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MUSIC AND INTELLIGENCE

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"Bête comme un musicien"('dim-witted like a musician') is in certain circles a current expression. In a partly similar vein, string players in an orchestra are in the habit of observing that in between concerts or rehearsals, when the string section reads, the wind section plays cards. One string player of my acquaintance, a cellist of the Concertgebouw-orchestra, once spent the early hours of a summer morning teaching a certain Italian thrush ('lijster') how to whistle a certain Beethoven theme. Let us draw from these modest examples the general conclusion that there is, at a minimum, some positive connection between music and intelligence. Moving on from this bright bird and its smart teacher, with whom I once spent hours discussing my book about Isaac Newton, I shall now discuss two cases of wider import and significance. In both cases music history, musical theory, and musical performance come together with intelligence in the happiest of ways. One case is the rise of the early music movement of the late 1960s, the other the nature of musical harmony as such, considered from a mathematical, physical, and physiological, in short, from a scientific point of view. I address the early music movement first.

In my student days in the mid-1960s a housemate who shared my predilection for the music of Bach and other Baroque composers used to maintain that somehow music of this particular kind was routinely being performed the wrong manner — either wishy-washy and sloppily sentimental or just mechanical in an unimaginative, soulless kind of way. One day he turned his biting criticism into something more constructive, and took me to the city of Haarlem where in an ice-cold, at most half-filled, 15th century church (the Bakenesserkerk) we attended a harpsichord performance by a certain Gustav Leonhardt. This became a decisive moment in my personal musical history. Not only was this young musican's interpretation of pieces mostly well-known to me in other ways at odds in the most wholesome manner with the performance style even of contemporaneous harpsichord players who likewise refused to play Bach on the *pianoforte* since that instrument did not even exist in Bach's time. But what with these colleagues of Leonhardt's, such as Janny van Weering and a few more rare birds, was mostly a matter of taste, of sentiment, of hardly reasoned preference, turned out on further inspection to be with Leonhardt a quite novel, extremely well reasoned-through standpoint. It was more than a standpoint, it was a fully worked-out doctrine of how music from before the Romantic era should really be performed, namely, to the largest possible extent such as the composer had meant it to be performed.

Here, in brief, is how Leonhardt and a like-minded friend and colleague of his by the name of Nikolaus Harnoncourt, arrived at their doctrine of what soon became known as the 'authentic' playing style of early music — a doctrine and concomitant practice which soon came to dominate

and, in somewhat toned-down versions to be sure, almost half a century later still dominates the field. The core consideration is that with the outgoing Classical and the early Romantic style periods, say in the 1820s, something almost entirely new happened, without precedent in the world history of music, to wit, the performance of music composed any earlier. If, as a late 16th century bishop, you felt in need of a well-composed Mass, you ordered from your court choir master Josquin Desprez a new one, rather than instructing him to rehearse and then perform one composed by Josquin's teacher Johannes Ockeghem, or by Ockeghem's teacher Guillaume Dufay, or by Dufay's teacher ... etc. You did not even order your servant Josquin to fish one of his earlier Masses out of the moth-balls; no, you required a new one just about every single time the demand for a Mass arose. That is how Josquin came to compose in his lifetime at least sixteen Masses and at least 61 Motets (these are the numbers of those of his works that have actually survived). There was no historical performance style, good or bad, because (barring very few exceptions) there was no historical performance in the first place.

All this changed, as I said, and as both Leonhardt and Harnoncourt insisted, with the rise of Romanticism and its radically new, historicist leanings. It is well-known that in 1829 the young composer Felix Mendelssohn decided to resurrect Bach's Matthäus Passion, which by that time had not been performed for close to a century. But musical style had in the meantime changed a great deal, as it has kept doing from time immemorial. Compare a Mass composed by Josquin to Beethoven's Missa Solemnis or even to any Mass composed by Mozart, and you will recognize every single word but not the way melodies are formed or how they are made to sound together — there are even certain chords that Mozart routinely uses but that were to Josquin quite foreign because they were felt in his time to be dissonant, that is, to comprise musical notes that do not sound at at all harmoniously together. So Mendelssohn directed Saint Matthew's Passion in the musical language of early Romanticism and also with the musical instruments of his own time, which were those of the large symphony orchestra — something non-existent in Bach's time. What Mendelssohn so commendably started, has persisted — the routine performance of musical compositions at a later time and under other circumstances than when and for what they were composed originally. As a consequence, thanks to Romantic historicism we can still hear so many intensely moving pieces of music that after their *première* had never been heard again. Only, the habit of performing them in the predominant style, not of their original composition but brought up-to-date with the latest performing habits, persisted. Nor was there a clear-cut way out of the predicament, as there was always, and inevitably so, this time gap that even at its narrowest was close to a century wide — after all, no tradition had been preserved of the performance of music from before the rise of historicism. So Mendelssohn set a new precedent, and his disciples started a new tradition which they passed on to their disciples, and these in turn to their disciples, and so

on, always rendering Baroque music in that either somewhat lifeless or romantically overblown or vaguely sentimental and in any case deeply un-Baroque performance style so much deplored by my student house-mate in the mid-1960s.

And then there was Gustav Leonhardt. He was, of course, a most promising, highly gifted musician, but he was also a scholar. He had begun to face, and then to tackle, the full consequences for performance style of a gap in time which had best be summed up by the assertion that there is a large measure of performance continuity between us and, say, the late Beethoven, but no continuity at all between us and Bach or even Mozart. Together with Harnoncourt, then, Leonhardt decided to close the gap to the farthest extent that, given the regrettable lack of music recording apparatus prior to the early 20th century, can possibly be attained. In the inevitable absence therefore of any direct acoustic evidence Leonhardt began to examine systematically what written evidence remains of how these composers from the Baroque era and earlier used to perform their own works. For a faithful reconstruction, first in theory and then in practice, of how the Matthäus Passion and countless other works were originally performed he began to examine in painstaking detail scores of scores and dozens and dozens of treatises, the latter not by Bach himself but by certain contemporary musicians, in which many performance rules of their own time were laid down. Above all, he and Harnoncourt became aware that there was always a great deal of tacit knowledge around — for instance, musicians knew that when a certain musical phrase occurs in the score before your nose a second time, you do not simply replay it the same way but rather follow certain conventional, rhetorical rules for the kind of variations to which you may subject that melodic phrase a second or a third time. They found out that the present-day habit of violinists to play *vibrato* all the time is an attainment of the Romantic era — before, *vibrato* was not a habit but an incidental, attention-demanding piece of ornamentation like trills or *ritardandi*. They fiercely debated among each other and then also with their numerous followers what to infer from the pertinent manuscripts and literature regarding instrumentation, proper *tempi*, fingering, phrasing, articulation, in short, all possible aspects of musical performance.

As a result of all this assiduously acquired and collected and internalized knowledge, the performance of early music quickly began to change almost beyond recognition — dead passages became alive through seemingly new but really quite old ways of phrasing and articulating them; where possible, musical instruments began to be used that originated (either really or in careful reconstruction) in the period from which the music stemmed. In many a case this involved a return to earlier ways of building instruments. Trumpets were stripped of the valves with which they had been fitted out from the 1830s onward; church organs were with increasing care and regained expertise restored to an earlier state — the very long period when they were not yet built or refashioned with a view to imitating the Romantic symphony orchestra but when they were still

meant to embody an almost completely different ideal of musical sound — that of Pythagorean heavenly harmony.

The early music movement, thus initiated by Leonhardt and Harnoncourt in the first place, caught on very quickly. Certain developments in the recording industry helped a great deal; the anti-authority spirit of the late 1960s contributed its part, too; yet the sheer zest and enthusiasm of the pioneers in the face of a meanwhile rather frozen performance practice was probably the biggest cause of this sudden rupture, of which I feel with some pride that, in the Haarlem Bakenesserkerk, I had the privilege of being present at its very creation.

Little did I suspect then, in that church, that in due time, no longer a student but a scholar, I would become involved in another albeit partly related combination of music and intelligence. This combination finds its origin in certain inalterable, mathematics-determined and nature-given rules, discoverable by means of not too difficult calculation chiefly, that govern all musical performance whether we know it and whether we like it, or not.

Here are the four basic rules.

Rule (1) Due to the manner in which air vibrates with strings or pipes or drums, every musical interval may be rendered as a numerical ratio (an 'interval' is two notes sounded together).

Rule (2) In musical harmony, the consonant (that is, the well-sounding) intervals derive from very simple ratios, composed of no more than three numbers (beyond 1) and their multiples, to wit, 2, 3, and 5. The number 2 comes in to produce the octave (1:2); the number 3 to produce the fifth (2:3) and the fourth (3:4), and the number 5 to produce both the major and minor third (4:5 and 5:6) and the major and minor sixth (3:5 and 5:8).

Rule (3) When one interval is 'added' to another, as when for instance you form an octave C-c by piling the fourth G-c upon the fifth C-G, then the corresponding arithmetic is not addition but multiplication: in the present case (2:3) x (3:4) = 1:2 (the short answer to why this is so being that our hearing happens to work logarithmically).

Rule (4) Powers of figures not divisible by each other can never be equal. Thus, 1/2 to the power of 7, which corresponds to seven octaves piled upon each other, can be told in advance not to equal 2/3 to the power of 12, i.e., twelve fifths piled upon each other. So the c reached by going up seven octaves from C is not the same note as the b sharp attained by departing from the same C and going up twelve fifths. This is what modern textbooks on the history of music theory mean when they say that the circle of fifths is not closed. The 'difference', a very complex fraction and, hence, a harshly dissonant mini-interval, is known as the *Pythagorean comma*. Here you see and hear how it comes about. [(I)]

Quite possibly, from rule (2) onward all this has sounded pretty esoteric to you. Having given you

at least an inkling of mathematical/physical/musical theorizing of this kind I shall therefore cease overwhelming you with these arcane matters, and just discuss briefly with you one principal conclusion about what all this means in terms of actual musical practice.

The profoundly sad yet inescapable conclusion is that it is just not possible, it is ruled out *a priori*, to have all musical intervals as pure or, more technically expressed, to make music, any music, in just intonation. This is a problem for instrumentalists, most of all for keyboard players like pianists, harpsichord players or organists, whose keyboards predetermine the exact nature of every single note — you cannot change pitch as you play along. Keyboard players therefore suffer from an inescapable tuning problem. Ever since the late 16th century rise of these instruments the problem has found numerous solutions, each with its own assets and its own liabilities. Since the rise of the piano in the early nineteenth century one particular solution has won out, to such an extent that it has by now become the universal tuning system. It is called equal temperament, it is a myth that Bach wrote his 'Wohltemperierte Klavier' for it, and it has many drawbacks and only one asset. The one virtue of equal temperament is that it allows you to play in any key you wish, from C major to G flat minor (technically expressed, it allows you unlimited modulation). The principal drawback is that (apart from the octave) no interval whatever sounds pure any more. This has grave consequences for the principal chord in Western music, the triad (e.g., C-E-G on the piano). Never hearing anything else from our earliest exposure to music onward, we have become quite used to our equally-tempered and therefore rather impure triad, and to impure intervals generally. However, one of the great things of the early music movement is that it has led to experiments with these other, historic tuning systems. I shall now let you hear the opening fragment, in two distinct tuning systems, of Pachelbel's well-known Canon & Gigue. The first time you hear it, you hear it in our customary equal temperament. The second time you hear the same fragment in what was by and large the standard tuning in the 17th century, known as mean-tone temperament. Quite unlike in equal temperament, this tuning system has most of its major and minor thirds pure. I hope that you can hear, and perhaps even enjoy, some of the difference [(II)].

So much for keyboard instruments. Although the incompatibility of the pure intervals is inevitable and therefore applies as well to singers, they have flexible voices and can adapt their intonation at least to some extent as they move on. Further, in the period of Josquin Desprez and his predecessors certain intervals that later came into standard usage were not yet regarded as proper part of a musical piece, with far-going consequences for the purity (albeit inevitably limited) of the Masses and Motets they composed.

I end this little talk about music and intelligence with one example of what the intelligent reconstruction of the performing habits and the intelligent tuning system of Renaissance vocal polyphony has been able to achieve in our time. The example is the Motet that Josquin composed

in 1497 at the occasion of the passing-away of his teacher, Johannes Ockeghem. Exceptionally, in the first portion of this 5-part motet he quite on purpose imitates his master's style. In the wake of the group's founder, Rebecca Stewart, the performers have done everything they can to follow the known practices of Josquin's own time — against the background of the 's Hertogenbosch railway station we watch them singing from a *facsimile* of the original score; having examined Renaissance music practice, they have fully immersed themselves in it; for enhanced coordination as we know from contemporary paintings, they sing from one shared music lectern; and they intone with the utmost attainable purity. I hope that you will be struck by this performance as much as I am, every single time I hear it. [(III)]

(I) *the Pythagorean comma*
https://www.youtube.com/watch?v=1DUZsQ2by2s

(II) *Pachelbel, fragment of Canon & Gigue in equal temperament and then in meantone temperament*
https://www.youtube.com/watch?v=d2I1zNw2w-c

(III) *Josquin's 'Déploration de Jean Ockeghem'*
https://www.youtube.com/watch?v=qToBYimC8AE

cantus firmus: Requiem aeternam dona eis Domine
et lux perpetua luceat eis.

cantus firmus: Eternal rest grant unto them, O Lord,
and let perpetual light shine upon them.

Nymphes des bois, deesses des fontaines,
Chantres expres de toutes nations,
Changes vos voix fors claires et haultaines
En cris trenchans et lamentations,
Car Atropos tres terrible satrappe
Votre Ockeghem atrappe en sa trappe,
Vray tresorier de musiqe et chef doeuvre,
Doct elegant de corps et non point trappe,
Grant domaige est que la terre le couvre.

Wood-nymphs, goddesses of the fountains,
Skilled singers of every nation,
Turn your voices, so clear and lofty,
To piercing cries and lamentation
Because Atropos, terrible satrap,
Has caught your Ockeghem in her trap,
The true treasurer of music and master,
Learned, handsome and by no means stout.
What great a pity that the earth now covers him.

Acoultres vous dhabis de doeul,

Josquin Piersson Brumel Comper,
Et ploures grosses larmes doeul,
Perdu aves votre bon pere.

Requiescat in pace.
Amen.

Put on the clothes of mourning,
Josquin, Pierre de la Rue, Brumel, Compère,
And weep great tears from your eyes,
For you have lost your good father.

May he rest in peace.
Amen.