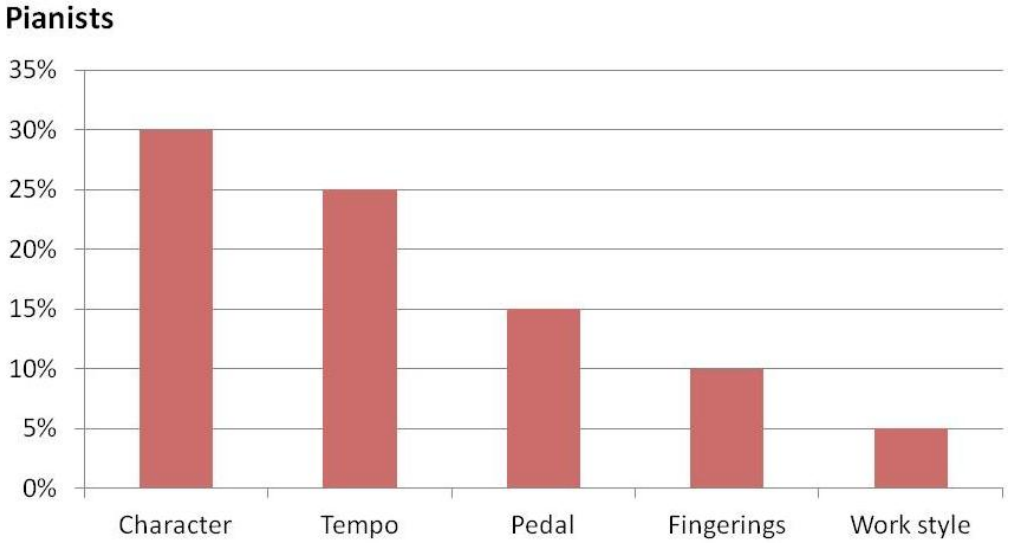
Figure 2 - Influence of the work style above all evaluated subjects



3) Expressivity can be practiced, and implies a integration of musical parameters:

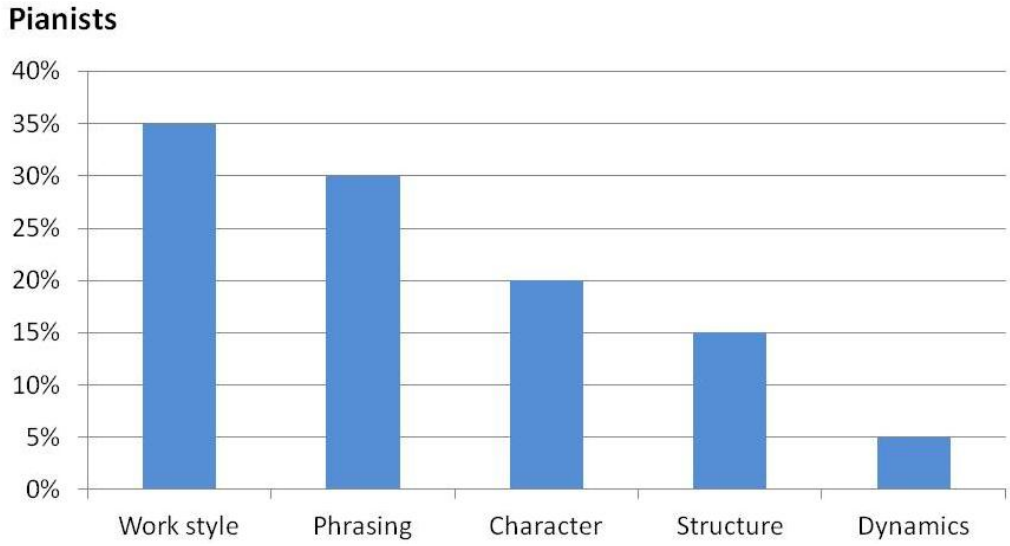
- Articulation is first related to character followed by tempo, pedal and fingerings, followed by work style (Figure3);

Figure 3 – Hierarchy of musical parameters related to articulation



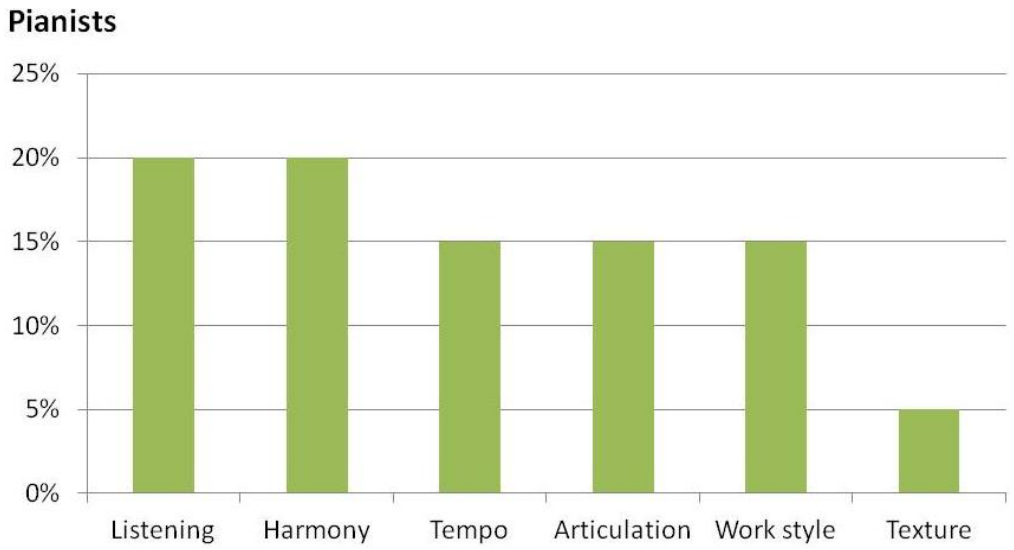
- *Rubato* is first related to the work style, followed by phrasing, character, work structure and dynamics (Figure 4);

Figure 4 – Hierarchy of musical parameters related to *rubato*



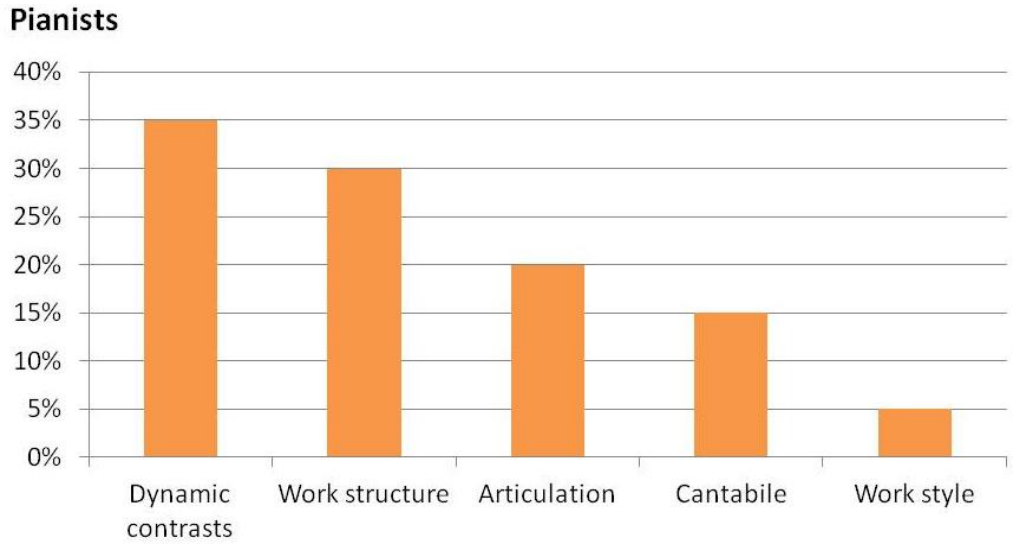
- Pedal is first related to listening accuracy and harmony, followed by tempo, articulation and work style, followed by texture (Figure 5);

Figure 5 – Hierarchy of musical parameters related to the sustaining pedal



- Phrasing is first related with dynamics contrasts, followed by the work structure and articulations, followed by cantabile and work style (Figure 6):

Figure 6 – Hierarchy of musical parameters related to phrasing



In general, most relevance was attributed to articulation, followed by *rubato*, and, less importantly, to pedal and phrasing.

From this analysis, it is possible to suggest the following hierarchical system for the expressivity practice of each element:

- <u>Articulation</u>:
  1) Adapting the execution of articulations to character, tempo, and work style;

2) Using the pedal as an auxiliary for articulation playing;
3) Choosing fingerings according to articulation characteristics;
4) Trying other instruments as a tool for improving articulation knowledge.

- *Rubato*:
  1) Thinking about *rubato* amplitude according to the stylistic character of the work: pieces from the Romantic period allow for more freedom;
  2) Establishing reference points for *rubato* at melodic culminations;
  3) Adapting the *rubato* to the character of the piece and being careful with large amplitudes (which could disfigure the piece);
  4) Analysing the piece in order to organize the use of *rubato*;
  5) Singing, conducting, and listening to recordings as a way to learn *rubato*;
  6) Organizing *rubato* according to dynamics and following one's own emotional sensations while playing *rubato*.

- Pedal:
  1) Using pedal in different gradations (full, half, quarter) to mix or separate harmonies;
  2) Organizing pedal application according to tempo, work style, articulations and texture;
  3) Using "a tempo" or "syncopated" pedal in order to help the execution of different kinds of articulations, and conceiving pedal as a flexible mechanism in order to adequate it to different halls' acoustics.

- Phrasing:
  1) Performing dynamics contrasts between melodic notes according to harmony, interval relations, and melodic tensions;
  2) Organizing phrases according to their culminant points;
  3) Observing the role of the phrase in the general context of the work and emphasizing articulations contrast in order to clarify expressive intention;
  4) Singing as a guide to a natural melodic direction for the phrase;
  5) Slowing down the time to underline a specific melodic line;

6) Relating the phrasing mainly to context and stylistic aspects of the work, and listening carefully to the passage from one note to another as a mechanism to phrase leading.

The suggested results of this research represent specific ideas related to the interviewees and cannot be generalized. Its relevancy is undoubted, as its value and application in order to research expressivity. However, these results do not discredit other contradictory approaches. Expressivity is a complex phenomenon that involves the interaction of objective and subjective elements, and requires multiple approaches. With this study, I hope to help performers to reflect on and practice expressivity.

References

Aono, Yushi, Haruhiro Katayose, and Seiji Inokuchi. 1997. "Extraction of expression parameters with multiple regression analysis." *Journal of Information Processing Society of Japan* 38 (7): 1473-1481.

Arcos, Josep L., Ramon L. de Mántaras, and Xavier Serra. 1997. "SaxEx: A case-based reasoning system for generating expressive musical performances." Paper presented at the International Computer Music Conference, Thessalonikia, Greece (Edited by P. R. Cook, ICMA, San Francisco, CA), 329-336 (Proceedings), September.

Bardin, Laurence. 1997. *Análise de Conteúdo*. Lisboa: Almedina.

Benetti, Alfonso. 2009. "Uma análise comparativa das estratégias de estudo e desempenho pianístico na elaboração de repertório: Três estudos de caso." Paper presented at POST-IP – 1º Fórum Internacional de pós-graduação em estudos de música e dança - Aveiro, Portugal, December 4-5.

Benetti, Alfonso. 2011. "Expressivity and piano performance: Practice strategies." Paper presented at the Conference on Performance Studies, Aveiro, Portugal (Edited by Rosário Pestana e Sara Carvalho), May 19-21.

Bengtsson, Ingmar. 1967. "Anteckningar om rytm och rytmiskt beteende" (Notes on rhythm and rhythmic behavior). *Unpublished Report*. Department of Musicology: Uppsala University.

Bresin, Roberto. 1998. "Artificial neural networks based models for automatic performance of musical scores." *Journal of New Music Research* 27 (3): 239-270.

Camurri, Antonio, Roberto Dillon, and Alberto Saron. 2000. "An experiment on analysis and synthesis of musical expressivity." Paper presented at the 13th Colloquium on Musical Informatics, L'Aquila, Italy, September 3-5.

Chaffin, Roger, and Anthony F. Lemieux. 2004. "General perspectives on achieving musical excellence." In *Musical Excellence*, edited by Aaron Williamon, 19-39. New York: Oxford University Press.

Clarke, Erik. 1988. "Generative principles in music performance." In *Generative Processes in Music: The Psychology of Performance, Improvisation and Composition*, edited by John A. Sloboda, 1-26. Oxford: Clarendon Press.

Clarke, Erik. 1995. "Expression in performance: Generativity, perception and simeosis." In *The Practice of Performance: Studies in Musical Interpretation*, edited by John Rink, 21-54. Cambridge: Cambridge University Press.

Clynes, Manfred. 1986. "Generative principles of musical thought: Integration of microstructure with structure." *Communication and Cognition* 3: 185-223.

Clynes, Manfred. 1995. "Micro structural musical linguistics: Composer's pulses are liked by the best musicians." *Cognition* 55: 269-310.

Cortot, Alfred. 1928. *Principes rationnels de la technique pianistique*. Paris: Maurice Senart.

De Poli, Giovanni, Antonio Rodá, and Alvise Vidolin. 1998. "Note-by-note analysis of the influence of expressive intentions and musical structure in violin performance." *Journal of New Music* Research 27 (3): 293-321.

Drake, Carolyn, and Caroline Palmer. 1993. "Accent structures in music performance." *Music Perception* 10 (3): 343-378.

Ericsson, K. Anders, Ralf T. Krämpe, and Clemens Tesch-Romer. 1993. "The role of deliberate practice in the acquisition of expert performance." *Psychological Review* 100 (3): 363–406.

Friberg, Anders, Roberto Bresin, and Johan Sundberg. 2006. "Overview of the KTH rule system for musical performance." *Advances in Cognitive Psychology* 2 (2-3): 145-161.

Gabrielsson, Alf. 2003. "Music performance research at the millennium." *Psychology of Music* 31 (3): 221-272.

Hashida, Mitsuyo, Noriko Nagata, and Haruhiro Katayose. 2006. "Pop-E: A performance rendering system for the ensemble music that considered group expression." Paper presented at the 9th International Conference on Music Perception and Cognition, Bologna (Edited by M. Baroni, R. Addessi, R. Caterina, and M. Costa, ICMPC): 526–534 (Proceedings), August 22-26.

Hazan, Amaury, and Rafael Ramirez. 2006. "Modeling expressive performance using consistent evolutionary regression trees." Paper presented at the ECAI Workshop on Computation.

Hofmann, Josef. 1976. *Piano Playing With Piano Questions Answered*. New York: Dover Publications.

Hudson, Richard. 1994. *Stolen Time: The History of Tempo Rubato.* Oxford: Clarendon Press.

Johnson, Margaret L. 1991. "Toward an expert system for expressive musical performance." *Computer* 24 (7): 30-34.

Juslin, Patrik N., Anders Friberg, and Roberto Bresin. 2002. "Toward a computational model of expression in music performance: The GERM model." *Musicae Scientiae*, Special Issue 2001-2002: 63-122.

Juslin, Patrik. 2003. "Five facets of musical expression: A psychologist's perspective on music performance." *Psychology of Music* 31 (3): 273-301.

Krämpe, Ralf T. 1997. "Related changes in practice activities and their relation to musical performance skills." In *Does Practice Make Perfect? Current Theory and Research on Instrumental Music Performance*, edited by H. Jorgensen and A.C. Lehmann, 165-78. Oslo: Norwegian State Academy of Music.

Lhevinne, Josef. 1972. *Basic Principles in Pianoforte Playing*. New York: Dover Publications.

Livingstone, Steven R., Ralf Muhlberger, Andrew R. Brown, and Andrew Loch. 2007. "Controlling musical emotionality: An affective computational architecture for influencing musical emotions." *Digital Creativity* 18 (1): 43-53.

Mazzola, Guerino, and Oliver Zahorka. 1994. "Tempo curves revisited: Hierarchies of performance fields." *Computer Music Journal* 18 (1): 40-52.

Mazzola, Guerino. 2002. *The Topos of Music: Geometric Logic of Concepts, Theory, and Performance*. Basel, Switzerland/Boston, MA/Berlin: Birkhäuser Verlag.

Neuhaus, Heinrich. 1973. *The Art of Piano Playing*. London: Kahn & Averril.

Repp, Bruno H. 1990. "Patterns of expressive timing in performances of a Beethoven minuet by 19 famous pianists." *Journal of the Acoustical Society of America* 88 (2): 622-641.

Seashore, Carl. 1932. *University of Iowa Studies in the Psychology of Music (v.1): The Vibrato.* Iowa: University of Iowa.

Sloboda, John. 1996. "The acquisition of musical performance expertise: Deconstructing the "talent" account of individual differences in musical expressivity." In *The Road to Excellence: The Acquisition of Expert Performance in the Arts and Sciences, Sports, and Games*, edited by Anders K. Ericsson, 107-126. Mahwah, NJ: Lawrence Erlbaum Associates.

Sundberg, Johan, and Violet Verrillo. 1980. "On the anatomy of the ritard: A study of timing in music." *Journal of the Acoustical Society of America* 68: 772-779.

Sundberg, Johan, Anders Askenfelt, and Lars Frydén. 1983. "Musical performance: A synthesis-by-rule approach." *Computer Music Journal* 7 (1): 37-43.

Sundberg, Johan, Anders Friberg, and Lars Frydén. 1991. "Common secrets of musicians and listeners: An analysis-by-synthesis study of musical performance. In *Representing Musical Structure*, edited by P. Howel and R. West, 161-197. London: Academic Press.

Todd, Neil. 1985. "A model of expressive timing in tonal music." *Music Perception* 3: 33-58.

Todd, Neil. 1989. “A computational model of rubato.” *Contemporary Music Review* 3: 69-88.

Todd, Neil. 1992. “The dynamics of dynamics: A model of musical expression. *Journal of the Acoustical Society of America* 91 (6): 3540-3550.

Todd, Neil. 1995. “The kinematics of musical expression.” *Journal of the Acoustical Society of America* 97 (3): 1940-1949.

Widmer, Gerhard. 2002. “Machine discoveries: A few simple, robust local expression principles.” *Journal of New Music Research* 31(1): 37-50.

Widmer, Gerhard, and Asmir Tobudic. 2003. “Playing Mozart by analogy: Learning multi-level timing and dynamics strategies.” *Journal of New Music Research* 32 (3): 259-268.

Williamon, Aaron, and Elisabeth Valentine. 2000. “Quantity and quality of musical practice as predictors of performance quality.” *British Journal of* Psychology, 91: 353-76.

Williamon, Aaron. 2004. *Musical Excellence*. New York: Oxford University Press.

Windsor, W. Luke, Peter Desain, Armandine Penel, and Michiel Borkent. 2006. “A structurally guided method for the decomposition of expression in music performance.” *Journal Acoustical Society of America* 119 (2): 1182-1193.

Woody, Robert H. 1999. “The relationship between explicit planning and expressive performance of dynamic variations in an aural modeling task.” *Journal of Research in Music Education*, 47 (4): 331-342.