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MUSIC TEMPO CALCULATED

Introduction

Every lover of music, amateur musician and the professional musician in particular is extremely aware that any musical performance depends entirely on how it is performed. In other words: every suitable musical performance can only succeed if it is performed entirely in the appropriate manner. When we ask ourselves whereupon a suitable musical performance depends, we come up with the following essential characteristics:

a. Acceleration and deceleration
b. Differences in volume (dynamics)
c. Other aspects connected with articulation and phrasing

This essay is about acceleration and deceleration in a musical performance. There are two well-known musical terms that precisely express what this refers to : agogics and rubato. These two terms or concepts express in principle that all music is performed and based on the musical phenomenon of acceleration and deceleration. Both terms refer to very subtle changes in movement which are indispensable in any musical performance.

In the entire world of classical music it is commonly thought that musical deceleration and acceleration are merely arbitrary and are generally based on 'habit', which ensues from the musical performance itself as well as the musicians from all over the world nowadays and as well as in former times. At the same time it is assumed that agogics and rubato are dependent on musical feelings rather than musical regulation. I rigorously oppose this very general point of view. My investigation demonstrates that the musical performance is based entirely on stringent musical laws which in their turn are based on natural laws. This is how I describe a natural musical performance and I will explain my points of view systematically.

Music and convention

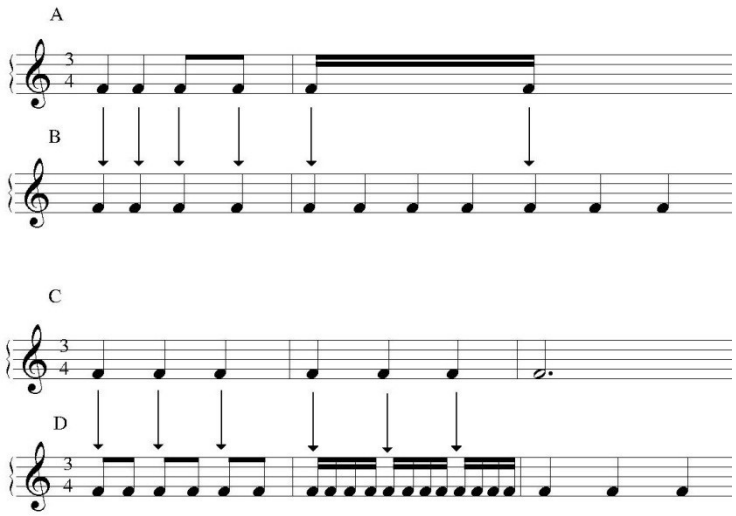
When 10 different performers play Für Elise composed by Ludwig von Beethoven, we will notice subtle differences in all 10 performances. This can raise a major problem, as to which performance is the right one? A subsequent question might be raised: is there a perfect performance in our world of imperfection? Plato would respond: yes there is, but only in an abstract world of Ideas, not in our world of five senses. However, can we consider all of them to be a really perfect performance? A professional musician has to admit with great

reluctance that there is no single way to perform perfectly. At the same time he will acknowledge that not every performance can pass the test of convenience. Of course some performances are not so good and some are even bad. In other words, musical performances can be judged differently, yet at the same time there can be more acceptable ones in the opinion of most musicians.

During the discourse concerning musical practice there is no ideal measuring-gauge to determine whether a musical performance is an appropriate or perfect one. It is relatively a matter of good taste in the common world of music based on musical feelings which are in turn based on fashionable musical trends. When we consider the waltzes of F. Chopin for instance and realize they need to be performed in an appropriate way, we can perceive that every renowned musician uses his own freedom of movement which is attributable to subjective musical feelings and understanding. At least that is the reasoning of every musician. In contrast hereby I emphasize that this opinion fails undeniably. In other words, the assumed relationship between musical feeling and a convenient or correct musical performance is an imperfect one because of the absence of a proper criterion for measuring sound. I will suggest a better method based on calculation and physical law.

Music and notation

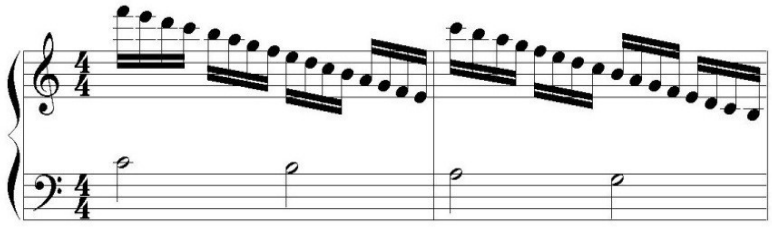
Having searched for many years to find an objective measuring-gauge for a musical performance, I encountered a very curious shortcoming in music notation. I attempted to find out what the real connection was between the note value and what was really happening in the actual performance. Let's consider this in an almost phenomenological way.



It is very curious to observe that in our assessment the notation of longer and shorter notes is quite the opposite. Let's study the two examples below very profoundly.

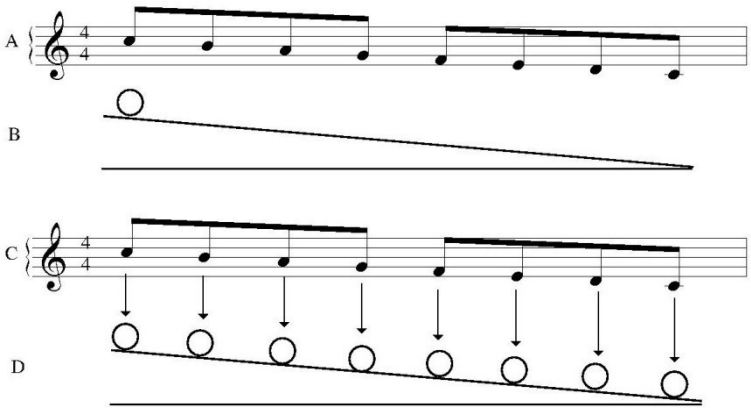
When we compare crotchets with quavers for instance, only then is it conceivable that quavers need twice the time length as crotchets. In the case where 8 crotchets have a distance of 8 centimeters, then 8 quavers have an exact distance of 16 centimeters! Here we can see a precise connection between music and physical reality. Let us be very clear in this respect. Movement in music has nothing to do with musical feeling but only with a simple understanding of physics. I can demonstrate this very clearly on the piano. When I start with my left hand in an ascending motion in crotchets and at the same time start with my right hand in an ascending motion in quavers, the distance from my right hand will be twice as much. However, in our notation we see exactly the opposite! Let us study the two examples divided in A, B, C and D very thoroughly. In examples C and D it is evident what we normally find in our notation. Optically it looks as if 4 semiquavers cover the same distance as one crotchet, but we realized that this cannot be the case. A semiquaver moves 4 times faster than a crotchet and because of this covers 4 times the distance. The main problem lies in our conventional notation, which does not allow different notes according different time lengths and distances. The important thing here is that we must admit that there is a truly physical proportional relation between movement (of notes) and distance (of notes)!

There is another very peculiar oddity in our notation. Let's look at the following example. We see in the right hand music semiquavers. According to our understanding of music there are 32 notes altogether and we would wager that what we have seen is really correct, but in reality our interpretation is fundamentally wrong. I will demonstrate this in the following example.



Let us examine the example below. In examples C and D we see a descending scale made up of 8 notes. That is optically true but for understanding our style of playing music is totally wrong. What we must try to understand is that examples A and B give us a realistic view. In fact, only one object is moving, for instance a marble, which is depicted in 8 different places. Our notation indicates that there are 8 notes, but in fact we are confronted by an object that is rolling down. I now hope that it is obvious to see that we are dealing with movement, time and distance. Just to make it easy, imagine a marble rolling down a hill and if I make a picture

of it every three seconds, I will then have several pictures of one and the same object. Thereafter I can show 8 pictures in a row as if there are 8 different marbles but in actual fact there is only one ! This very important observation shows us that in the case of movement, we have time and distance, not many objects, but only one!



I hope we can understand what is going on in the above example. Our music notation is a registered system of notes which is a rather limited rendition of moving objects in physical nature. Slowly but surely we can learn to understand that the notes in our music notation are notational fixations in a constructed system of notes, yet they can be compared with moving objects such as cars, bicycles, marbles, etc.

Music Score and physical nature

Our playing of music is in many cases a music score (not improvisation). In this way we read the notes of Für Elise in a music score. When we do this we shall recognize the following aspects:

a. Movement in general
b. Time scale (it takes two and a half minutes to play a piece of music for example)

But we are still missing an essential component: distance! This is very strange. We realize without doubt the aspect of movement, even the lapse of time but we miss the aspect of distance. Here we come across an impossibility. An object that is moving in time also makes an undeniable movement in distance, even when an object is moving in one place at the same time (a bouncing marble). In brief a moving object covers a distance over a period of time. A car that moves does so over time but cannot do this without covering some distance. In other words we can recognise every moving object according to the moderation of physical law: movement = time combined with distance. From the moment we begin to recognize

music as a physical movement we learn the exact speed, which can be assessed from that moment on. We then come to the following statement:

movement in music is a blueprint of movement in physical nature.

As soon as we comprehend the similar functions of physical nature and (movement in) music, we will discover the possibility of seeing movement in music as a system which is in principle determinable and calculable. It is clear that movement in music can be calculated in the same way as movements in physical nature such cars, bicycles, marbles, and so on. It was Isaac Newton who formulated his three laws:

A. An object at rest will remain at rest unless acted on by an unbalanced force. An object in motion continues in motion with the same speed and in the same direction unless acted upon by an unbalanced force.
B. Acceleration is produced when a force acts on a mass. The greater the mass (of the object being accelerated) the greater the amount of force needed (to accelerate the object). In formula: F = m * a (F = Force in Newton; m = mass; a = acceleration in m/s2)
C. For every action there is an equal and opposite re-action.

Musical performance in a physical framework.

What conclusions can we draw from this? In the first instance we can comprehend that musical performance is a blueprint of physical nature. Secondly, musical performance is a matter which can be calculated according to the knowledge of physical law formulated by I. Newton. The possibility to calculate the movement of cars, bicycles, marbles and so on, is the same procedure used to calculate the movement in music! Let us emphasize this.

The reader may think that he needs to have an intense knowledge of physics to understand this. First of all he might consider doing all kinds of complicated calculations. That would not be necessary. What I recommend is to imagine the musical movement as a natural movement in nature as we know it from experience. Real calculation is a procedure for the future and reserved for physicians.

In Conclusion

Up until now there has been no clear explanation for understanding musical movement. Nevertheless, I am really convinced that only the physical approach is appropriate for understanding a musical performance. We have seen that our optical perception is not an exact interpretation of what happens in music. We have been able to conclude that there is

evidence of a missing link which is the component: 'distance'. Now that we have put that right we are now convinced that musical performance in principle is based on the law of physical awareness which was initially introduced by I. Newton.

We now only need to allow our musical presentation to work in the same way as objects in nature move and project this into our consciousness of a musical performance. We will then observe how closely linked music and nature are. Only when we realize this will our musical performance become easier to understand.