Nature versus Culture in ritardando performances

Miguel Molina-Solana

Department of Computer Science and AI, University of Granada, Spain
miguelmolina@ugr.es - http://www.ugr.es/~miguelmolina

Maarten Grachten

IPEM - Department of Musicology, Ghent University, Belgium
maarten.grachten@ugent.be - http://users.ugent.be/~mgrachte

Background in Music Performance. The first empirical studies on music performance date back to the beginning of the 20th century, mainly focusing on timing in performance. In the last decades, performance studies have earned recognition as a discipline in its own right.

Background in Computing. Machine learning and data mining techniques have been widely applied to expressive music performance, focusing on finding general principles underlying expressive 'deviations' from the musical score in terms of timing, dynamics and phrasing. These principles aim to model aspects of renditions in a formal quantitative and predictive way (Widmer & Goebl, 2004). Modelling of performances has also been used for identify the performer of a musical work (Molina-Solana et al., 2008; Saunders et al., 2008).

Aims. The main aim of this work is presenting a particular face of the nature vs. culture debate, applying it to music performance. Nature and culture are matched respectively with the structure of the piece and the intentions of the performer. We focus on ritardando performance as it is a commonly studied resource in music performance research.

Main contribution. We present in this work the two traditional visions for the role of performers in music performance. These two alternatives can be seen as a particular case of the nature versus culture debate. The first vision considers that performances are shaped by the structure of the piece, with the performer being a mere transmitter. The second one claims that performers do have a more active role, with the obligation of shaping the music according to their own will. We offer a brief review of several ideas and works, supporting both sides, about the issue. Besides this discussion, we describe our own experimentation.

Implications. Several works dealing with performer and piece identification using expressivity on the performance come to the conclusion that both the performer and the piece are important for a given performance. Obviously, this importance varies depending on the style and the performer. Our own experimentation on ritardandi shows that, despite the fact that ritardandi are mainly piece-dependent, there are clear evidences of performer signatures on them.

Music might be viewed as a communication process in which composers code musical ideas in notation, performers recode from the notation to musical signal, and listeners recode from the signal to ideas (Kendall & Carterette, 1990). Henceforth, the role of performers in this system is a central one; without them, the composer's message could hardly reach the listeners. Of course, the relative importance of performance in music differs depending on the structure of the piece, genre, and performers themselves. An immediate question researches has asked is why performers play in certain ways.

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We present in this paper a study of how this relationship has been addressed in the performance of ritardando. The central question would be: Are performances shaped by the performer or by the piece?

For our work, we will take advantage of the fact that studies on measurement of performances are, with difference, the most numerous within the empirical research on music performance.

We will constrain our study to Western classical music, as it is by far the most studied domain in the existing literature. We will also concentrate on timing, especially in ritardando (the slowing down toward the end of a performance). However, many other aspects (such as dynamics, articulation or vibrato) could be object of study, and included in this *nature vs. culture* debate.

Nature vs. Culture as Piece vs. Performer

We argue here, that the nature-culture distinction can also be made in the context of expressive music performance. As said above

common view on the process of musical performance is that the purpose of musical interpretation is to express intentions to the listener. Although there may not be a single unambiguous way to express such intentions, there are definitely constraints on the way this communication takes place. In part, the performance is constrained by purely natural phenomena, such as the motoric and perceptual characteristics (and limits) of the performer and listener as human beings. For example, in order for a listener to be able to grasp the rhythmic and metrical structure of the music, a performer should keep tempo fluctuations within certain limits (Honing, 2005).

Another natural constraint, that nevertheless appears to have a cultural taste, concerns the expression of phrase structure. Musical phrases seem to be universally marked by arch-like forms of timing and dynamics (Clarke, 1988; Todd, 1985). This practice of demarcating temporal structure might be explained by a reference to Gestalt-theory, but it can also be regarded as a cultural convention.

Further constraints in expressive music performance are unequivocally cultural, for instance the performance conventions that belong to particular historical genres, such as baroque music.

In spite of the many levels of constraints natural and cultural constraints in music performance, there is apparently still enough freedom for performers to develop their own personal style.

Although natural and cultural factors do not need to be framed necessarily as being opposed, the above examples suggest a gradual ordering of factors influencing performance, ranging from purely natural (biological constraints) to increasingly cultural, and ending in individual or personal factors. This ordering can also be seen as ranging from necessity (in a physical sense) to contingence.

Our approach to investigating the individual style of music performers has been to separate the individual component of expression in performances from the common component across performers. Thereby we

effectively divide the natural-cultural range into that which is individual (one could say 'hyper-cultural') and that which is not, assuming that everything which is not individual is roughly constant across performers, and can therefore be indexed by piece rather than by performer. Although this is admittedly a huge simplification, we believe it is methodologically useful in the study of such complex phenomena.

Music Performance

The process of performing has been traditionally little investigated. According to the idea of music as a communication system, performers are in charge of carrying the composer's message to the listener. Providing that it is commonly assumed that performances transmit emotions, many studies have focused on discovering if such emotions are due to the performer intention, or the melody itself (the structure of the piece).

Some studies in music performance are related with either performer identification or piece identification. The objective in performer identification is to discover the personal touch -that we will call *culture*- that is responsible of distinguishing one rendition from another even if they both are of the same piece. Several studies support the existence of this component (Molina-Solana et al., 2008; Saunders et al., 2008).

Opposed to performer identification (where performers are supposed to have distinctive ways of performing) is piece identification --- which requires the structure of the piece to imply a particular expressive behaviour, regardless of the performer. In other words, the existence of a norm to perform a given piece is supposed on this approach. It also assumes that all performers will follow these universal principles. In the context of this work, those common principles will be called *nature*.

Persson (2001) claimed that performers are influenced by both 'internal' (e.g. emotions, wanting to express something personal) and 'external' factors (e.g. musical style, the

structure of the piece, the composer's intentions).

According to Juslin (2003), some examples of piece-related factors that might influence a performance are the structure of the piece itself, its genre and style, the notation, and comments from the composer. Some performer-related factors could be performers' technical skills, their mood while playing, their expressive intentions, and interaction with co-performers and with the public.

Of course, there seem to be other aspects that affect music performance that are not directly controlled by the piece or the performer. We can include here acoustics, condition of the instruments, and even performer's random variations and motor capabilities.

Two traditional points of view about the role of performers with respect to a musical interpretation can then be identified depending on whether performers take a passive or active role. We will see both aspects in the following sections.

The piece (nature)

The first one considers the performer as a mere transmitter. Hence, performances are mainly determined by the original expressive intentions of the composer. This approach implies a careful study of the score and the composer by the performer, allowing no creativity.

One of the clearest examples of this vision is the work by the scholar and pianist Roy Howat (1995). He indicates that the performer cannot follow his will; rather he should express the music as the author devised it. This way, he makes a critic to those performances that he considers to be non-scholarly styles of playing.

Performers analyse the structure of the piece according to the current aesthetic norm, and then they express it following those principles. Other factors such as the style and historical context of the piece also help to prescribe how performers should interpret the piece. It is reasonable to think that pieces

from contemporary authors share several compositional and interpretative resources.

The structure of the piece, its genre, its author… they all conform the *nature* of the piece.

Several researchers have proposed models of performance. The fact that they have been proposed in itself may suggest the hypothesis that some performance principles do exist and are common to several pieces and performers. These principles might summarize and explain given phenomena.

Examples of such models are the ones proposed by Widmer and coworkers (Widmer & Goebl, 2004) -obtained automatically from measurements by machine learning; the one by Mazzola and Beran (1998) –supporting that performance depend only on the score; and the GERMS model (Juslin, 2003) -which takes into account several sources for expressivity.

The GERMS model is of special relevance as it is, to the best of our knowledge, the first model including both aspects from the *nature* of the piece, and from the *culture* of the performer (next section).

The Performer (culture)

On the other hand, we can find authors that support that the 'intuitive feeling of music' precedes the logical analysis. They consider that performers should have much more freedom, playing a bigger role than just being a mere transmitter. This view encourages performers to play according to their own aesthetical judgements, which can even come from simple intuition. The performer can shape the piece in order to express a different emotion than the one the composer initially devised.

This is possible because music sheets are far from being complete descriptions of the music, despite the fact that they are the most reliable reference of our classical repertoire. This gap allows the musical sense of the performer -apparently not very scientific- to exist and have a key role in the process. This way, performances are not just a monotonous and mechanical transcription of the written notation.

Several studies have proved that a given piece allow different valid performances by just modifying some acoustic parameters (i.e., the same notated structure can be performed in several different ways). Each of these performances generally leads to the expression of a different emotion.

Expressive abilities differ according to individual levels of expertise and may also differ among individuals because of gender and idiosyncratic cultural preferences in coding the expressive identity and musical location of sonic qualities (Sloboda, 1996). This claim indicates that performer can shape the expressivity of a given work.

The standard paradigm in studies of emotional expression in music performance relies on this. This paradigm is as follows: performers are asked to play a number of melodies expressing different emotions and those recordings are later analysed to study which acoustic means were used to shape the melodies. Those experiments point out the fact that several emotional performances can be done over the same melody. Hence, all these researches rely on the hypothesis that emotional performances do not depend solely on the piece, as there are several valid performances; rather, it is the performer who decide how to finally shape the melody.

According to Davidson (2002), some of the factors that may influence the development of a solo performer are early strong experiences of music, frequent exposure to music and support from others, motivation and personality.

Nature vs. Culture in Ritardandi

According to Gabrielsson (2003), the majority of research on music performance is focused on measurements, especially on timing as it is used in performances on all instruments.

But what is timing? The term *timing* refers - within this context- to how the duration of notes differs during a performance from what is actually written on the score (the so-called 'mechanical performance').

Penel and Drake (1998) discussed three alternative explanations for expressive timing in music performance. They also conclude that all of them may contribute in different combinations. These explanations are: a) use of timing to highlight and communicate the musical structure to the listener; b) use of timing to compensate perceptual biases in time perception; and c) timing as an effect of biomechanical and instrument-related constraints.

As the reader can see, the latter two explanations are more or less involuntary, whereas the first is completely under control of the performer, who uses timing to express certain emotions.

Even more, those timing variations have in practice been proved to contain little noise, as performers are able to replicate them with a high accuracy. How and when those variations are made make listeners appraise different emotions. This fact suggest that some patterns exist which produce different feelings. In fact, analysis of recorded performances revealed that almost every performance variable was affected in ways specific to each emotion.

In a study by Johnson (2000), experts performed a section of Beethoven's Symphony No. 5 in three versions: mechanical, interpreted and exaggerated. By analysing these performances, Johnson came to the conclusion that the versions differed considerably more in timing than in dynamics.

This fact may suggest that timing is more affected by the performer's expressive intention, while dynamics are more stable among performances. In other words, it may suggest that a musical score admit several timings (which depend on the performer), while dynamics are more constrained (depending more on the piece).

Of course this is not a rigid claim, but summarizes in the context of our present discussion between culture and nature, the results by Johnson.

A particular case of timing is ritardando. It is the slowing down toward the end of a performance to conclude it gracefully. Even though, ritardando is a tiny part of a whole musical work and can hardly represent a musical performance, we feel that it is representative of what we want to illustrate in

this paper: the trade-off between piece (nature) and performer (culture). Johnson's results would suggest that ritardandi are more prone to be performer-dependent. However, intuitively that dependency is not clear.

Studies on analysis and computational modelling of ritardandi show that evidences supporting both visions do exist. In the following lines, we will describe our own experiment to support that claim.

We employed Friberg and Sundberg's (1999) kinematic rubato model as a means of studying the performed ritardandi. The original data consisted in measurements of timing data of musical performances taken form commercial CD recordings of Chopin's Nocturnes. We represented these data by the model parameters obtained by fitting the model to the data. That representation was proved (Grachten & Widmer, 2009) to be mostly piece-dependant. However, we investigate whether the model parameters, when normalize per piece, reveal the performer's identity more clearly. To test this hypothesis, we carry out a set of experiments using machine learning classifiers with leave-one-out cross-validation. A more detailed description is found in Molina-Solana et al. (2010, submitted).

The results indicated that in spite of the extremely reduced data representation we use, pianists can often be identified with accuracy significantly above baseline. Also, they point out that performer's signature exist in music interpretation regardless of the particular piece being played.

Conclusions

Music performance research is a very active area of research, with studies on measurement of performances being by far the most numerous. These studies are increasing the knowledge about why performers play in a way or another.

We have presented here the two views on the role of performers. These two alternatives can be seen as a particular case of the nature versus culture debate. The first vision considers that performances are shaped by the structure of the piece, with the performer

being a mere transmitter. The second one claims that performers do have a more active role, with the task of shaping the music according to their own will.

In our opinion, there is something to be said for both views: the performance of a musical piece contains both nature and culture aspects. Our work offers a brief review of several ideas and works, supporting both sides, about the issue. In this context, we have also summarized work-in-progress, in which we investigate the balance of performer and piece specific aspects of expressive timing in ritardandi.

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