AN EVALUATION OF COMPARATIVE PIANO
TECHNIQUE SINCE 1902

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CHAPTER I

INTRODUCTION TO THE STUDY

The Problem

Hans von Bulow is credited with having said, "It is a difficult thing to play the piano," and further, that since it is difficult, we must be very exact in every movement and master each technical detail from the first.

There are no figures available, but if a survey were made, possibly more people would be found engaged in the study and teaching of piano than any other musical instrument. It is much to be desired for both teachers and students to have an intimate acquaintance with the principles underlying the structure of modern piano technique. The situation as it generally exists contrasts sharply with the ideal situation. The ignorance of this important phase of piano study causes an enormous annual waste of time and money on the part of students. With an adequate technical knowledge, teachers, instead of allowing their pupils to practice blindly and mechanically, would be able to explain the reason for each movement they ask them to perform. Many failures in both classes occur because of the lack of understanding of what piano playing requires.

1 Harriet Brower, Art of the Pianist, p. 3.
Need for the Study

The question of technique is important in the study of piano both from a professional and amateur point of view. The fact that a student has neither ability nor inclination to become an artist makes the laying of a good foundation none the less important. It is easier to learn the right than to unlearn the wrong. Technique becomes the more important when it is remembered that adequate expression depends on adequate technique.

The literature on the subject is both extensive, controversial, and in many cases, vague. Many writers interest themselves with the advancement of their own ideas or those passed on to them by the exponents of a particular method, with little regard for what others have been able to contribute. Such a maze of conflicting ideas and opinions tends to confuse rather than enlighten the student. So it seems there is a need for a critical, dispassionate study of the literature in order to determine some measure of truth about the technique of piano playing.

The study has been limited to a survey of the literature printed since 1902. In that year, Leschetizky, one of the first of the great modern teachers, published his first work on piano technique. Before that time piano playing was taught by stiff-hand, stiff-arm methods which have been universally discredited today.
Reliability of the Data

The writings of four great modern teachers, namely, Leschetizky, Breithaupt, Matthay, and Fielden, have been studied. In cases where their own writings have not been available, as in the case of Leschetizky, who never wrote about his method, the investigator has examined their ideas as expostulated by their students or colleagues. Their influence has been so great that recent teachers and virtuosi tend to follow one of these four. The results of the revolutionary scientific investigations of Carl E. Seashore and Otto Ortmann have also been examined for the objective evidence they have made available.

Organization of the Study

In this study, the investigator has devoted a chapter to the physiological conditions in the development of technique, and to the muscles used in playing, inasmuch as a clear understanding of the subject is dependent on accurate knowledge of the former. The next chapter deals with such technical problems as touch, relaxation, weight playing, rotation, and finger action as dealt with by the four teachers mentioned earlier. The ideas of others who are clearly followers of one or another of these schools will also be represented. In the final chapter, an attempt is made to weigh them in the light of objective data, and to present certain conclusions about the problem of technique.
CHAPTER II

PHYSIOLOGICAL CONDITIONS IN PLAYING

Before a study of piano technique can be undertaken, there are certain things, on which practically all writers are agreed, which need consideration.

Thomas Fielden has given an excellent account of the physiological conditions in playing. The three important factors in the development of technique are mental, nervous and muscular. Since they react upon and coordinate with one another, it is necessary to develop all three as far as possible simultaneously. In any physical act the following process takes place; a movement conceived by the brain is communicated to the muscles by the nerves and the orders are carried out by the former as well as they are able. ¹

Without a complete mental knowledge, it is impossible to perform a piece of music with sureness. Prolonged mechanical practice may insure a certain facility, but the element of uncertainty is always present, because of the lack of mental direction. Continuous practice may even result in reflex movements, but uncontrolled and controlled reflex actions are entirely different. Individual reflex action can become so swift, even automatic, that they become involuntary. It is

¹ Thomas Fielden, The Science of Pianoforte Technique, p. 11.
possible, however, to will them in detail slowly and control their speed by taking them in groups. This makes for certainty and swiftness of technique. To do this, the mind must be able to analyze the simple elementary movements which become parts of these groups of reflex action.

The player must have a knowledge of the muscular movements taking place in any given action of arms and fingers. He may toil at a technical difficulty and through ignorance of muscular conditions be going away from rather than approaching its solution.

The nervous factor directs and coordinates muscles. It is not enough for the mind to have grasped the musical contents of a piece and the muscles to be quite fit; rehearsal is necessary to coordinate these factors, to train them to react swiftly and accurately.  

An important function is isolating muscular movements. For example, independence of fingers is gained more by keeping away all nervous connection with the non-operating fingers and concentrating nervous impulses on the operating ones than by muscular restraint.

A correlative of this is that nervous control connotes muscular control. If more students realized this, much time spent in hard muscular exercises could be saved. Control, not abnormal development, is needed.  

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2 Ibid., p. 13.
3 Ibid., p. 14.
The importance of the muscular side must not be obscured by too much insistence on the nervous side. Nerves cannot operate to their full efficiency unless the muscles are in good condition. This means the assurance to them of a proper supply of blood, which enables them to respond to the swift nervous messages conveyed to them by the brain. Strength is more often the result of perfect timing and coordination of the muscles and body operating as a weight and power behind the fingers than a result of abnormal development of muscles. Speed is the real motive force which produces power. It is the power of exercising this speed which is present in the physical and nervous organism of those said to have fingers of steel.

The goal of muscular efficiency, then, is fitness rather than abnormality, suppleness rather than strength. Suppleness does not mean flabbiness and muscular isolation is not so necessary as nervous isolation. In fact, it is almost impossible because so many muscular movements are coordinative.

Before analysis and observation can be undertaken, a knowledge of the muscular structure of arms and hands is desirable.

A muscle is a mass of contractile tissue which is attached directly or indirectly at each end to bones. The attachment nearest the trunk or middle line of the body is the 'origin' and the other attachment is the 'insertion'.

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4 Ibid., p. 19.
The two processes of muscles are contraction and relaxation, each being capable of great variation in degree. Bones function as levers in moving parts of the limbs.

Limbs may move of their own will only by means of contraction; relaxation has nothing to do with it. The weight of the arm can be used in the process of relaxation, but only when the arm is placed in a certain position by muscular action. For example, relaxation of the brachialis (flexor muscle) only enables the arm to fall by its own weight and at a speed determined by the action of gravity. Control of the movement, either slowing up or speeding, must be regulated by nervous and muscular action.

Muscular action is not only used to produce movements of limbs, but also to keep them in any position they may have assumed by steadying them and preventing movement. 5

Arising out of the fact that every movement of any limb is the result of the contraction of the muscles controlling that limb is the fact that there can be no relaxation, unless there has been nervous contraction.

In a study of muscular action, one must investigate the function of bones. In action, bones follow the general law of leverage, namely, that every lever must have a fulcrum or fixed point on which to operate. Fielden refers to this many times as an 'anchorage.'

For example, in a forearm stroke, the bone of the upper

5 Ibid., p. 21.
arm (humerus) is the fulcrum and the forearm is the lever. For the latter to work freely, the upper arm must be fixed. Otherwise, control of the forearm would be uncertain.

Tendons are white, inextensible, fibrous cords of various lengths and thicknesses. They are connected with the muscles and movable parts such as bones and cartilages. 6

Tendons differ from ligaments in that tendons join muscles to bone, while ligaments connect bones. The tendons are pliant and flexible; the ligaments are inextensible; yet with lack of exercise, they are liable to become less supple. The tendons are merely connections between muscles and bones and their inextensibility is reasonable, since any play would impede their immediate response to muscular action.

The bones of the arm and shoulder are: the scapula (shoulder bone); clavicle (collar bone); humerus (upper arm bone); radius and ulna (forearm bones); carpus (wrist, consisting of eight small bones); metacarpal (hand) and phalanges (fingers).

The scapula and clavicle are anchorages for the shoulder muscles. They are: the deltoid, which lifts the whole arm to the horizontal position; the pectoral, which swings it inward and forward; the dorsal muscles, on the back of the shoulder (scapula and clavicles assisting as anchorages) swing the arm laterally outward and backward. 7

The pectoral and dorsal muscles act in pulling the arm down from the horizontal. The scapula is also the origin of

6 Ibid., p. 23.
7 Ibid., p. 24.
attachment of the biceps and part of the triceps. The humerus is the anchorage for the brachialis (flexing muscles of the forearm) and the triceps (extensor) muscle. The lower end of the humerus serves, with the radius and ulna, as anchorages for the wrist, hand and finger muscles. The radius rotates on the ulna by means of the pronating and supinating muscles in the forearm. The carpus, includes eight small bones in the wrist. The wrist-joint is the actual joint by which the radius articulates with two of the small carpal bones.

The group of muscles, flexor carpi radialis, flexor carpi ulnaris and their corresponding extensor muscles serve to flex and extend the wrist. They also assist in rotating the hand on the wrist. All except the flexor carpi ulnaris are inserted into the metacarpal bones of the hand. 8

The latter are anchorages for the interossei muscles, which abduct and adduct the fingers and assist in their extension. The lumbricales, which flex the first phalanges of the fingers, arise from the tendons in the hand. The interossei are in two layers, palmar and dorsal. The former adduct the finger towards an imaginary line running through the center of the third finger; the latter abduct them away from that line. 9

Fielden summarizes the important points in muscular action as follows:

1. All muscles have reciprocating muscles; flexors reciprocate extensors and vice versa.

8 Ibid., p. 27.
9 Ibid.
2. The muscles operating any limb are at a distance from the levers. For example, the muscles operating the forearm (biceps, brachialis and triceps) are located in the upper arm.

3. The lumbricales flex the first phalanges of the fingers, and the flexors and the flexor profundus digitorum flex the second and third phalanges. In extension, the reverse takes place. The extensor communis digitorum extends the first phalange and the interossei the second and third.

4. The superficial muscles on the front of the forearm practically correspond with those on the back of the forearm.

5. While the extensor communis digitorum sends tendons to all four fingers, the index and fifth fingers have their own tendons as well. Although the tendon of the index finger joins with the main extensor communis digitorum, that of the little finger, while joined to the common tendon by a thin tendinous slip, runs through a separate compartment in the ligament where the radius joins the ulna. This enables these fingers to be extended while the others remain flexed.

6. The fourth finger has cross ligaments on either side of its tendons which serve to support the metacarpal bones of the hand. The cross tendon formation is necessary in order to join with the separate tendon of the little finger. This apparent irregularity accounts for its
supposed weakness. Recognition of this peculiarity and special treatment in the development of its strength will overcome the weakness. 10

Muscles can be used to assist in the work of greater muscles, when their own special function is fulfilled. For instance, the flexors of the fingers can assist in flexing the wrist and forearm, when fingers have been flexed to their limit.

Interaction of muscles must be considered when using parts of the arm in combination. For example, if the forearm is to be used directly, the hand must be rigid and "of a piece" with the forearm, especially at the moment of contact with the key; otherwise the hand operates in a non-coordinated fashion. The significance of this is that the hand should be fixed at the moment of contact, not before, although in some cases preliminary fixation helps in speed of attack. 11

10 Ibid., pp. 27-28.
11 Ibid., p. 32.
CHAPTER III

METHODS OF TECHNIQUE

Theodor Leschetizky

E. R. Kroeger writes that in the early nineties the 'Leschetizky wave' spread over the country, dominating piano instruction for many years. Although Leschetizky claimed to have no method, his assistants and pupils published methods and articles which indicate what he wanted. The main object was equality of fingers combined with a full round tone. The elbows curved outward in ordinary legato; wrists were depressed, knuckles arched and fingers rounded. Crystalline clarity and distinct articulation were striven for.

Florence Trumbell, who was one of his pupils, says that he maintained that pure physical strength was not necessary to get great volume and tonal effects. Nervous energy, applied with the correct pressure of the wrists at the right moment will produce as great a tone with more resonance.

This shows that Leschetizky was searching for a nervous rather than a physical solution. It was a step towards the concept of nervous control so important now.

1 E. R. Kroeger, "Changes in Piano Teaching in Fifty Years," Etude, XLIX (December, 1929), 885.

There were certain exercises he considered necessary for the development and control of the hand. These exercises were collected by his assistants and published.

The Fundamental Principles of the Leschetizky Method by Marie Prentner is one of these works. It had at least the tacit approval of Leschetizky, as he allowed her to use the book in teaching during the years she served as his assistant.

The principles of finger movement for tone production are developed in a series of exercises. The operating finger is placed in contact with the key (called 'preparing') before the key is depressed. The first principle is contact playing for legato. All these exercises are done with all fingers, except the operating ones, pressing the keys down. ³

After these preliminary exercises, the student proceeds to the 'completed legato.' This means the depressing of a key by a finger already placed in contact with it, without having been previously raised above the note, 'soundless' repetition of the pressure in slow tempo, and the raising of the finger only when the next one has begun striking. ⁴

The way in which a strong tone may be brought out legato in a cantilena is described in the following way by Malwine Bree in The Ground Work of the Leschetizky Method, which was endorsed by Leschetizky as 'a brilliant exposition' of his personal views.

⁴ Ibid., p. 12.
The strength of the fingers does not suffice, but must be reinforced in the following way: touch the key lightly and force the finger to press it down by means of a swift upward movement of the wrist; at this instant, the wrist and finger-joints must be firm. The same effect may also be determined by a rapid down-stroke of the wrist. Immediately after striking the tone, the wrist must return to its normal position, while the finger holds the key lightly.

This is the 'high-fall' and 'low-fall' of the wrist described by Fielden, except that for the latter the impetus for the muscular movement comes from the shoulder muscles instead of the wrist.

When playing legato or non-legato, the inactive fingers are held high and curved with exception of the thumb. This is a point which contrasts sharply with almost all the more recent theories of piano teaching.

The exercises preparatory to scale playing develops further the idea of preparing the tone. As soon as the thumb has struck it passes under the hand and 'prepares' the tone it is to strike. A quiet hand is insisted on. 6

The principle of chord playing is to press rather than strike them, because striking results in 'hard' tone. They are played in the same manner as legato in a cantilena. For playing forte or fortissimo, the wrist movement is greater, for piano chords less extended and slower. 7

Prentner takes a little different view. She says:

Sonorous chords are executed in the following way:

5 Malwine Bree, Groundwork of the Leschetizky Method, p. 29.
6 Prentner, Fundamental Principles, p. 15.
7 Bree, Groundwork of the Leschetizky Method, p. 33.
The fingers are placed in readiness on the keys, which they strike strongly, with the full assistance of the arm, whereupon the wrist by a slight depression and then a return to its normal height, relaxes the strain of the arm, thus avoiding any fatigue during the holding down of the chord. 8

George Proctor (a former pupil of Leschetizky and at the time of writing a teacher of piano at the New England Conservatory of Music) writes that in long-continued chord playing the weight of the upper arm and shoulders is added. Whenever possible the student should place the hands in position, fingers on the keys of the chord, and by a quick and slightly downward movement of the hand and wrist produce the desired volume of tone and relax immediately afterwards. This is to be preferred to striking, as one is more likely to play right notes. 9

The latter two describe the same process, but one urges striking and the other not striking the keys. It is thus difficult to say whether Leschetizky actually advocated playing with hand and finger strength alone. But it is true that the major emphasis was placed on finger technique. He probably regarded arm movements as undesirable in the early stages of playing because of their preventing the establishment of correct finger action.

Leonard enumerates the following as prominent parts of his teaching: (1) downward pressure of the wrist after a chord, bringing into play muscles of the forearm which

8 Prentner, Leschetizky Method, p. 44.
9 Proctor, A Course In Pianoforte Playing, Lesson VI, p. 5.
assist in the pressure, (2) development of strength by repetition and accenting and extra power, (3) development of velocity by gradually increasing the speed of the passage and playing in rapid groups with pauses on chosen note.

Among the more recent teachers who have ideas similar to Leschetizky is Vantyn, who is a professor at the Royal Conservatory of Music at Liege. He interprets technique as pertaining to the movements of the fingers. The scientifically correct movement of the fingers is as necessary in a cantilena as in brilliant passage playing. Every effort called for in the execution of a musical work necessitates a greater or smaller amount of finger movement.

From the contact of the fingers with the keys, we obtain touch. On the correct quality of this contact between the fingers and keyboard depends the tone. It is a mistake to think that only the fingers and wrist need to be developed. All muscles, from shoulders to fingers, need to be trained with patience.

Clarity of touch is most essential and can only be obtained by lifting the finger as high as possible so that the attack will be free.

The movement of the hand also plays an important part in technique. A well-developed wrist will influence the tone, even in legato passages, making the tone more

11 S. Vantyn, Modern Pianoforte Technique, p. 5.
beautiful. It will do away with playing from the arm.

When chords are played fortissimo, the keys should not be attacked with the full force of hand or arm. A direct blow should be avoided because it leads to noise. One should avoid

... the accumulated weight of hand and arm, added to the swiftness of movement, becoming a direct striking force. ... The weight alone of the arm suffices; and instead of the harsh blow we shall obtain a weight-leverage on the notes. 12

Perfect finger motion or technique is the basis of all real pianoforte playing. Pressure (weight) on the keys, rather than attack gives a soft, mellow tone required in the cantilena. The finger attack is less vigorous and the tone is less brilliant. 13

Trumbell says of Leschetizky:

Technic to him was just a means to an end. To me Leschetizky stands for 'music and art.' His interpretations stood for holdness of outline, super-rhythm, sanity, honesty, warmth, beautiful tone, healthy sentiment, delicacy and finesse of tempo and color. Without technic, none of these things are possible. Technic and interpretation must ever go hand in hand. 14

Carl M. Breithaupt

Breithaupt writes that all restraints in the muscles and hindrances in the movements of piano playing can be removed only by learning to relax and by intelligent training in movements. Only in this way can inefficient, superfluous contractions be avoided and the work be divided equally among the groups of muscles concerned. 15

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12 Ibid., p. 106.
13 Ibid., p. 113.
14 F. Trumbell, "Leschetizky As I Knew Him," Etude, XLIX (February, 1931), 139.
15 R. M. Breithaupt, "Hindrances To Artistic Piano Playing," Etude, LX (February, 1933), 84.
In most players the wrist is supple enough, working as a passive spring. The hand follows the arm and is a part of all its chief movements, so it must yield in the wrist, balancing or rocking up and down. This yielding serves as a relaxation from the attack already made and as preparation for the next one. This yielding is what Fielden calls the breaking of the 'double-anchorage,' with the hand left free to swing on its own single anchorage. He would not agree that 'in most players the wrist is supple enough.'

In practical playing it is necessary to follow the general principle that the hand must relax in the wrist after each attack and the fingers be freed from all pressure. The player should avoid all over-tension, continuous tension (also continuous pressure) and all excessive friction (inner and outer).

The player must be sure that while playing, the hand retains as far as possible its 'natural medium pose.' For this, the fingers are 'not too strongly flexed' nor extended, nor bent too far to the right or left. Every change from this position by the hand or finger 'must be made instantly, with the greatest speed.' 16

In the widest stretches, as well as when the fingers are close together, the players' hand must move with the fingers, from finger to finger by 'swinging, rolling or gliding.' In the case of chords which are difficult to reach and sustain, in arpeggios or other passage-forms

16 Ibid., p. 84.
having wide stretches, this principle must be observed. The hands and fingers must be relaxed immediately after playing.\footnote{Ibid., p. 84.}

From this last statement, can be inferred that he realized the necessity for some contraction during playing. In saying that the hands and fingers must be relaxed after playing (presumably successive notes or chords) he agrees with Fielden.

Levinskaya includes Breithaupt among the 'weight-touch' pioneers of the twentieth century. He continued the work done by his predecessors and developed his own ideas about the use of weight in playing.\footnote{Levinskaya, The Levinskaya System of Pianoforte Technique, p. 44.}

He rejected the possibility of combining the swing of weight of one part of a limb, with tension or fixation of another. Tenseness and fixation were renounced as undesirable. This interpretation seems to be incorrect from what he writes in the article quoted. He mentions tension, but warns against 'over-tension,' probably meaning stiffness.

He completely withdrew from finger articulation and for the sake of unity, established the 'swinging whole' as the 'standard of technique.' This differs fundamentally from Fielden's main contention that there must be free use of the whole arm with all its parts acting in coordination.

About Carreno's playing he said:

The idea of the swinging motion of mass (weight) as a technical function, to the playing of Carreno

\footnote{Ibid., p. 84.}
seemed to be the simplest, most effortless and most natural that one can imagine. Here the problem of technique was solved in such a playful way that the Secret of Freedom and Looseness — which ceased to be a secret, revealed itself through movement and tone. 19

Tobias Matthay

Matthay is regarded as another of the 'weight touch' pioneers. He has developed his ideas and written a number of books on the subject. His First Principles of Pianoforte Playing contains a clear exposition of them.

He says that the louder the player wishes a tone to be, the more swiftly the key must be made to descend. For a beautiful tone quality, the key and string must be set into motion gradually. A less brilliant tone may be had by depressing the key suddenly, hitting the string by means of the key, but not by hitting the key. If the sound is to be exactly what the player wants as to quantity and quality, he must direct his efforts wholly to the sound and in choosing the right effort for each note. 20

The key must not be squeezed on the bed beneath or the effort chosen for a particular inflection of tone will be partly spent on the key beds instead of on the strings. 'Key-bedding' tires the hands and fingers, preventing agility.

The two chief rules of technique are: (1) to feel how much the key 'resists' you and (2) to listen for the moment each sound begins, so effort can be directed to the sound

19 Ibid., p. 55.
alone.

The key must never be hit or hit at. The finger tip may fall on the key, and in gently reaching the key, the fall may be followed up by acting against the key for the purpose of making it move.

For legato, no more weight should be left on the key than will just suffice to hold it down. The weight left on the keyboard should, therefore, be light. He says:

... in playing a loud note either tenuto or legato, you have really to do two different things: (1) you must use sufficient energy to make the key move down swiftly to obtain that forte, and while you must stop using most of this energy the moment the hammer reaches the string you must nevertheless (2) continue using some little remnant of energy... to keep the key depressed.22

In 'weighing' the keys, the player is aware of using arm weight and of the fact that this reaches the keys through the fingers and hand. The fingers and hand must be doing something. They must be exerted slightly to support the slight arm-weight on the keys. The finger, in acting downward upon the key to support the weight, also reacts upward against the knuckles with equal force. The hand is also exerted downward at the knuckles and reacts against the arm at the wrist-joint and thus supports the arm there. All exertion must feel 'upward.' The moment the player feels as if he were acting 'downward,' he is using the wrong exertions.23

21 Ibid., p. 3.
22 Ibid., p. 4.
23 Ibid., p. 8.
Matthay recognizes Three Species of touch. The Third Species is that employed in making the key move by a combination of the weight of the arm with exertion of the hand and finger. When the arm weight is removed from this combination by supporting the arm with its own muscles, we have the Second Species of touch. In place of this, the sound can be produced by finger exertion only. This is the First Species. The arm is 'floating,' the hand lying loosely and fingers used alone against the key to move it.

The First Species enables the player to move quickly across the keyboard, but not to get much tone. The Second Species gives more quantity, but reduces agility, while the Third gives the full range in tone amount, but can not be applied in very quick passages.

The finger, hand and arm may be considered as separate levers which may be used independently of the others. When the finger only is moved, it may consist of (a) an exertion of the finger only, (b) an exertion of the hand behind the finger (hand only moving, although the finger is active), and (c) arm weight released behind the hand and finger (finger only moving). 24

Hand touch (when the hand alone moves) may consist of (a) combined exertion of hand and fingers (no movement of fingers relative to the hand), and (b) arm weight behind the hand and fingers.

24 Ibid., p. 11.
Arm touch is the touch employed when the arm itself is moved, fore-arm or whole arm. This is the Third Species of touch and the arm must be relaxed to cause the movement. The fingers and hand also act to convey this weight upon the keys. The arm must fall of its own weight rather than be exerted downwards.

The choice of these is determined by the speed of a particular passage. For slow passages, the arm touch is used; for quicker passages, the hand touch; and for the quickest passages, the finger touch is used.

Differences in tone quality chiefly depend on whether the act of touch is started by 'willing muscular-exertion' or by 'willing weight release.' 25

In using the Third Species of touch, that 'triple muscular combination' can be started either by

- willing the hand and finger exertion, but allowing the arm-release to occur in answer to the reaction felt at the wrist; or you can cause the combination to arise by (b) willing the arm-release itself, and allowing the finger and hand to act purely in response to the weight felt to be set free. 26

For brilliant tone, the combination must be started in the first way. The Third Species may then be said to be 'muscularly initiated' or to be a muscular touch. For a singing, carrying tone, the combination must be started in the second way. The touch is then 'weight-initiated' and is

25 Ibid., p. 12.
26 Ibid., p. 13.
a weight touch.

The First and Second Species must be musically started, since there is no weight-release in their case. Their tone-quality is of the more brilliant type.

For beauty of tone, the student must not think of action or exertion but of weight and use of the flat finger. If the weight touch is properly used, the keys feel as if they go down 'of themselves.' The player must not become conscious of the exertion of finger and hand because he "cannot feel weight-release, since it arises owing to his ceasing to act with arm-sustaining muscles, the more completely so, the greater the tone required." 27

He speaks of the thrusting and clinging methods of touch. In the former, the finger is well bent and thrusts against the key, producing a sharper or more brilliant kind of tone. If the key is reached from a flatter position of the finger, it gives rise to a singing quality of tone.

When the player allows a change in the state of the forearm to cause a 'twisting of it upon itself,' this act of touch is called 'rotation touch.' 28 This state of forearm can be altered without visible movements. The fingers can be helped in producing tone in this way. By inclining the weight towards one side or another, they will be helped towards a singing tone. It is also helpful in brilliant passages.

27 Ibid., p. 13.
28 Ibid., p. 15.
If the player wants to act strongly with the fingers at one side of the hand, the forearm must be released 'rotarily' in their direction. No rotary action of the arm should be allowed to keep energy away from the side of the hand where it is needed.29

H. S. Packer describes this kind of forearm rotation. He says that forearm rotation is apparent even in the simplest passages. One cannot play anything properly without adjustment of the muscles controlling forearm rotation. This extends to scale, broken chord and arpeggio passages.30

A greater muscular difficulty (according to Matthay) is in trying to use the fingers and hands alone without forcing the arm downward, an exertion which should be avoided.

Movements toward the keyboard, whether of the finger, hand or arm should be passive rather than active in nature. The finger, in moving toward a key, should not be exerted more than will bring its tip upon the key without really hitting the key surface. It should almost fall by its own weight. The hand, in hand-touch (so-called wrist-touch), should fall of its own weight, if previously raised from the key surface. The arm must be allowed to fall of its own weight upon the key. It should not be more relaxed than will permit it to fall on the keys comparatively gently, unless a

29 Ibid., p. 15.
harsh tone is desired. 31

This attitude towards passive playing is reflected by a number of writers. Bilby writes that most of the power in modern piano playing comes in consequence of a method whereby weight is manipulated. Being a less violent exertion, it becomes steadier in operation and gives a more pleasing and sustained tone than the percussive stroke. 32 In another article, he says that when the hand is allowed to fall on a key to produce tone, gravitation is at work and the weight is always the same. Muscular power pressure is always variable. 33

Fairchild describes the two ways of playing the piano, the old-fashioned way of training weak muscles and the modern way of muscular relaxation, especially of the weaker muscles and the substitution of weight controlled by larger and stronger muscles. We must get away from the old muscular idea. The solution lies almost entirely in the relaxed wrist. 34

C. G. Hamilton writes of the 'cardinal principles of weight-playing' which may be summarized:

31 Matthay, First Principles, p. 18.
34 L. Fairchild, "Playing the Piano With the Minimum of Effort," Etude, XLIX (March, 1931), 171.
(1) Weight playing is produced by the sudden relaxation of a part or the whole of the arm and hand.
(2) The effectiveness of weight playing will depend on the amount of weight that is released.
(3) The effectiveness of weight playing will depend on the direction in which the weight is released.
(4) Weight in playing may supplement or cooperate with active muscles and muscular effort.
(5) In the hand touch, the weight of the hand and arm are important factors.
(6) The arm-weight touch, with loose wrist is well adapted to the production of sustained tone, in alternation with the hand touch.
(7) In the full arm touch, the player is given the maximum control over the finer gradations of tone, by the proper regulation of the arm weight.
(8) Weight playing of any kind implies previous support of the playing members.
(9) The application of weight should cease or be minimized as soon as the desired tone is produced. 

Hamilton devotes a section of his Touch and Expression in Piano Playing to a discussion of the various kinds of touch, perhaps stressing action a little more than Matthay. 

Wesley Weyman writes that only recently have we realized that the arm is available not only in its active attitude of exerting muscular energy, but also in its passive attitude of relaxed weight. With this, we have a gigantic power at our command, capable of meeting any of the requirements of the modern instrument. There is no fatigue in relaxation. This weight force is the most easily controlled of all forces and may be released in every degree from pianissimo to forte.

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36 C. G. Hamilton, Touch and Expression In Piano Playing, pp. 8-17.
Matthay says there are slight changes in the height of the wrist, in passages where the thumb is required alternately on white and black keys. The wrist is slightly lowered for the black keys, but its normal position is on a level with hand and forearm.

Relaxation is ease, derived from the omission of all unnecessary muscular exertion (in conjunction with accuracy in its application to the key), forms the main secret of all easy and therefore accurate Playing. 38

He stresses the fact that the act of touch is a 'Duplex' process, consisting of acts of 'resting' and 'added impetus.' The act of resting may occur at the surface of the keys or at the bottom level of the keyboard. The slight difference is the difference between staccato and legato. The first form does not assist key-depression. The second does, being enough to over-balance the key into deflection. Both forms tell the player where the keys are and their resistance. The 'added impetus' is the energy movement momentarily applied to the key during descent, required in all touches to induce the requisite tone quality. It must cease to exist at the moment the sound begins. 39

His Muscular Relaxation Studies contain exercises for the study and teaching of the 'muscular expertnesses' required in piano technique.

Matthay's ideas do not represent the very latest ideas

38 Matthay, First Principles, p. 63.
39 Ibid., p. 114.
on piano technique. Lawrence Schauffler gives three types of movements which we make in playing the piano:

(1) The free rapid movement of playing the key or of making a quick jump to another position.
(2) Fixation or the holding firm of certain parts of the hand during the stroke.
(3) Relatively slow arm movements for adjusting the hand and fingers to their various playing positions preparatory for making free, rapid movement of the stroke itself. 40

This free, rapid movement, the fundamental of every piano stroke, is described by Stetson; At the beginning of the stroke, the flexor muscles of the hand or finger contract suddenly and by the time the finger has swung through a fourth of its path, the contraction ceases and the finger or hand swings freely to the end of the stroke, carried by its own momentum. So in normal touch there is relaxation in the stroke.

The newer conceptions of free, rapid movements replaces the older idea of playing with weight. Instead, we play with 'momentum' and during the movement there is relaxation. 41

Thomas Fielden

Thomas Fielden, Professor of Pianoforte at the Royal College of Music, London, has written an interesting book on piano technique. He finds that the solution to the problem of touch is perfect timing. Before proceeding with his definition of 'timing,' he analyzes the factors involved in

41 Ibid., p. 24.
playing, namely, the laws of leverage and physiological conditions.

The factors of leverage are power, weight and fulcrum. The fulcrum may be either above or below and may be anything solid. Piano-playing requires a downward leverage. The levers of the human body are hinged on one end, rather than in the middle. The end of the lever touching the weight is ineffective until the fulcrum comes into action. The power acts through the fulcrum, the energy taking effect throughout the lever to the weight to be moved. 42

Owing to the hammer acting on the escapement principle, the point where the pressure is exerted (where the hammer hits the string) is a passing one, the energy or leverage beyond that moment a diminishing one, the power being relaxed.

In piano playing, the levers (fingers, hands and arms) contain within themselves the sources of power, so that pressure from the outside is not needed.

'Anchorage' is a term used to indicate the attachment of origin of the muscles which produce a given movement and the fulcrum on which a part swings. 43

For example, in finger action, the knuckle-joint is the fulcrum and is maintained in a fixed position by the steadying action of the forearm muscles. The attachment of the finger

42 Thomas Fielden, Science of Pianoforte Technique, p. 47.
43 Ibid., p. 49.
muscles (in the hand and forearm) and the knuckle-joint together form the anchorage of the swinging finger. Their combination allows the pressure to take effect at the other end of the finger, thus securing a 'double anchorage' at the moment of pressure on the key. Energy is exerted throughout the length of the limb which is in action. The limb, starting from a single anchorage, ends with an anchorage on both ends. 44

Levinskaya has much the same ideas on this matter. She says that the main thing to remember about a machine is that to work with precision its levers must bend from a fixed fulcrum. In the human body this fulcrum must be selected and fixed. We must realize which lever we intend to use and then create a firm basis for its operation by fixing some part with muscular contraction to hold it in position. She concludes that no loose movement can give the same precision of sound and accuracy as the definite action of a lever from a stabilized fulcrum. 45

Fielden stresses the idea that the arm or whatever part of it is being used as a lever must be, at the moment of contact, in a condition of resistance, which means muscular contraction.

As a means of sensing this contraction, he suggests placing the hand lightly on the table; then, with the

44 Ibid., p. 49.
45 Maria Levinskaya, The Levinskaya System of Pianoforte Technique, p. 122.
exertion of pressure, the feeling of contraction will be met. Perfect timing of this sensing constitutes the real act of touch. 46

The more relaxed the arm or hand previous to this moment of 'sensing,' the keener will be the sense of timing and the greater the energy with which it can be employed. Resilience of the effort after this moment will render the arm free to operate again in the same way. The intention to relax the effort, once the point has been reached, will be an invaluable aid to the perfection of sensitiveness and energy at the exact moment of timing.

The exact moment where this muscular resistance is 'sensed' is the point at which any keyboard stroke must be aimed. The player must imagine that the keyboard opposes his downward thrust by an equal upward thrust. The meeting-place of the two forces is the point where the hammer hits the strings. This point is just before the bed of the keyboard is reached. The fact that this point is resilient, occurring as it does in the course of descent of the key, thus enabling a relaxed 'follow through' and also that the pressure on the double anchorage is muscular, hence elastic, has the effect of emphasizing the importance of perfect timing of the feeling of resistance of the hammer before the bed of the key is reached. 47

46 Fielden, Science, p. 50.
47 Ibid., p. 51.
This point may be designated as the point of contact. In the act of touch, he considers three things: (1) approach towards the point of contact, (2) the point of contact itself and (3) departure from that point. The factors of the approach towards the point of contact are: (a) use of arm weight (b) use of muscular effort and (c) balanced fixation.

The use of arm weight.—The arm may be held over the keyboard with elbow bent and be allowed to drop. The elbow may be imagined as a weight exerting a pull on the arm. The pattern of all movements towards the keyboard is this free, unaccelerated descent of the arm to the keyboard. Volume of tone will be determined by the speed of descent, the limit of which will be determined by the actual weight of the arm. The heavier the arm, the greater is the power of momentum. It is true that the acceleration of all falling bodies is the same, but the power delivered by a falling body varies with the weight. 48

The descent of the arm on to the keyboard is stopped by the hand coming into contact with the keyboard, not by any 'braking' action of the shoulder muscles. Were the hand a harsh unyielding substance, this contact would result in a harsh tone. The difficulty is met by 'catching' the weight with the resiliency of the flexing muscles. 49

It was said that the unimpeded descent was the pattern

48 Ibid., p. 52.
49 Ibid., p. 53.
of all forms of approach to the keyboard. The reasons are: (1) the more relaxed the muscles in the approach to the point of contact, the more sensitive they are to correct timing and (2) any spasmodic checking or snatching in any part of the arm sets up an interference with the original impulse and causes friction among the muscles. The gradual relaxation of the shoulder muscle does not constitute an impediment because the muscular action of the shoulder muscles is uniform and pre-determined.

The use of muscular effort.—Applying the statement to piano playing, that the power of momentum of a weight depends on its speed, the latter determined by the height from which it falls, we find that the arm cannot always be raised high enough above the keyboard to get the necessary momentum. Such a movement would be ungainly, and in fast passages would require violent physical exertion and striking the notes would be too uncertain. The difficulty may be met either by using a part of the arm, for example, the forearm, with the elbow a fixed anchorage, or by muscular action to move the weight of the whole arm, with hands closer to the keyboard. 50

In using a part of the arm, the part which controls it must be partly fixed, generally the part just above. If the forearm is used, the upper arm must be more or less rigid to act as an anchorage for the forearm to swing on. Undue movement of the upper arm forces the forearm to move with it, so

50 Ibid., p. 55.
nullifying the extra speed gained by using the forearm. This method has the advantage of greater speed in repetition. The disadvantage lies in the inhibition of the extra power obtained by the additional use of the upper arm at the point of contact. It is possible by practice, to secure relaxation of the fixation of the anchorage at the point of contact. When this power of swift relaxation has been attained, this method will be found to be of great advantage in chord and octave playing. 51

The second method, acceleration by muscular action, is illustrated in the following example. The hand is placed on the keys, ready to strike a chord, with fingers nervously prepared for the shape of the chord. The arm is held suspended from the shoulder, and at the required moment the shoulder is relaxed and the arm is pulled down by the pectoral and dorsal muscles. This requires the 'low-fall' action of the wrist.

For the 'high-fall', instead of the arm being pulled down by the muscles just mentioned, it is thrust forward by the combined action of the triceps muscles (extending the forearm) and the shoulder muscle (lifting the whole arm forward). These movements secure freedom of the elbow and more flexible cooperation of the whole arm.

In both cases, there is freedom from spasmodic movements. The initiation of movement must be a nervous impulse.

51 Ibid., p. 56.
and the full muscular strain should come at the point of contact.  

Levinskaya notes that power can be produced in the human body by using release and fall of weight, or by muscular tension. These may be used separately, for special touches, or in combination.

For producing a beautiful, rich tone quality, the arm weight behind the fingers is required. She states as her principle contention, that the whole arm should hang in its 'natural' state of dead weight, free from the shoulder blade, when the fingers are in contact with the piano.  

This corresponds to Fielden's insistence on the necessity for resilience of the muscular effort after the point of contact. It contrasts with Matthay's 'self-supported' arm, wherein the shoulder muscles take the weight of the arm, leaving only enough to keep the key depressed.

Levinskaya points out that this power of the naturally hanging arm weight should be fully used in tone production: in forte, by dropping the weight quicker with additional driving force and in piano, by using the weight with muscular energy retaining force.

A sense of equilibrium is of greatest importance, because it provides continuous rest between every two notes.

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52 Ibid., p. 57.
54 Ibid., p. 117.
The idea of the 'self-supported' arm intended as a corrective for stiffening, prevents all possibility of exploiting the natural arm weight.\textsuperscript{55}

The balanced fixation.--The problem of the control of the variety of the tone remains. This brings up the subject of the balance of the arm which cannot always be secured by mere relaxation of the suspending muscles, however gradual. For example, a very slow descent of the arm, carried out by gradual relaxation, may depress the key without resultant sound owing to the escapement of the hammer mechanism. Doubtless, mere gradual relaxation is not enough. There is a limit to the slowness of the speed of descent, which is governed by variation in heaviness of the key-action.\textsuperscript{56}

The solution lies in the study of the relations of power, fulcrum, and weight. Use of the elbow as a fulcrum, forearm as a weight, and the muscles of the upper-arm as the power exemplifies what should take place in positive action necessary to make the hammer hit the string. The descent of the weight is steadied by the brachialis, but the power is delivered by the triceps using the elbow as a fulcrum, pulling the weight of the forearm down with enough power to manipulate the hammer. Both brachialis and triceps act together, the former gradually relaxing.

\textsuperscript{55} \textit{Ibid.}, p. 118.
\textsuperscript{56} Fielden, \textit{Science}, p. 58.
and the latter gradually contracting, steadying the descent of the forearm, at the same time imparting a continuous momentum. 57

In any manipulation of weight when control is desired, there must be a fixation, balanced according to the volume and quality of tone needed, occurring at the fulcrum. 58

Levinskaya speaks of this as a 'double action,' in saying that all properly willed muscular action consists of a contraction of the flexors, and their simultaneous release with the contraction of the extensors, a slow, gradual process. The ligaments stretch between muscles and bones and adjust the speed of all movements. If, before the second return action, control is lost and the contraction of the flexors is stopped suddenly, a jerky, spasmodic movement will result. 59

Fielden concludes that while each part of the arm may act independently, using its own muscular inception, and its own fixation for approach and contact, yet, practically all movement is contained in and initiated by the shoulder muscle. The arm can be said to be carried in the shoulder, and its parts with their own self-contained mechanism, ready to operate in coordination when needed. The less stiffness there is in the arm, the greater the chance for suppleness

57 _Ibid._, p. 58.
and swiftness. Dunn explains the ways in which the parts of the arm may act independently, designating them as different kinds of touches. The various species of touch, producible by finger alone, by finger linked to hand, or hand to arm, so increasing the length and power of the human lever, all serve the same purpose of the easy attainment of key speed and time duration required for each note in any particular passage. None of them effect a modification of tone color.

In pure finger action, the forearm is supported at the elbow so that the hand rests lightly on the keys and no tension is felt at the wrist and knuckle joints. If the fingers are flexed, still keeping a loose knuckle and wrist, the player will be using a pure finger stroke. The downward thrust against the key is weak so as to depress the key slowly, with resultant weak tone. The finger acts as a lever. To be effective, it must have a fulcrum at the knuckle-joint to bear against. So, under the conditions described, they do not yield a thoroughly efficient fulcrum and pure finger action is weak and seldom used. Greater resistance may be imparted to the fulcrum by muscular tension, tightening the fingers at the knuckle-joint by exerting both flexor and extensor muscles. This is more correctly called finger-and-touch. It is used in performing rapid, forte

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60 Fielden, Science, p. 59.
Increasing the tension of the finger muscles yields a gain in power, but causes a loss in fulness and warmth. This is due to the fact that each finger rises swiftly from its key, causing the damper to take effect sooner and silence the tone quicker than when the finger is held more loosely. The effect is that of a legato that just falls short of staccato, commonly called a hard or brilliant touch.

The hand may be actively raised and lowered with the fingers and is usually spoken of as wrist action. If, instead of balancing the arm, it is relaxed a little, and some of its weight bears on the keys; the fingers, hand and arm are knit more closely. The knuckles are held steady, so as to allow the fingers to execute their strokes with enough power to produce a uniform series of sounds. The tonal result is one of warmth, fulness and greater legato than was attained by unaided muscular tension of the hand.

If a slight downward pressure of the arm is used, the connection of sound is so close that the tones slightly overlap. This is due to the looseness of the fingers and the slight downward pressure of the arm which causes the finger to move more slowly with the key. 63

In the forearm touch, the forearm may be connected with the hand and finger by means of the tension of the

62 Ibid., p. 21.
63 Ibid., p. 23.
flexor and extensor muscles of the hand. The fulcrum is shifted back to the elbow and the finger, hand and forearm move in one piece. Forearm touch has a wide dynamic range, and is efficient and reliable at any speed from very slow to moderately fast.

Finally, the whole arm touch may be used by linking the forearm to the upper arm by slightly tightening the elbow. This gives a huge range of tone, but can be employed only in slow tempos. 64

On the point made earlier, that these various touches are for the purpose of the easy attainment of key speed and time duration rather than for modifying tone color, neither Fielden nor Levinskaya would agree. Yet, on the whole, their ideas are so similar as to cause the investigator to group them together. In her introduction, Levinskaya says:

> Whichever of the combined actions of the arm are required in piano playing as a whole, it is necessary that every component part should be developed and used either separately or in coordination according to the tone color required. 65

At the point of contact, the muscles act as supports of the weight of the arm, in addition to being 'spear-heads' of imparted muscular energy. Therefore they must be in a state of contraction.

A right understanding and proper management of this

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64 Ibid., p. 28.
65 Levinskaya, Levinskaya System, p. 9.
contraction is the cause of good tone production, as well as of securing the right technical conditions. It should finally, as the result of practice, be reduced to the shortest possible duration commensurate with full consciousness and control.

In striking the keyboard, the flexing muscles are supporting the blow and they act as a buffer, preventing shock to the arm. They also contribute this same action of resilience to avoid a thumping effect, thus securing greater beauty of tone.

When the arm strikes the keyboard, the contracting muscles should not be at full rigidity at the crucial point. They should be in a state of resilience, so as to have the effect of speed and flexibility. The 'sensing' of this act of resiliency is the beginning of the act of relaxation, and continues if the chord struck is final, or if the chords are in succession. In swift chord-playing the resiliency is used as a connecting link with the physical effort of playing succeeding chords. The full relaxation corresponds with the 'follow through' in tennis.

An advanced form of touch control is that in which the arm, instead of being suddenly relaxed, is allowed to descend slowly under full conscious control of the shoulder, until the point of contact is reached. The whole arm is the instrument

66 Fielden, Science, p. 60.
67 Ibid., p. 64.
of operation, like a rigid mass, rather than a flexible rope. This form of touch is used where strong control is necessary, for example, in delicate pianissimo. 68

The act of touch has three sections which may be demonstrated (1) in the approach section, control should be as far back in the forearm, upper-arm or shoulder as possible, the action being a swing of the operating member, whether finger, hand or forearm, from its own anchorage. This swing is controlled by the big muscles of the arm, the smaller one (which control the operating members) doing their own work within the impetus of the larger ones, all coinciding at the point of contact. Relaxed dropping of the hand or arm is negative, producing poor tone with no control. At the other extreme, stiffness in the operation is equally bad, leading to hard tone and use of unnecessary muscles. 69

William Mason shares this viewpoint in saying:

Force without elasticity produces a hard tone. Too much elasticity produces a tone without character. The combination of these two principles in right proportion accomplishes the desired results.

The muscular construction of the whole arm, the combination of flexor and extensor muscles is involved in this combination of elasticity with force. . . the triceps affords practically the key to the whole situation. It has an important influence in the development of a generally relaxed muscular condition and of a musical, resonant, singing and carrying tone. Daily practice, therefore must be devoted not alone to

68 Dunn, Basis of Pianoforte Playing, p. 34.
69 Fielden, Science, p. 65.
acquiring strength, but also largely to the use of that kind of touch which will develop the various muscles. All parts of the muscular system must be in working condition to produce the desired tone. 70

He distinguishes various touches by the predominant activity of one or another of the parts much as Dunn did. Finger touch, down-and-up-arm touch and hand touch are described. 71

For the second section of the act of touch, right conditions in the approach are sure to result in the accurate attainment of resiliency at the point of contact. Right conditions there must lead to the right conditions at the final section. This is the beginning and carrying out of real relaxation at the right moment in the right way. 72

Varieties of tone depend on variations of speed in the descent of the key. They are controlled by muscular power, the inception of speed being made by a nervous impulse given to the muscular power. The quality of tone in every variation depends on perfect timing at the point of contact. The muscular organism is never fully contracted until this point is reached, all being in a state of nervous preparation for it. Stiffness in playing comes from too much contraction beforehand; flabbiness, from too much relaxation before this moment. True suppleness lies in securing the full contraction

71 Ibid, p. 158.
72 Fielden, Science, p. 66.
at the right moment. At the point of contact the muscles are not relaxed but contracted, resilient, and preparatory for relaxation, if necessary. More frequently, this resilience is used to carry the arm to its next movement. 73

Later on, he re-emphasizes the importance of this timing, by saying that the key-bed should be aimed at as the place where muscular effort should cease. To say that the place where the hammer hits the strings (which is just before the completion of key-descent) is where muscular effort should cease, is analogous to saying that in tennis, the racquet should be propelled only as far as the ball instead of beyond the point of its resistance. 74

Levinskaya is of the opinion that the teaching on non-key bedding as that by Matthay is subversive to good technique. Her pupils are asked to imagine that they are exerting pressure past the key-bed. The playing of those who do not do so is colorless, slovenly and non-legato. She points out that there must be no release, whether in alteration of weight or in pressure, until the next note is played. This is in direct opposition to non-bedding of the keys (where the weight is lifted). In the former, the weight of the arm rests on one key button until it has been actually transferred to the next, the finger having served

73 Ibid., p. 66.
74 Ibid., p. 148.
as a pivot. 75

She does not allow the conclusiveness of the scientific evidence that the tone cannot be influenced after the hammer reaches the string. She says that the residue of sound (that which is heard after the sound begins) can be interrupted in its normal course.

By observing the piano mechanism, one can see (according to Levinskaya) the alteration from pressure at the bottom of the key-bed to light rest that the relative position of the hammer, string and damper is altered. The hammer is brought nearer the string and the damper recedes from the string. Corresponding to the mechanical change of position is a perceptible tonal change, a loss in intensity and richness. 76

Richness of sound is influenced by intention of the player beforehand. When the player feels he must stop at the moment of sound production, a reserve is put on action, since it must be stopped before the resistance of the key-bed is met. An uncertainty created by a feeling of insecurity will always produce a sound lacking in depth. The mental preparation to aim past the key-bed gives the maximum of intensity at the vital moment of sound production.

When the weight is lifted and key-resistance is gauged, a certain instability of hammer and damper is created and

75 Levinskaya, Levinskaya System, p. 178.
76 Ibid., p. 185.
has an instant repercussion on the subsiding sound, interfering with its purity and producing a tremolando effect.

Her final word is that when weight is removed from the key, with only enough left to hold the key down, it can only be lifted by the arm-supporting muscles. This is a waste of energy and is responsible for the sense of insecurity which makes for nervousness. 77

Fielden offers a combination of the high and low wrist as a solution of the problem of wrist position in playing. At the point of contact, the wrist has been shown to be horizontal. In the 'follow-through' it has been assumed that in relaxing, the wrist dropped below the horizontal. The same effect of 'follow-through' can be had by making the wrist rise as well as drop. This can be employed in advanced technique, not only to suppleness, but also to economy of exertion. The dropping movement he calls 'pulling' and the thrusting upward 'pushing.'

These are two ways of regulating the direction of arm weight, already explained as the 'high-fall' and 'low-fall' action of the wrist. There is a slight difference at the point of contact. These two main ways may be used alternately, the end of one movement acting as the starting place of the other. The movement from one to another may be spread over a group of notes, in places where the contour of the

77 Ibid., p. 192.
keyboard demands a readjustment of the wrist.\textsuperscript{78}

If the wrist were always allowed to drop down, it is clear that to get a new arm stroke, the whole arm would have to be lifted up again. Use of both 'pulling' and 'pushing' enables a start to be made from each extreme. This secures economy of exertion and movement.\textsuperscript{79}

Chase has a different opinion on wrist position, although on most points she agrees with Fielden. She favors a low position of the wrist, always. The flexor muscles, used in the finger stroke, pass through the forearm to the elbow, where they are fastened to the bones near the elbow. In raising the hands from the wrist they are stretched to their limit and so are able to obtain their greatest possible contraction.\textsuperscript{80}

Using the two movements in conjunction, by exercising control of timing and cultivating sensitiveness of feeling of points of contact, it is possible to have a series of points of contact contained in one comprehensive downward or upward movement of the wrist, the wrist being the regulator, controlled by the muscles of the arm which perform the 'pushing' or 'pulling.' The wrist-joint acts as a guide through which controlled movements of the arms and fingers can operate, 'the clearing-house' of all intricate and combined

\textsuperscript{78} Fielden, \textit{Science}, p. 72.

\textsuperscript{79} \textit{Ibid.}, p. 93.


muscular movements of arms and hands. Suppleness is inevitable, since a stiff wrist, or even a wrist which is held straight without conscious stiffness, would be an impediment to free arm movement.

These are the points he stresses. (1) The wrist movement supplements and facilitates the movements of the muscles of the shoulder and arm. It is the only way the player can use the whole arm freely. The upper-arm muscles provide the machinery, and the wrist is the channel through which the machinery operates. (2) The wrist is used as a means of breaking the rigidity of the 'double-anchorage.' When the wrist is relaxed the arm can begin to prepare itself for the next stroke, and the hand can be free to swing on its own single anchorage.

The 'pulling-down' action is especially used in chord playing to provide resilience in the arm, which is an important factor in producing good tone.

The following natural experiment may be used as an argument in favor of the low wrist in finger passages. (Chase gives the same experiment in her book).

If the hand is held in line with the forearm, fingers extended and then the fist is clenched, the back of the hand drops at an angle to the keyboard. This shows that the extensors of the wrist tend to take the strain from the flexing

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61 Fielden, Science, p. 73.
action of the fingers. If, when the hand is closed, an effort is made to prevent this, there will be a feeling of extra strain on the flexing fingers. 82

From this he infers that finger action can be facilitated by keeping the wrist low to allow free play to this tendency. It is certainly useful in playing brilliant finger passages which require vigorous treatment.

According to Fielden, there has been much misunderstanding on the subject of relaxation. As presently taught and understood there is no such thing as relaxation. It is not a negative action, but a definite, positive muscular function. It has been useful in turning the minds of pianists away from the stiffness and rigidity of the old schools. This view is shared by a number of other writers. 83 Dunn thinks that too much is heard about relaxation and too little about tension. He points out that many expositions of piano technique have been worded so as to make the student believe that piano playing calls for little exertion and that a comfortable, relaxed state of the muscles and joints is conducive to technical efficiency. 84

Beryle Rubinstein says that the term relaxation, applied to piano playing, is a misnomer. The function of the muscles is to produce motion. Scientifically, relaxed

82 Ibid., p. 74.
83 Ibid., p. 75.
84 Dunn, The Basis of Pianoforte Playing, p. 17.
muscles are incapable of motion. Muscles are either relaxed or contracted; by contracting they cause the bones to move. We want neither complete relaxation nor extreme contraction.\textsuperscript{85}

Levinskaya agrees that the idea of relaxation has been greatly overdone. Relaxation cannot be preached with impunity, while paying too little attention to the definite exercise of muscles and control of movements. For every form of physical action, definite energy must be used and piano-playing, being definite work, provides no exception to the rule.\textsuperscript{86}

The adherents of relaxation, as has been said, advocate the free descent of the arm to the keyboard. If the arm were to be allowed to descend to any part of the keyboard, irrespective of definite notes or tone quality, they would be right; but the piano is not meant to be played in that way. Some sort of control must be in operation to ensure the right notes being played. For this the arm must be kept moving in a direct line towards an objective. The hand must be held in a controlled position to avoid lateral or longitudinal deviations from the line of objective. This steadiness is secured by the shoulder muscles and then by the various muscles in the arm down to the fingers themselves. Whether it is muscular contraction exercised to the extreme or the minimum of muscular control, one of these factors

\textsuperscript{86} Levinskaya, \textit{Levinskaya System}, p. 88.
must be in operation; each connotes some form of fixation, not relaxation.

Leimer and Gieseking point out that the free fall in piano playing only resembles the free fall of a body in the physical sense. It can be extended to the whole arm, lower arm, wrist or fingers; but the free fall, with no additional feature is only a theoretical mode of touch which has no practical application.

Fielden states that if the arm in playing were released like a falling stone, all tone would be harsh and uniform in quality. At the moment of striking the keyboard, the arm must be in operation to meet the force of inertia and to regulate resilience of the muscles, to get the desired tone quality. It is better to keep control throughout the descent, by adapting a state of nervous preparation, rather than to relax control and take it up again before the imparted momentum is completed.

Once the player has determined the mode of striking the keyboard in a particular case, muscular and nervous control must be confined to that and practice concentrated on the avoidance and elimination of extraneous and involuntary nervous movements. This is inhibition and has often been called relaxation.

87 Fielden, Science, p. 76.
88 Karl Leimer and Walter Gieseking, Rhythmics, Dynamics, Pedal, p. 31.
89 Fielden, Science, p. 77.
True resilience lies, then, in eliminating or inhibiting all movements except those deemed necessary to the performance of the action of allowing free swing to the movement once started, but keeping nervous control of it, concentrating the mind on the point of contact and diminishing the effort once the point has been reached. Diminishing does not mean relaxing; absolute relaxation cannot occur in continuous playing. Playing the piano is active rather than passive. Relaxation after every effort means that each effort is isolated. All must be kept fluid and changing. The student must learn to discriminate between relaxation and contraction. He must realize their equal importance.

Levinne is of the opinion that the secret of the use and application of relaxation is to use it in the right places. Firmness and relaxation are needed at the same time, but not in the same place.  

Levinskaya warns against confusing expressions such as 'firmness,' 'contraction,' 'tension' or 'fixation' with stiffness. As long as the possibility of instantaneous release is kept, even simultaneous tension of several muscles will not degenerate into stiffness.

The need for conscious contraction is the greatest with those muscles which take the recoil from the point of contact,

90 Ibid., p. 85.
91 H. Brower, Modern Masters of the Keyboard, p. 76.
92 Levinskaya, Levinskaya System, p. 94.
chiefly the muscles of the arm itself, especially those from the forearm downward. Shoulder muscles are used mainly in carrying the weight of the arm, partly by propulsion or passive relaxation. At the point of contact the greater part of the resistance is taken by the forearm and finger.93

The weight and power of the whole arm is effective in big chord-playing and in legato work. In swifter actions, such as wrist-staccato, forearm staccato and firm attacks, the forearm not only takes up the recoil, but also approaches its objective in a condition of fixation. When a sharp, firm attack is needed, a greater effect can be secured if the lever is a rigid entity (hand and forearm braced together).

Fielden ascribes the lack of accurate physiological observation and knowledge and absence of the application of the laws of mechanics as reasons for the wide-spread controversy which has raged over the use of rotating movements of the hands and arms.

The rotary movements of the arm are controlled by combinations of muscles so as to make it difficult to divide them into separate compartments. This is unimportant however, since most of them deal with rotation of the wrist and elbow joints, both of which are really controlled by the shoulder.94

93 Fielden, Science, p. 85.
94 Ibid., p. 89.
The two main movements are (1) rotation of the forearm on its own axis, actuated by the supinating and pronating muscles in the forearm, and (2) the rotation of the elbow joint (and sometimes wrist-joint) actuated by the shoulder muscles. Lack of understanding and confusion between the two causes much of the controversy.  

Levinskaya applies the term 'rotation' to the action of the rotary muscles of the forearm and the term 'curvilinear' to the circular movements described by the joints.

Forearm rotation can only be used for broken octaves and tremolos and trills fingered one and three, two and four, and three and five. The use of forearm rotation to play arpeggios or extended passages, such as dominant sevenths, is a mistake. The reason advanced is that it relieves the strain of undue stretching of the finger. This reason is insufficient, especially since the strain can more easily be removed by a pure lateral and horizontal movement of the arm. From a mechanical standpoint, a lever requires a fulcrum, which to be fully efficient should be in a direct line with the lever. This fulcrum is supplied by the flexing muscles of the forearm acting with direct, not rotatory movement at the point of contact, against the fulcrum, either at knuckle or wrist. If the rotatory forearm

95 Ibid., p. 89.
96 Levinskaya, Levinskaya System, p. 83.
movement is used, the fulcrum is not in a direct line, as the leverage starts from an oblique position. The fingers may act against the wrist as a fulcrum, but only by a stiff and awkward lateral action. Weakness of the fourth and fifth fingers is accentuated.

Many claim that the fingers are enabled by rotatory movement to be transmitters of weight of the arm, the weight being applied equally to all the fingers. In practice, the different lengths of the fingers, and the different angles at which the fingers strike the key, contradict the theory. It is poor technique to use the fingers as organs, just as it is poor walking to use the legs as such, knees and ankles inactive.

The real rotatory movement is that of the elbow, which forms so great an asset in technique and solves the strain of stretching the fingers. The solution is to move the arm to the most advantageous position, the one least exacting of strain to the fingers. A straight lever is better than an oblique one and the finger can function with more freedom and power if the arm is in a direct line with it.

The best way of shifting the arm and its weight is to shift the whole arm laterally, using the wrist in an undulating way and in return movements, avoiding irregularity by rotating the elbow. For example, after shifting the

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97 Fielden, Science, p. 91.
98 Ibid., p. 93.
forearm laterally in a given direction, we make the return shift in the same horizontal line, we get a movement marking a 'check' at each end. This difficulty can be overcome by rotatory movement of the elbow made possible by the undulating wrist. The elbow moves in the path of an ellipse.

So, strain is relieved, and the application of the weight in any extended passage is obtained by lateral shifting of the arm, operated by the rotatory movement of the elbow in a horizontal plane. 99

It has been shown that the undulatory movement of the wrist is part of the movement of the whole arm. Its upward and downward fall was demonstrated as the result of the 'pushing' and 'pulling' of the arm. Wrist and elbow moving together have a 'gimbal-like' effect, both acting as universal joints which enable the whole arm to move freely in a given direction. Rotatory action of the wrist is so often mistaken for the rotatory movement of the forearm, whereas it is really both the cause and effect of the rotatory movement of the elbow, which in turn is operated by the upper arm and shoulder. 100

The expressions 'finger independence,' 'playing from fingers alone,' 'immovable arm' and so on have been greatly ridiculed by many modern teachers.

Their principal argument is that complete independence

99 Ibid., p. 94.
100 Ibid.
of fingers is physiologically impossible, because the muscles of the fingers are in the hand and forearm. Although this is true, there is no need for deducting that independent action of the fingers from the knuckles and inhibition of conscious arm movements are undesirable. 101

The proper use of the fingers depends on the realization of their dependence on the rest of the arm. In the development of finger technique, the same attention must be paid to muscular conditions as to other parts of the arm. The general laws of contraction and relaxation must be observed. 102

When the fingers are flexed, the lumbricales come into play, first, by flexing the first phalanges; in proceeding, the second and third phalanges are acted upon by the forearm flexors and the flexion of the first is continued. In the return movement, the forearm muscles act first, extending the first phalanges, and the interossei follow with extension of the second and third.

Thus, flexion and extension of the fingers start from different points, the former from the hand, the latter from the forearm. Since the fingers articulate at the knuckle-joint, flexing and extending from different points obviate friction and are important guides to finger action. This explains why the hand stiffens if the fingers are held

101 Levinskaya, Levinskaya System, p. 156.
102 Fielden, Science, p. 96.
straight, since the muscles controlling the straightening action are in the hand. It also shows why a bent position of the fingers is best.\textsuperscript{103}

In the act of touch, the real muscular strain on the flexors comes when the point of contact is reached, and all flexing muscles cooperate in acting as a brace against the downward pressure of arm weight. The descent of the finger is begun by the lumbricales and the main function of the forearm flexors is to take the resistance at the point of contact. This does away with strain and friction.

Finger action should be simple in its movement. The finger should articulate from the knuckle-joint, being raised in its entirety, keeping its natural curve.\textsuperscript{104}

The older idea of raising the finger and 'hooking' it is physiologically wrong. This hooking is done by the forearm flexors which cause the downward action of the finger. As the finger is lifted and extended, these flexors then come into opposition with the extensors. The flexing of the second and third phalanges comprises the shape of the finger for the downward stroke. They will have to be extended before they can come into their proper action, which is taking the strain of resistance at the point of contact. The interrossei are the extensors for the process of unflexing, but if they are already engaged in assisting the

\textsuperscript{103} Ibid., p. 97.
\textsuperscript{104} Ibid., p. 98.
flexing of the first phalanges at the beginning of the downward stroke, they are being employed in two functions at once, which is sure to result in strain. 105

It must be realized that any blow of the finger must have its repercussion on the arm. The weight of the arm is behind the fingers. Mere contraction of the finger is not enough to depress the key with enough force to get good tone. The secret of producing good tone is dependent on accurate timing of arm weight into the action. Tone is produced by the meeting of weight and inertia, and the amount of weight (and its speed) determines the quantity of tone. The recoil of this weight falls on the muscles in the hand as well as in the arm. There is, therefore, a moment of rigidity in the hands. This explodes the theory of keeping the fingers relaxed throughout. Meeting resistance with relaxed fingers produces flabby tone.

Independence of fingers depends more on isolation of the nerves attached to the large muscles than isolation of muscular feeling. In successive finger action, the urgent question is raising the fingers. Obviously a finger must be raised before it can be lowered. The difficulty is to perform this act without stiffening the hand. 106

Several fingers may be raised at once; it would be subversive to suppleness to try to prevent sympathetic movements of the fingers (caused by pull of cross tendons).

105 Ibid., p. 98.
106 Ibid., p. 100.
Conditions at the point of contact, namely, the downward stroke of the fingers, accompanied by the thrust of sufficient arm weight and muscular energy, to take the resistance, are necessary before any tone is produced. For example, if the third finger is ready to do this and the fourth is not, the latter will fall on the key without sufficient energy to strike it. This separation of muscular energy will require practice, but it will be right practice. Fingers may be left to move by associative tendon movement.

Each striking finger should be released (inhibited) as soon as its work is completed. Forcing it upward in trigger fashion is useless and causes stiffness.\(^{107}\)

The question of stretch presents a problem. Much of the difficulty can be avoided by correct movements of the arm. It has been shown that the elbow was shifted to get the weight of the arm behind each finger as it was used. It is important to avoid as much as possible playing with fingers at full lateral stretch. It is better to swing the hand laterally on the finger already holding the note until the next finger to be used is as near as possible in a position to play with the arm directly behind it. In a stretch from the third to the fourth finger, the abducting movements are made first, the flexing being deferred until the actual moment of descent. The finger should describe a curve. We

\(^{107}\) Ibid., p. 100.
thus have the true rotatory movements which connote real suppleness, in which all curves are combined, fingers moving in a curve, wrist rotating in a vertical plane, the elbow in a horizontal one, the whole arm thus coming into action. This brings us to the point to which all investigations of the theory of technique converge, namely, the free use of the whole arm with all its parts acting in coordination.  

Scientific Investigations

Carl Seashore states that piano touch is a 'touchy' subject in musical circles. People are deeply impressed with the enormous possibilities for characterizing musical artistry and expression of musical feeling in terms of this art. The current vocabulary is extensive and loose.  

For example, Brower says "The rotary or curving motion, in playing chords, has great influence on touch and tone. To come down flatly on the keys, and lift the hand straight up again, gives a thin dry tone."  

Sumner writes that the pianist who gets the habit of hitting keys acquires a 'hard' touch which is the result of tension and rigidity. The remedy suggested is relaxation so as "to allow a free flow of nervous current from the spinal

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108 Ibid., p. 102.  
110 H. Brower, Art of the Pianist, p. 104.
column to the fingers, unchecked by tension and loss of energy at the joints between." 111

Samaroff is convinced that if a student has "that acute sense of musical hearing which will enable him to distinguish the finer gradations of tone, he will instinctively touch the key in such a way as to produce the desired tone quality.\textsuperscript{112}

Recent scientific approaches have done much to clear up the situation. Ortmann has found that the pianist may control only two of the four factors in music: intensity and time. Pitch and timbre are determined by the instrument.

Intensity can be controlled only in terms of the velocity of the hammer at the moment it leaves the escapement mechanism and by the action of the pedals.

The only two significant strokes of the key are the percussive and non-percussive. The difference is that the former contributes more noise to the tone and the latter gives the performer better control of intensity.\textsuperscript{113}

This is the only way the player can modify the quality of the tone by the manner of depressing the key or by manipulations after the key has struck its bed. The time factors which influence quality can be controlled only by the action of the dampers, either through the keys or the pedals. Many musicians have refused to recognize the significance of these facts. Yet all scientific investigators working with

\textsuperscript{112} H. Brower, \textit{Modern Masters of the Keyboard}, p. 148.
this problem have reached the same conclusions.

Intensity (the physical fact) and loudness (the mental fact) is a function of the velocity of the hammer at the moment it impinges on the string. After that, the hammer is modifiable only by action of the dampers. The piano action for any key consists of a compound lever system, the purpose of which is to facilitate control of the force of the blow on the strings. The velocity of the hammer depends on the velocity of the escapement lever at the moment the hammer is released and the force of the blow depends on the velocity of the hammer at the moment of impact.\textsuperscript{114}

From this, it can be said that it makes no difference what kind of movement (accelerating, retarding or irregular) is used in striking the key, because the only significant thing the player controls in the stroke is the velocity of the key at the exact moment it throws off the hammer.

This fact has profound significance for the theory of playing, hearing and enjoyment of music. It takes away much of the glamour and grace of mannerisms in the mode of depressing the key. Touch is reduced to the fundamental factor of intensity.\textsuperscript{115}

This does not detract from the resources of the instrument or the opportunities for individual expression or lessen the many indirect effects of intensity. Rather, it

\textsuperscript{114} \textit{Ibid., p. 227.}
\textsuperscript{115} \textit{Ibid.}
clarifies and reveals the extraordinary refinement that is necessary in artistic touch. The elaborate care taken in the development of form, weight, pressure and rate of arm, wrist and finger movements is justified so far as it results in a refined control of the intensity of the tone, but not for changes in quality of tone.

The hammer is released slightly before the key reaches its bed and it contacts the string only once, being an instantaneous impact followed by an immediate rebound. Any movement of the key cannot influence the hammer after it has been released. The only way in which the key can affect the string further is by a new stroke of the hammer.

The player is able to produce a great variety of tone qualities indirectly, by his control of the intensity of the tone. Having imparted a given velocity to the hammer, the pianist is dependent on the instrument for the determination of qualitative changes taking place in the tone, except for the manipulations of the dampers. The piano is so constructed that it can produce a vast number of tone qualities, each a function of the intensity of the tone. In this respect, each instrument has its own relatively fixed characteristics. Generally, the louder the tone, the

\[116\]
Ibid., p. 228.
richer the quality. A piano may be calibrated by setting up a scale of intensities which yield approximately the corresponding scale of tone qualities. The situation is not so simple, however, because each instrument has its own resonance characteristics and responds differently to different chords. Every pianist must set up a scale of equivalents for intensity and tone quality by an empirical method.\(^{117}\)

The pianist can modify quality by controlling the time factors in three ways. The tempo and temporal aspects of rhythmic features are determined largely by (1) the duration between the moment of incidence of successive tones; (2) the duration of vibration determined by the moment of application of the dampers through key release; and (3) the vibration continued by holding notes with the sostenuto pedal.

Piano tone fades out rapidly soon after the hammer stroke, but the ear tends to ignore this. Instead of hearing tones as having sudden changes in intensity and timbre, it tends to hear the initial characteristic of the tone until the next key is struck.

The greatest change the artist can give to tone quality is by pedal action. Using the sostenuto pedal, tones may be carried through a series of chords, thus greatly enriching the harmony through gradual overlapping

\(^{117}\) Ibid., p. 229.
and fading of antecedent tones. 118

The pianist has many devices for changing the quality of tone by freedom in the use of intensity or time. Tone coloring is a very conspicuous feature in artistic playing, but it usually means that the pianist strikes the notes in the chord with different forces and can produce varying resonance effects from the same chord. There are considerable resources in the variety of uses of the pedals, as to time and intensity. The pianist has varied devices for getting sympathetic vibrations and modulate overtones. There are also a vast number of illusions which have qualitative significance.

So, in general, the only way in which the pianist can produce qualitative changes is through dynamic and temporal changes and then only within the limits set by the instrument. 119

Ortmann says that one reads about the need of a relaxed arm in playing, the reason being that relaxed muscles produce a different quality of tone. By a graph, he shows the paths traversed by the hammer when moved by a relaxed arm and a rigid arm respectively. The only difference is one of loudness, not quality. Relaxation moderates the intensity of rigidity and permits a better control of tone intensity (as Seashore pointed out) by reducing or eliminating

118 Ibid., p. 231.
119 Ibid.
the noises resultant from a percussive attack on the key.
If this percussiveness could be done away with, a perfectly
rigid arm could produce the same tone as that produced by
a relaxed arm. Really, in the coordinated movements of
piano technique, relaxation in any great degree is seldom
present at the moment of tone production. Muscular fixa-
tion is a mechanical necessity. An apparatus sufficiently
sensitive to record the muscular contraction will show it.
The value of relaxation is in its use before and immediately
after tone-production.120

The doctrine of weight transfer came soon after relax-
ation in the history of piano teaching. It came as a re-
action from the early schools of finger action. The weight
schools have gone to another extreme in speaking of weight
transfer when the mechanics of the movement make this an
impossibility. In a technical figure involving rapid finger
repetition, the transfer of arm weight is impossible. This
can be shown on any suitably arranged dynamograph. In many
figures, the use of arm weight seriously interferes with
speed and brilliance of technique.

He has recorded the movements of the piano key, hammer
and string for most of the terms usually employed to char-
acterize musical tone. Without exception, the results show
that the so-called qualities are quantitative differences

120 O. Ortmann, "Piano Technique In the Light of
Experiment," American Mercury, XII (November, 1927), 444.
plus the mixture of noise elements. These intensity differences are transferred to other sensory fields and linked with the fundamental 'pleasure-pain' distribution common to all senses, giving rise to the qualities designated. The pleasurable qualities (full, round, warm) are tones of moderate intensity; those mildly unpleasant (thin, surffacy, dry) are of weak intensity; those very unpleasant (brittle, brassy, strident) are tones of great intensity. This transfer into visual, kinesthetic and gustatory fields is an interesting psychological phenomenon.\footnote{121}

In every case of a difference in style of playing, differences in tonal intensity and rate of tonal succession are found. When those elements are changed, the particular style is gone.

An absurd assumption is that the string is gradually set into motion, non-percussively. A glance inside the piano will dispel that illusion.\footnote{122}

The conclusions of Seashore and Ortmann would seem to settle the matter of piano touch. But there are other investigators who feel that there is more to be said than that touch is nothing more than intensity and temporal change.

Donald N. Ferguson concedes the fact that the pianist has at his disposal only those variations of tone which

\footnote{121}{Ibid., p. 445.}
\footnote{122}{Ibid., p. 446.}
are due to different speeds of the hammer and those due to sympathetic vibration (from the action of the damper pedal).

This is true as far as the physical argument goes, for detached tones. But the tones produced by the artist are not heard in this way, but in relations of extraordinary complexity, as music.

Color is far less an acoustically analysable affair of overtones with their fundamental vibrations than an artistically perfect balance of intensity between 'that which is more and that which is less significant musically.' Unless the choice of color is based on a sure discrimination of the expressive sense of the tones, the result is an artistic blunder. So, beauty of tone depends less upon the 'intrinsic acoustical quality' than upon its fitness for the realization of the character of the passage to be played.

Harold Bauer is one of the few pianists who has this view of the matter. He says that since the pianist cannot color single tones, he must do it with a succession of tones through their relation to one another.

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124 Ibid., p. 392.
125 Brower, Piano Mastery, p. 98.
Harriet Cohen says:

It is the relation of all the notes to one another that gives the illusion of tone. This is a very different matter from striking one note, then asking the hearer to guess whether the resulting sound came from a stick, a hammer or the finger of Paderewski. 126

Ferguson agrees with Ortmann that a great deal of harm is done by piano teaching which begins and ends with the idea that an unrelaxed stroke is wrong. The truth is that the relaxed condition is so much more conducive to precise control of the force with which a key is struck. Instruction based on the idea of the relaxed attack is vicious because it fixes the player's attention on the process of execution rather than on the idea to be realized through that process. 127

Flexibility and accuracy in the control of complex dynamic intensities together with the control of pure color-values (accomplished by the pedals in conjunction with the sensitive fingers) — all these finely adjusted muscular operations must become so united with the concepts of the value, succession and combination of sound that they will arise spontaneously in response to the general musical desire. 128

The question of the order in which elements of the habit are developed is of great importance. The player may consider the musical problem as primarily physical: to conceive his effects as results of conscious command of

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127 Ferguson, *op. cit.*, 396.
the condition and operation of the playing mechanism. This is exactly what Levinskaya does. She says, "Whatever change is produced in the muscular state of our arm it must inevitably react with mathematical exactitude on the quality of touch on the piano." 129 Fielden expresses this when he says that to criticize his tone, the student should be guided by his physical sensibilities as much as by his ear. A hard tone produces a hard repercussion on the fingers and arms. Such a result carries a feeling of discomfort and means wrong conditions. 130 Tone is thought of in terms of finger movements. Or, if he considers the physical problem as secondary, he may think of tone in terms of tone, to which finger movements are but the necessary correlative.

The significance of this distinction is great, because it determines the character of the player's thought at the crucial moment, which is the instant before the tone is struck.

If, during the learning of a passage, the attention is given to the condition of the playing mechanism long before the question of musical value arises, the primary character of the habit formed will be that of mechanical consideration. Tone-values will be largely conceived in terms of finger-movement and weight distribution. The consideration of the tone, as an element of the musical idea, will not be mentally heard until after the key is struck. On the other hand, if

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130 Fielden, Science, p. 67.
attention is given as soon as possible to the character of the passage, the tone production will be preceded by a highly imaginative concept of the desired tone-value. This is the 'secret' of the pianists' beautiful touch.\footnote{131}

Relaxation, proper position, flexibility and other details of a correctly developed technique, essential as they are, can only remove physical obstacles to the production of beautiful tone.

He concludes:

The essence of beautiful tone is not in its pure acoustical quality, but in its fitness for the realization of the musical idea to be expressed; and the beautiful touch is but the representative and agent of the imagination which conceives musical sound in this sense.

The piano can produce tone of precisely such intensity, color and duration as the hammer, resonant substances and dampers provide. Though these elements of actual tonal effects are few, their combination, in very subtle proportions, gives results of great complexity, even when considered from the acoustical point of view alone. But when the element of musical interest is added to the acoustical, variations of tone take on a significance altogether disproportionate to their physical variety; and it is really in his power to provide this incalculable increment of musical significance that the pianist shows his possession of beautiful touch. He who would teach this quality, then must free himself from the primary consideration of fingers and keys, and enter the illimitable regions of the imagination.\footnote{132}

Granting all this, at least one writer finds more to be said about this controversial phase of technique. William G. Hill has written a very thought-provoking article on this subject.

\begin{footnotes}
\item[131] Ferguson, "Secret of the Pianist's Beautiful Touch," \textit{Musical Quarterly}, X (July, 1924), 397.
\item[132] Ibid., p. 399.
\end{footnotes}
He enlarges upon the auditory illusion that was mentioned by one or two of the other investigators. He goes to the field of ancient Greek architecture to illustrate his point.

The Greeks of Periclean Athens, after having brought their architecture to a point of excellence unsurpassed in subsequent history, solved the problem of a certain hardness and dryness by recognizing the effect of the optical illusion. For example, because columns were truly vertical, they appeared to topple outward. Many years of experimenting were necessary before the proper correction of the absolute was determined. By a number of refinements they were able to satisfy the eye's perception of a plan as a work of art, with none of them appearing to the eye as such.

So the Greeks recognized that aesthetic truth is what the senses perceive: The subjective rather than a complex of objective absolutes. It is surprising that those who discuss music have so seldom observed the analogy to this in their field. They try to explain the bases of the aesthetic experience of sound patterns with the same appeal to the theoretical absolute that the early Greek architects expected to find sufficient. There is an aural 'illusion' which is

133 W. G. Hill, "Noise In Piano Tone, A Qualitative Element," Musical Quarterly, XXVI (April, 1940), 244.
134 Ibid., p. 245.
aesthetically the only truth. Results arrived at by intricate devices for the precise objective measuring of the various sound phenomena are as irrelevant to music as the straight lines and angles of geometry are to architecture. If a device says that a sound effect should be one thing, and through an illusion, the ear's experience of that sound is another thing, then aesthetically the ear is right and the device is wrong.

Subjective response to sound phenomena through the sense of hearing is the only possible basis for an aural aesthetic, and any theory of music, based on absolute, objective measurements of these phenomena, is fundamentally unsound. We hear music with the aid of the ears, not of measuring devices. . . .

During recent years the acoustical physicist has increasingly recognized this fact and recent researches are attempts to arrive at a determination of the various characteristics as subjective experiences. Their attitude differs from the older and with the layman still current attitude that objective measurement represents the complete truth. 135

The layman, lagging behind, too often thinks in terms of obsolete scientific concepts and is likely to be seriously mislead. His legitimate respect for what he regards as laboratory findings, causes him to jump at conclusions.

The vexed question of piano tone is a good example. Some years ago, discussion seemed to settle the matter satisfactorily for many. It was their conviction that the only variation in piano tone is a variation in dynamics. Such a plausible case was made out that the few who wished

135 Ibid., p. 246.
they might believe their own sense of hearing, were silenced in the face of the scientific evidence.

But there were others who were disturbed by the 'hard, dry results' that this acceptance has brought into much piano playing. A conviction that variety of quality is impossible tended to develop a cynical indifference to whatever it was that was delightful. If it was an illusion, it was one that could be calculated and depended upon to produce an effect and so has a very material value. 136

It is usually assumed that tone quality is largely or entirely conditioned by the presence of overtones in a given tone. But the ear, refusing to be bound by arbitrary limitations, hears as the quality of a tone all the sound elements present. He points out that many have overlooked the fact that a very conspicuous element of sound produced by any instrument is noise. It fuses in non-analytical listening into the resultant tone, just as overtones do. In many cases, noises are the most striking characteristic features of the 'tonal physiognomy.' 137

He says:

In regard to possible variation in piano tone, it is agreed that, since the hammer, set in motion by the key, is freely swinging when the key is struck, contact with the key having been lost, then the only effective cause of the vibration set up in the string is the force transmitted by the hammer, variable only by varying speeds by which the hammer may be thrown. Thus the only possible difference in tone at the

136 Ibid., p. 247.
137 Ibid., p. 248.
control of the performer is a difference in intensity. I do not believe anyone will find difficulty in accepting this conclusion with regard to the tone, insofar as it is made up of the sound waves set in motion of the string's vibration. But this view of the matter entirely disregards the fact that a significant part of piano tone is pure percussion - pure noise. And the amount and nature of that noise is conspicuously under the control of the performer. 138

It is well known that the force with which a moving body meets an obstruction depends on the weight of the body and the speed with which it is travelling. The loudness of piano tone depends on the total force communicated by the activating body. In the case of the piano, it has been assumed that this force is merely that of the hammer meeting the string and that since the hammer has constant mass, the only variable is velocity. This is true as far as the strings resultant vibration is concerned.

But there are accompanying noises, as the percussion of the hammer against the string, the noise of the key hitting the key-bed, and other noises set up in the action itself at the moment of impact and the percussion of the finger against the key. The latter two are under the control of the performer, since they are conditioned by the mass and velocity of the effective part of the arm and hand that set the key in motion. 139

Proper adjustment of weight and speed (proportional decrease of one as the other is increased) makes possible

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138 Ibid., p. 249.
139 Ibid., p. 250.
the maintenance of equal forces with widely varying portions of the two elements. For example, a light weight may be accelerated to transmit as great a force as a heavy weight moving proportionately slower. These forces applied to the keyboard will result in tone of equal loudness but of different quality. Seashore and Ortmann contend that for a given loudness on a particular instrument, the resulting quality is always the same, no matter how the key was depressed. He hopes to show that the tone, in which the element of weight is predominant will be found to have a 'singing' quality, while that in which speed predominates will be brighter and more brilliant.

If we alter the elements of weight and speed in the same directions by like amounts, the tone may be greatly increased or decreased in total force and hence loudness of the resultant tone; but when the proportions of weight and speed remain constant, the same quality of tone is produced.

He shows how these adjustments in the proportion of weight and speed can be carried out. There are various means for the application of force. The finger, used alone, must be swung with considerable velocity to depress the key. Speed is thus a conspicuous element in its touch and the tone is necessarily brilliant, no matter what its intensity.

When the hand is swung from the wrist, the weight is materially increased, but the finger tip moves farther and

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Ibid., p. 250.
hence faster than the hand swings from the hinge of the wrist. So speed is again a conspicuous element in tone production and the tone is brilliant.

The addition of the forearm greatly increases the weight of the active unit, but the lever system is much the same as that of the hand swinging from the wrist. Brilliance is still conspicuous, but with a marked difference. If the intensity of the forearm is to equal that of the hand tone, its speed will have to be reduced to a speed proportional to the increase in weight. So there is a conspicuous difference in the noise elements of the tones. The wrist tone has a 'splashiness' quite foreign to forearm tone. In the former, the noise of the finger hitting the key and the superficial jar in action color the tone effectively.\textsuperscript{141}

The forearm is made up more largely of 'tone' as produced by the string since the slower approach to the key diminishes the noise element. The question of 'good' or 'bad' tone is irrelevant. Certain tones or colors are merely useful in certain settings and not in others.

When the whole arm is swung from the shoulder, we not only greatly increase the available weight, but we find a new sort of lever system that permits the arm to be raised so as to make its weight effective without necessarily lifting the finger tip above the key surface. For the first time, we are able to reduce the speed element to a minimum.

\textsuperscript{141} Ibid., p. 251.
while having a weight great enough to compensate for the loss and to maintain tonal intensity. This supplies the conditions necessary to the production of tone suitable to a sustained melody. 142

Any of these weights may be used at any speed. The conditions just described were those necessary to the production of tones of fairly like intensity.

Generally, any increase in the proportion of speed as compared with weight makes for brilliance of tone through the greater percentage of the percussive noise element. The opposite conditions make for a tone relatively rounded, smooth and 'singing.'

Piano tone is judged by its quality and intensity at its initial impact and not by what happens after that. Thus a 'dynamic nuance' is arrived at by fitting a series of these initial impacts to a dynamic curve projected in the imagination. 143

Hill gives an interesting explanation of why a true legato is impossible on the piano. Because the tone dies away after the initial impact, its intensity will have dropped to a level below that at which the next tone enters. An appreciable time is necessary for damping the tone, which varies as the intensity of the vibration to be damped. A tone with a high proportion of tone will persist

142 Ibid., p. 251.
143 Ibid., p. 252.
longer as noise having no resonance is damped immediately. This explains why a definite blurring will occur when tones with a high proportion of the tone elements succeed each other at high speeds.

Tones with a high proportion of the noise element in their make-up, may succeed each other at high speeds with what is to all intents and purposes, perfect clarity. The tones are damped quicker.

Tones of 'singing quality' tend to persist and pass from one to another with relative smoothness. Such tones are necessary for a slow, legato melody. In rapid successions, such tones blur and are unsuitable for fast passages. 144

Bright, brilliant, percussive tones fall away quickly and in slow tempos give a 'bumpy' tone line. This fact makes them desirable for rapid passages.

In conclusion, he states that one is apt to take for granted that the simplest solution must be the right one, whereas its very simplicity and slickness should make it suspect. We can find many examples of a plausible theory, accepted as final for a short time, but repeatedly and radically modified later. Each of these modifications has its day of acceptance as finality, but there is always some remainder.

144 Ibid., p. 256.
He ends with this statement:

I feel that the 'color value' of the noise element in musical tone is a very important part of the remainder that is left after the usual, orthodox and slickly plausible account of piano tone, has been given. I am also sure that it is not all of it. 145

145 Ibid., p. 446.
CHAPTER IV

CONCLUSION

There is one point on which all writers, investigators and virtuosi are agreed. That is, that technique is not something to be developed for its sake alone. Instead, the player should use it for the expression of musical ideas. Without adequate technique, there can be no adequate interpretation.

Touch is a highly controversial issue; the drawing of definite conclusions is very difficult. Seashore and Ortmann have done the most extensive research and it is perhaps best to accept their findings, at least for the present. As Seashore points out, the piano of today, the manner of its use, and the tastes and habits of hearing are determined largely by the heretofore existing mechanical limitations to construction of the instrument. Piano quality involves a 'variety of thuds, rattlings, raspings and various other forms of noise (pitchless sound) which are used for musical effect.'\(^1\) They add pronounced characteristics to the tonal elements, especially in the louder intensities.

Hill's objection to his minimizing of inharmonic elements is perhaps baseless. Seashore asserts that while all

musical instruments tend to produce tones composed of a series of partials, this harmonic structure is supplemented by these accessory noises and inharmonic elements which add to the quality of the tone. As such they may be measured and added to the description of the timbre of the tone.

He also says:

Measurements show that a fine pianist may be able to hear and reproduce differences as small as .1 d b in the middle register. The pianist perhaps has the greatest responsibility for the mastery of intensity control since this is one of the two principal media under his control and the instrument responds favorably to fine shadings in touch.²

It seems safe to conclude with Seashore that timbre is determined primarily by the number, order and relative intensity of the fundamental and its overtones. It is also modified by the absolute pitch and total intensity of the tone as a whole. In general, the louder the tone, the richer it will be in quality. Variety of tone quality is achieved through control of intensity or time, within limits set by the characteristics of the instrument.

The kind of tone which is used will depend on its appropriateness to the particular passage to be played. The 'hard' tones, so feared by many of these writers, may be the only ones that can be used in some cases. James Jeans writes that very hard striking increases the relative proportion of the upper harmonies, so imparting dissonance and harshness

²Ibid., p. 87.
as well as loudness. The natural association of the resulting sound is anger or despair. Yet the fact remains that all the shades of tone which the pianist can get out of one note form only one 'linear' sequence, this corresponding to the different speeds with which the hammer can strike the wire.  

Matthay was probably wrong in assuming that for a beautiful tone, the string must be set into motion gradually. A better explanation is that for degrees of tone moderately loud or less, the higher, more dissonant harmonics are more subdued.

The care taken in the development of weight, pressure, arm, wrist and fingers movement can be justified insofar as the player is enabled to have a refined control over intensity, and incidentally, quality.

Fielden's analysis of touch is the clearest and most satisfactory explanation. The arm, or whatever part of it is being used as a lever, must be in a condition of resistance (muscular contraction) at the moment of contact with the key. In using a part of the arm, the part which controls it must be partly fixed, usually the part just above. This is for control. While each part of the arm may act independently, using its own muscular inception and own fixation for approach and contact, yet, practically all movement is contained in and initiated by the shoulder muscles.

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3 Sir James Jeans, Science and Music, p. 98.
The arm can be said to be carried in the shoulder with its own self-contained mechanism, ready to operate in coordination when needed. The less stiffness in the arm, the greater the opportunity for suppleness and swiftness. True suppleness lies in securing the full contraction at the right moment. At the point of contact, the muscles are not relaxed, but contracted, resilient, ready for relaxation if necessary. A right understanding and proper management of this contraction is not the cause of 'good' tone production, but it will be a great factor in control. It should be reduced to the shortest possible duration commensurate with control.

There has been much misunderstanding on the subject of relaxation. Matthay has laid himself open to attack, as he is the leading exponent of relaxation. In a recent article, he defended his position by saying that relaxation in playing does not lead to flabbiness; nor does it imply omission of the exertions needed in all playing, but only those which may prevent the full use of the muscles needed. Later, he says that for the effective exertion of limbs, a 'stable basis' for that action must be established. For the exertion of the hand downward at the knuckle, the knuckles and wrist joints must be 'stabilized.' This word 'stabilized' does not appear in his *First Principles of Piano Playing* or

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Muscular Relaxation Studies. It is certain that he does not advocate relaxing everything indiscriminately, but he does not stress enough the positive exertions needed in piano playing. He allows hand and finger exertion, but insists on using the arm passively. The arguments against the active use of arm weight on the ground of 'hard tone' are baseless, as was shown earlier. Ortmann says that in the coordinated movements of piano technique, relaxation in any great degree is seldom present at the moment of tone production. Muscular fixation is a mechanical necessity, which could be shown by an apparatus sensitive enough to record the muscular contraction. The value of relaxation is in its use before and immediately after tone production.

Fielden was right in saying that once the player has determined the mode of striking the keyboard in a particular case, muscular and nervous control must be confined to it. Practice must be concentrated on the avoidance and elimination of involuntary nervous movements. This is inhibition and has often been mistaken for relaxation. Diminishing the effort after the point of contact does not mean relaxing; absolute relaxation cannot occur in continuous playing. He was wrong in assuming that 'relaxed dropping of the arm is negative and can only produce poor tone.' By controlling the rate of relaxation, the same quality of tone as that produced by active exertion can be had. Playing the piano requires poise and balance, which is active rather
Another point that Matthay has been attacked on is non-key-bedding. The player is supposed to listen for the moment sound begins and stop using most of the energy then. The weight of the arm is to be supported by the shoulder muscles and just enough left to hold the key down. The chief criticism of this is that ceasing the muscular effort at that point is like propelling the racquet only as far as the ball in tennis. There must be a 'follow through! This idea is likely to have a wrong psychological effect on players who are afraid of hitting the key-bed. Their playing is apt to be slovenly and non-legato. As Levinskaya explains it, when the player feels he must stop at the moment of tone production, a reserve is put on action. An uncertainty will be created by a feeling of insecurity. If it produces sound lacking in 'depth' as she says, it will be from monotony in intensity. It is unlikely that 'a certain instability of hammer and damper is created which has an instant repercussion on the sound, interfering with its purity and producing a tremolando effect.'

In playing, the whole arm must be used freely, with all its parts acting in coordination. Breithaupt, in omitting active finger exertions, made a great mistake. Shifting the weight of the arm on each finger in turn, without pronounced finger action, secures the continuous weight of the arm, but the fingers are rigid, acting as props for
the weight. The weight should be swung naturally in combination with finger action. These actions may be reduced in extent, but never entirely omitted. Leschetizky had the wrong idea in raising the finger and 'hooking' it. Fielden has given the physiological explanation of this, showing how finger antagonist muscles are at work, producing strain. The finger should be raised before striking rather than after. When it has struck a key, it should be released (inhibited) rather than forced upward. The idea of keeping all the fingers fixed except the operating one (Leschetizky's method of holding keys down all except the one in use) is subversive to suppleness. The sympathetic movements are caused by the pull of cross tendons.

Fielden's contention, that playing with relaxed fingers produces 'flabby tone,' is inconclusive. Actually, there must be resistance in the hand and fingers or they would collapse under the arm weight.

The question of wrist position in playing is perhaps best solved by Fielden. If the 'high-fall' and 'low-fall' are used alternately, the movements of the muscles of shoulder and arm will be facilitated. The use of the two positions will allow the whole arm to be used freely and will secure economy of movement. A low position of the wrist is useful in passage playing as the extensors of the wrist tend to take the strain from the flexing fingers.

Rotation is another highly disputed point. For most
writers it means forearm rotation. Fielden has shown why it
cannot be used to play arpeggios or extended passages. Strain
can be removed much easier by a lateral shift of the arm.

The real rotatory movement is that of the elbow. It
solves the strain of stretching of the fingers. By shifting
the arm laterally, using the wrist in an undulating way, ir-
regularity can be avoided. The elbow will be rotating in a
horizontal plane, a result of the wrist rotation in a ver-
tical plane.

Leschetizky was the first of the great modern teachers
who began to get away from the stiffness of the old school.
Its influence can be seen in some of his ideas; 'preparing'
for legato playing and 'hooking' of the fingers. Although
he did not speak much of arm movements, it is almost cer-
tain he used them to a greater extent than any of his pre-
decessors.

The relaxationists, of whom Breithaupt and Matthay
are the two leading protagonists, have, in trying to ob-
viate stiffness, swung too far in the opposite direction.
The main fault is that they did not stress sufficiently the
necessity for active muscular exertion.

Fielden, among the more recent teachers, has done the
clearest thinking and come nearer to the solution of the
problem of technique. He places great emphasis on nervous
control throughout; technique is ultimately mental. Some
of his ideas on touch are at fault, at least in the light
of the latest scientific evidence. The chief criticism by the relaxationists of those who use muscular exertion and vice-versa is in the matter of 'hard tone.' Neither is a valid criticism. As has been pointed out, the active use of the muscles gives better control. Suppleness and control may be considered as the real goals of technique.
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