VOSS

Evolution of Pianoforte Actions
And Pianoforte Technic

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THE EVOLUTION OF PIANOFORTE ACTIONS AND PIANOFORTE TECHNIC,
WITH REFERENCE TO DYNAMICS

by

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THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

Sophia M. Voss

ENTITLED The Evolution of Pianoforte Actions and Pianoforte Technique, with reference to dynamics

IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE OF Bachelor of Music

Frederick W. Lawrence

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All of the great composers have written for the pianoforte with a full conviction that although it has certain drawbacks, it has on the other hand advantages which make it the composer's instrument and the center of music making everywhere.

The invention of the piano, speaking in the general sense, is not to be ascribed to any one person; the instrument as we know it now, represents a growth. The germ undoubtedly existed in the monochord which was used by the Greeks, especially for the purpose of measuring intervals.

The earliest form of stringed instrument with a keyboard was the virginal, which was very popular in England in the sixteenth and seventeenth centuries. It was of small dimensions, about three feet long, a little more than a foot in breadth and from eight inches to a foot in depth. It was light enough to be carried easily by one person and was placed on a table when in use.

The first improvement was the spinet which was considerably larger. The virginals and spinets had usually a compass of four octaves with one thin string, generally of brass, to each key.

The next improvement was the harpsichord. It is wing-shaped, similar to the grand piano, and the strings are stretched the same as on the pianoforte but they are vibrated by means of little wooden tangents which rest upon the back of the key. These tangents contain mechanical contrivances by means of which goose
quills pluck the string when the key is depressed, producing a loud
tone in opposition to the clavichord which is very soft. It is not
capable of variation of tone or dynamics, and therefore is totally
inexpressive. The dynamics are the same whether you strike the key
forcibly or gently. The harpsichord was used for larger works such
as toccatas, concertos, and in connection with other instruments,
for opera and oratorio performances. The touch upon the harpsi-
chord is much lighter than on the pianoforte and is purely a finger
touch; a swift pressure which may be relaxed as soon as the key is
depressed. According to old prints the thumb was used but little.
The position of the hand was such that the wrist was lower than the
fingers, the thumb was allowed to hang down below the keyboard.

The three special peculiarities of the harpsichord are na-
mely:—shortness of tones, lack of sonority, and lightness of the
action. Therefore when tones had to be held or any particular ef-
fect was to be produced, embellishments of different kinds such as
turns, mordents, trills or appoggiaturas were used.

Harpsichord technic, then, involved light and rapid play-
ing of scales and arpeggios and of all sorts of finger passages in-
cluding trills and other embellishments. It required independence
and flexibility of the fingers and great dexterity, but not strength.
There was no employment of extended scales and arpeggios, however,
as there is in our modern music. In the first place these instru-
ments were much smaller in compass than our modern pianofortes,
rarely exceeding five octaves. Then too, the prevalent music was
polyphonic, and extended passages were impossible in fugue playing.
Each hand had generally to perform two or more voice parts at the
same time, and this involved the necessity of writing the parts
within a narrow range of notes. It was perhaps owing to this fact that the fingering of single scale passages in vogue at that time was so crude and clumsy. As late as the last decade of the seventeenth century the rules laid down in the instruction books for fingering scales, required them to be played with two fingers only, the third and fourth in ascending and the third and second in descending.

The use of all five fingers was a result of the development of monophonic playing. The hand not being hampered by the necessity of playing two or more voices, could indulge in much greater freedom of execution and out of this gradually came florid monophony culminating at last in our day in the difficult passages of Thalberg, Liszt and others.

Of this style of free polyphony involving florid monophonic passages, Sebastian Bach was as great a master as he was of strict polyphonic playing. In the latter he was unrivaled. He was both the greatest composer and the greatest player of fugues.

The greatest defect of the harpsichord for fugue playing was the impossibility of discriminative emphasis. In this respect the clavichord was somewhat superior. It was possible on this instrument to emphasize somewhat the entrance of a fugue subject or its answer, and to discriminate one passage or melody from another by greater or less force of delivery. Above all, it was superior to the harpsichord in lyric quality, in the possibility of prolonging the tones and imparting to them something of a singing effect.

The clavichord, Bach's favorite instrument, was constructed on a principle entirely different from that of the harpsichord. It had finer artistic capabilities than either the harpsichord or the
pianofortes of his day. The string was neither struck by a hammer nor scratched by a plectrum. The whole mechanism of the clavichord consists of a little bit of brass fastened upon the back of the key in such a way that when the key is pressed down, it strikes the string, which is made out of very fine wire and loosely drawn over the sounding board, thus producing a sweet but very soft tone.

As in the case of the harpsichord, the touch on the clavichord was purely a finger touch, but with this difference. As the tangent when pressed, acted like a bridge in holding the string taut to keep it vibrating, it was necessary that the pressure of the finger on the key should not be relaxed but continued firmly, as long as the value of the note demanded. As the key is thus continuously pressed, the pitch rises a little though not enough to amount to a half or quarter of a tone. This vibrating element is similar to that of the violin, and was called by Bach the "Belung." The touch must consequently be very light so that hardly any exertion is needed upon the part of the player. The tone of the clavichord is very expressive and capable of great modification and coloring. It was the instrument for which Bach wrote the "Well Tempered Clavier." It requires a great deal of skill to exert the proper pressure upon the key of the clavichord for tonal purposes and the art is now lost, but the tone of the harpsichord is the same however it is touched and differs from that of the pianoforte which has two dynamics, piano and forte.

Sebastian Bach's technic, therefore, was the technic of the harpsichord and especially of the clavichord. In him both polyphonic playing and polyphonic writing ended. He did all that could be done on the instruments of his time. He attained the utmost
independence of finger, the utmost ease, lightness and fluency; his dexterity in interweaving contrapuntal parts was perfection itself; he employed all five fingers in passages in which they could be used to advantage, disregarding the pedantic rules of his time. He made the most of the lyric capabilities of the clavichord. In short, he did and discovered everything that was possible on the instruments he used.

Haendel was also a great organist and harpsichordist, but devoted most of his life to the production of Italian opera. His technic however is very similar to that of Bach.

Domenico Scarlatti seems to have had more of the virtuoso spirit, as there is very much in his compositions to indicate a desire to overcome technical difficulties and to display his mastery of them. There are passages exceedingly troublesome to players even now, which seem to serve no ideal end, but to exist solely for the sake of difficulty. Nevertheless he undoubtedly contributed much to the mastery of technic and especially to the development of the monophonic style of playing.

When we compare the sonatas of Scarlatti, the suites of Haendel and the suites, sonatas and concertos of Sebastian Bach with the sonatas of Emanuel Bach, we find no sudden change in technique. Indeed the development of the technic of the pianoforte was so slow that neither Emanuel Bach, Haydn nor Mozart ever fully recognized the peculiar capacities of the new instrument. All three were bred harpsichordists and even in the Mozart concertos, most of the passages are perfectly practicable for the harpsichord. In the works of these three masters we find the same demand for lightness and fluency which characterized the concerto and other compositions of
Sebastian Bach's time. Of course this was due in part to the fact that the Vienna pianofortes (being modeled on those of the harpsichords then in use) had very light actions. The most important service rendered by Emanuel Bach, Haydn and Mozart in the development of pianoforte technic was their progressive recognition of the lyric element. The adagios in the sonatas of Emanuel Bach were distinct attempts to improve upon the singing effects already attained on the clavichord. They were probably written for the clavichord as much as they were for the pianoforte. Bach played both instruments though he is said always to have preferred certain effects obtainable on the clavichord to any which could be produced on the pianofortes of his time. The most peculiar of these effects was the "Belung" referred to above, a peculiar tremulous effect produced by a rapid repetition of slight pressure on the key.

Nevertheless the stress Bach laid upon the lyric element in playing the clavichord must have tended strongly to develop the lyric capabilities of the pianoforte, which was now rapidly growing in favor. By the time of Emanuel Bach's death, 1788, the pianoforte had almost superseded the older instruments.

Haydn and Mozart also cultivated the lyric element of the pianoforte. Their works show a steady development of it. Haydn modeled on Bach, and Mozart on Bach and Haydn, and in the Mozart sonatas and concertos we find what was probably a full and complete recognition of the lyric possibilities of the small, light Viennese pianofortes of his time. The extended scale and arpeggio passages of the Mozart concertos also show a distinct recognition of the capabilities of light and shade peculiar to the pianoforte.

Mozart had an Italian contemporary who was indeed an
artist and virtuoso although he was not such an original genius. This was Müジョ Clementi (1752-1832). He did much more in the development of pianoforte technic than Mozart. Clementi occupies somewhat the same relation to Mozart and Haydn that Domenico Scarlatti did to Bach and Haendel. He was a thorough musician, an excellent composer, so far as technical attainments went, and had very marked talent. Beethoven, however, preferred his sonatas to Mozart's. He composed about a hundred sonatas, the same number of studies, (Gradus ad Parnassum) besides symphonies, choruses, etc. In early life he aimed at brilliant execution, and especially cultivated difficult playing in double thirds, fourths, sixths and octaves. He afterwards acquired a broad cantabile and a nobler and more artistic style generally. He was a pianist rather than a harpsichordist and was really the first of the great players of whom this could be said. He preferred the English pianofortes with their heavy action and adapted his playing and his compositions to these instruments. He was an excellent teacher and formed some of the finest pianists of the next generation. Among them are J.B. Cramer, John Field, Alexander Klengel, and Ludwig Berger. He also conducted Italian opera in London and engaged in the manufacture of pianofortes.

Modern pianoforte technic rests entirely on the Gradus ad Parnassum. These studies afford an adequate foundation up to the compositions of Chopin, Liszt and Schumann. Even the Beethoven fifth concerto does not go beyond the Clementi technic in its principles or its extreme difficulty. Clementi's lifetime covers a period from seven years before the death of Haendel to four years after that of Beethoven and up to within two years of the establishment
of the Neue Zeitschrift für die Musik, by Schumann. He lived through
the whole epoch of the development of the sonata, its culmination
and transformation.

Our modern instruments are no more than sufficient for the
interpretation of Beethoven's greatest works. In this respect his
work is prophetic; but the essential elements of his technic are all
to be found in the Gradus of Clementi. One of the most noticeable
points of his early technic is his use of rapid succession of
chords as in the Sonata in C, op. 2, no. 3. This is evidently bor-
rowed from Clementi, who was at that time Beethoven's favorite mod-
el. The technic of Schubert and Weber was also based on that of
Clementi. Weber however made use of extended chords in a way whol-
ly original, an example which has been followed since.

In general it may be said that not only Clementi's contem-
poraries, but all classical players and composers since, have based
their technic on his Gradus ad Parnassum. Some, like Moscheles for
example, have elaborated some points at great length and in detail
which Clementi treated but briefly. In principle however all clas-
sical technic is to be found in Clementi; and all in our playing
which cannot be accounted for on his principles, can be referred to
Liszt and the other Romanticists. Only in one point of technic,
players have gone beyond Clementi's practice or suggestion and that
is the use of the damper pedal. Beethoven used it considerably,
Moscheles still more and Thalberg carried the use of it to its ex-
treme limit.

Indeed Mendelssohn was essentially a classicist in much of
his technic as well as in the clearness of his forms. Even in the
Songs without Words there is little which cannot be referred back
to the technical principles of Clementi. These principles depended mainly on the construction of compositions from five-finger passages, scales and arpeggios. The rules of fingering required that a five-key position should always be taken when possible; that a position once taken should not be changed unnecessarily; that all passages derived from scales and arpeggios should be fingered like the arpeggios or scales on which they were founded; that the thumb and little finger being shorter than the others, should not be used on the black keys, except in positions where their shortness produced no disadvantage. These principles suffice for playing all classical compositions in the monophonic style. But Mendelssohn, in many of his Songs without Words, introduced passages where a melody with an accompaniment to be played by the same hand could be played properly only by changing the fingers on successive keys, while holding them down with a continuous clinging pressure. This changing of fingers was not wholly new, for Bach had used it in polyphonic playing, and occasional instances of it had occurred since, in Clementi's works and elsewhere. With Mendelssohn, however, it assumed new and greater importance. His Songs without Words became the fashion, served as models to many composers, and intensified the already great and growing interest in the purely lyric style.

This interest was greatly heightened by the lyric pieces of Chopin. But Chopin's relation to technic was much more important than Mendelssohn's. He was an innovator; as original in his technical methods and treatment as he was in his ideas and his harmonies. Above all others he thoroughly understood how to write for the pianoforte and how to produce effects thus far unattained.
He improved the legato playing of chromatic passages especially in double thirds and other intervals, by putting the fifth finger under the fourth and third in descending and the third and fourth over the fifth in ascending. He showed how to produce a smooth even chain of tones in arpeggios dispersed in wide intervals and in extended chords. He wrote arpeggios so interspersed with passing notes and appogiaturas that no rules of fingering previously known would apply to them and showed how they could be played with ease and certainty.

Schumann also had a peculiar technic but one which seemed less perfectly adapted to the requirements and resources of the pianoforte. Apparently his innovations were not, like Chopin's, based on a thorough mastering of all previous technical achievements and a clear perception of new effects to be produced by a further natural development.

The new difficulties of Schumann's technic consisted partly in obscure and involved rhythms, partly in the peculiar relations of the melodies to their accompaniments, partly in the use of extended chords in awkward positions and partly in the participation of both hands in the delivery of the same phrase. In all these cases the thought is first in importance with the composer and facility of execution seems to be an entirely subordinate matter. Schumann's innovations therefore had for a long time very little influence on the technical treatment of the pianoforte. Of late years, however, players and composers have been greatly affected by Schumann's works and have thoroughly accustomed themselves to his technic. Some of his powerful effects demand many of the most important technical qualities both in player and instrument. Liszt
was certainly the first to popularize them both among players and pianoforte makers and was followed by a new school of writers represented by Brahms, Tschaikowsky, Moszkowski, the two Scharwenkas, the Brassin brothers and Sgambati, all of whom are deeply marked by the Schumann peculiarities.

With the exception of Chopin, no composer has wrought such remarkable changes in technic in his lifetime as Franz Liszt. It was Liszt's ambition to become the Pagáinni of the pianoforte. With this end in view he studied and experimented constantly to produce new effects in melody, harmony, and brilliant passages, to increase the power and sonority of his touch, to vary the quality or "color" of his tones by different kinds of touches, to discriminate the different elements of a piece as widely as possible, and to make his playing effective by violence of contrast, force, fire, spirit, delicacy, and refinement, all carried to the highest attainable pitch of excellence. In all this he was successful, and attained such mastery as was not only the despair of all players of that time but still remains unrivaled by any of the great pianists who have been formed on the principles of his own technic.

These principles were first, the development of greatest possible strength and power of discriminative emphasis in the individual fingers and second, a much greater use of the hand playing with a loose wrist than had hitherto been customary.

Liszt's works are always exciting, but few of them are poetic and inspiring. The effect of them and of Liszt's playing and teaching has been to revolutionize technic and to bring about great changes in the construction of the pianoforte both in a great increase of sonority and its capacity to endure a powerful touch
without injury to the quality of tone. Liszt will certainly be known in the history of pianoforte music as the greatest virtuoso of his time. It seems not improbable that he will be credited with the development of the pianoforte and of its technical requirements to the extreme limit of the possibilities of both. He, at least, has almost exhausted the capacity of the present instrument and has discovered and practiced every possible use of the muscles of the hand and arm in playing. He is the king of pianists and he will likely retain this title for all time.

In view of this discussion it will be seen that there are peculiar intellectual requirements, besides the increased demands on the interpretative powers of the player of today. Among these are the peculiar involved, intricate rhythms of Schumann and the extremely original harmonics and modulations of Chopin and Liszt. When these peculiarities have been perfectly grasped and assimilated, however, they are seen to involve mechanical difficulties of a character foreign to the classical technic.

Mr. C. S. Hill, a piano tuner, made an apparatus for my work with which the keys of different pianos can be tested as to the pressure required upon them to produce tones.
The figure on the preceding page is a rough sketch of apparatus made by Mr. Hill. It consists of an arm or beam AB which turns on pivot C. This beam is a little narrower than the width of a key and has a piece of felt glued on end B which strikes the piano key, in order that it may make as little noise as possible. The weight D can be moved along to E thus obtaining a weight of two ounces on the key at E. If more weights are necessary there can be attached at F any number by which the pressure required in ounces or pounds for any tone wanted piano or forte can be ascertained. With a fifteen ounce weight at a two inch stroke of the beam, a pressure can be obtained which corresponds to six pounds at the surface of the key. This was found by letting the beam B with a two inch stroke, strike a spring balance scale. A six pound stroke produces a strong forte tone, probably as loud as the ordinary player would ever have occasion to use.

The action of pianos made recently is very much stiffer than that of those made thirty-five and forty years ago, and of course is on an entirely different principle from that of the harpsichord and clavichord, thus requiring the performer to have a very much stronger and better muscular development.

The following pianos were tested by the above apparatus on middle C to find the pressure required to produce the softest tone possible.

<table>
<thead>
<tr>
<th>Piano</th>
<th>Age</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schomacker square</td>
<td>40 yrs. old</td>
<td>2 1/2 oz.</td>
</tr>
<tr>
<td>Emerson square</td>
<td>35 &quot;</td>
<td>2 3/4 &quot;</td>
</tr>
<tr>
<td>Baldwin upright</td>
<td>15 &quot;</td>
<td>3 1/2 &quot;</td>
</tr>
<tr>
<td>&quot;</td>
<td>4 &quot;</td>
<td>at University 3 3/4 oz.</td>
</tr>
<tr>
<td>&quot;</td>
<td></td>
<td>at University 3 1/2 oz.</td>
</tr>
</tbody>
</table>
Haddorf upright new  3 3/4 oz.
Steinway grand at the University  4 1/2 oz.
H. F. Miller grand at the University  4 oz.
Chickering grand new  4 oz.

The touch on the clavichord as has been stated is extremely light; blowing on the keys will depress them and one-half ounce pressure will produce a tone. Nevertheless no tone could be produced by dropping a weight on the key, although the strings could easily be broken in that way. The weight required to sound a harpsichord key varies enormously, according to the keyboards, stops combinations and part of the scale. It might range from one ounce or so to six or seven ounces; however the average pressure required on the harpsichord is three and one-half ounces.

Bach's preludes and fugues or any other music can be played upon the clavichord or harpsichord at any conceivable speed if the instrument is in good order and the player skilful. With these requirements a clavichord can be used at a greater speed with clear effect, than can our modern pianofortes. But it is a hard matter to compare these old instruments with our modern piano as the mechanism is very different.

The following is an estimate of the amount of power required by the performer to play Prelude III of Bach's "Well Tempered Clavier" in one minute eight seconds on four different instruments; on the clavichord 25.15 pounds must be moved the distance of the dip of the keys; on the harpsichord 177.4 pounds; on an Emerson square 640.01 pounds; on a Steinway grand 703.37 pounds. For the first chord of the piano solo in Mendelsohn's G minor concerto the estimate of power required on a Steinway grand is about forty-eight
pounds; on an Emerson square forty-four and one-half pounds, while on the harpsichord one and three-fourths pounds and on the clavi-chord only four ounces are required. The power required in playing the Chopin Concerto in E minor, Op. 11, on a Steinway grand piano is equal to that needed to move 22 2/5 tons the distance of the dip of the keys in twenty-four minutes eighteen seconds. On the harpsichord the power needed is only 2.13 tons in the same amount of time.

These several estimates of pressure on the different instruments therefore show that the necessity for muscular development has kept pace with the advancement made in the construction of the instrument.