

## ABSTRACT

Title of Document: SUMIKO MIKIMOTO'S PIANO METHOD: A  
MODERN PHYSIOLOGICAL APPROACH TO  
PIANO TECHNIQUE IN HISTORICAL  
CONTEXT

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The purpose of this dissertation is to introduce Sumiko Mikimoto's piano method, *The Correct Piano Technique (2004)*, which represents a modern approach to piano technique based on physiological and neurological study. The author places Mikimoto's method within a historical context, and shows how it offers a unique approach to piano playing with its anatomical-based awareness of localized muscle structures. Mikimoto not only describes different hand types, along with their accompanying strengths and weaknesses, but also presents a comprehensive picture of the development of piano technique through numerous exercises that are arranged incrementally. In addition to her various exercises, Mikimoto patented a finger-board in 1980 that helps the pianist stretch tendons and trains the small muscles of the hand and fingers. The strength of this method lies in its ability to address a broad range of technical challenges faced at many different levels from the beginner up through the advanced level pianist, as well as to help prevent tension-related injury.

Broadly speaking, the historical context of piano technique shows a gradually increasing awareness of the body. Since the turn of the twentieth century and continuing up to the present day, the fields of physiology, neurology, and wellness have informed the teachings of many pedagogues such as Tobias Matthay, Otto Ortmann, George Kochevitsky, Gyorgy Sandor, and Seymour Bernstein. In this stream of studies of piano techniques and methods, Mikimoto's method may be viewed as an extension of the work of Otto Ortmann (who conducted extensive scientific studies on physiological mechanics of piano technique) and George Kochevitsky (who incorporated an understanding of the neurology of motor skills into his teaching).

With the growing obsession with technique, there has been an increase in injuries among pianists. Tension is at the root of many injuries, and injury prevention has been a growing topic since 1980s. Mikimoto's careful analysis of students' physical characteristics (including the different shapes of fingers, wrist, hands, arms, and their tendons) provides insight into some of the causes of weakness and tension. It possible to use her analysis to find the root of some injuries, aid in rehabilitation, and perhaps prevent them from happening to future students.

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APPROACH TO PIANO TECHNIQUE IN HISTORICAL CONTEXT

by

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## **Chapter I**

### **Introduction**

Whether one is a student, a piano teacher, or a professional pianist, she or he faces issues of piano technique every day in the pursuit of excellence. Often students find the learning process extremely trying; it seems to take a long time to surmount technical challenges in just one piece. For teachers, there is a life-long vigilance to establish a proper technical foundation in their students and to correctly diagnose and prevent bad technical habits from becoming ingrained in the student. An injury can sideline a professional career either temporarily or permanently, depending on the severity of the injury and the quality of rehabilitation. All these scenarios point to a common problem in the technical approach of piano pedagogy. Despite many discussions of anatomy and physiology, these disciplines have not been adequately integrated into technical training. In the realm of sports science, athletes have greatly improved their performance by means of scientific research. Advanced knowledge of how muscles work together has facilitated this effort to achieve and maintain peak athletic performance. Yet pianists have not benefitted from this same type of coaching that is based on science. In fact, it is only recently that musicians and doctors have started to collaborate. In 1988, a group of physicians involved with the medical care of individual musicians and dancers formed the Performing Arts Medicine Association in the United States. Since then, the organization has grown to include not only health professionals but also performers, educators and even administrators for the exchange of information.

While this is a step in the right direction, the problem remains that musicians usually seek out scientific knowledge only when they face injury, not beforehand. As musicians, we have placed our trust in over three centuries of experience and tradition. Many useful trends have evolved over these 300 years: finger technique, weight technique, and the physiology of playing (how the arms and body function). Pedagogical methods stretch back to the age of harpsichords and clavichords, leaving us with a long and grand tradition of finger technique, which is still used today. With the innovation of the piano and its continuous development, the pianist's whole body became involved in technique, which led to greater awareness of weight technique and tone production. Today, many of us are more aware than ever of the whole body function and the consequences of overuse injuries. Yet all of these approaches are ambiguous at best, and musicians are still taught in traditional styles often based more on the teacher's own experiences rather than on concrete scientific research. I believe we need to combine these traditional technical methods with a more systematic approach rooted in science and anatomy. We need not discard our great pedagogical tradition which has brought us so far, but merely need to build on it in order to further develop modern piano technique. A combined traditional/anatomical approach would not only set a secure technical foundation, it would also help prevent many possible future injuries which could occur from misuse of the body.

As early as 1885, German pianist and piano teacher Ludwig Deppe (1828–1890) suggested involving the whole arm in so-called weight playing instead of the traditional finger-concentrated piano playing.<sup>1</sup> Since then, many pedagogues have tried to find

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<sup>1</sup> Harold C. Schonberg, *The Great Pianists from Mozart to the Present*. (New York: Simon & Schuster, Inc., 1963) p. 275

more efficient body movement in their piano methods through their research and experience. This movement of defining and redefining piano technique has continued to the present day. The modern approach to piano technique in terms of physiology, biomechanics, and the coordination of body parts is increasingly discussed in the field of piano technique.

The Japanese pianist and piano teacher Sumiko Mikimoto is one of the pianists and piano pedagogues who developed a modern piano method that successfully combines the traditional approaches with scientific knowledge of anatomy and physiology. From her experiences as a pianist and over thirty years of teaching, she has developed many exercises and ideas that solve the modern pianist's problems. Mikimoto is a prominent piano teacher in Japan, having presented master classes at major Japanese music colleges. In 2004 she published her method book *The Correct Piano Technique*,<sup>2</sup> which was reprinted in four editions, attesting to its popularity. Mikimoto was introduced to the United States in 1970 by the pianist Malcolm Frager, in *Clavier Magazine*.<sup>3</sup> In 1972, some of her finger exercises were translated in two series as "A New Idea in Finger Training"<sup>4</sup> and "More about Sumiko Mikimoto's System of Finger Exercises"<sup>5</sup> by Dorothy Packard in the same periodical.

Mikimoto's anatomical approach is unique to piano playing because it enables the pianist to play more efficiently by isolating specific muscles and muscle groups. In point of fact, she views the pianist as an athlete. Mikimoto has developed numerous finger,

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<sup>2</sup> Sumiko Mikimoto, *The Correct Piano Technique*. (Tokyo, Japan: Ongaku no Tomo Sha, 2004).

<sup>3</sup> Frager, Malcolm and Dorothy Packard, "A Conversation with Clavier's Editor". *Clavier* (1970, Dec.) p. 10

<sup>4</sup> Sumiko Mikimoto, trans. Dorothy Packard, "A New Idea in Finger Training," *Clavier* (1972, April). p. 14

<sup>5</sup> Sumiko Mikimoto, trans. Dorothy Packard, "More about Sumiko Mikimoto's System of Finger Exercises," *Clavier* (1972, June). p. 30

hand, and wrist exercises that raise the pianist's awareness of localized muscle structures, and which can be applied to specific problems such as octaves, speed, and sound control. She also patented a finger-board in 1980 that helps the pianist stretch tendons and trains the small muscles of the hand and fingers for increased speed and dexterity.

I will structure my dissertation into seven chapters, each focused on a different aspect of various piano methods which are related to Mikimoto's method, and will provide commentary. Following this introductory chapter, I will show in chapter two how her method fits into an historical context of piano pedagogy starting with the early finger technique (technique for the harpsichord) of J. S. Bach (1685–1750), Francois Couperin (1668–1733), Jean-Philippe Rameau (1683–1764), and the finger technique of Carl Czerny (1791–1857). I will continue through the more recent approaches such as the weight and relaxation technique of Ludwig Deppe (1828–1890), Rudolf Maria Breithaupt (1873–1945), and Tobias Matthay (1858–1945), as well as more scientific approaches based on analysis of physiological mechanics of finger, hand, and arm by Otto Rudolph Ortmann (1889–1979) and George Kochevitsky (1903 –1993), who was concerned with the neurology of motor skills. In Chapter Three, I will describe the unique features of Mikimoto's method, namely, an anatomical approach that is based on an awareness of localized muscle structures. I will also examine her numerous finger/hand/wrist exercises and discuss her description of the different hand types with their individual strengths and weaknesses, as well as bad hand habits and tension. Her patented finger-board will be discussed in great detail.

Chapter Four will compare Mikimoto's with other modern methods that are concerned with physiology, neurology, and wellness in piano playing, such as those by

Tobias Matthay, Otto Ortmann, George Kochevitsky, Gyorgy Sandor and Seymour Bernstein. In Chapter Five, I will discuss the actual application of some of Mikimoto's approaches to students and the results obtained thereby. In Chapter Six, I will address how the growing obsession with technique has increased injury among pianists, and the role that tension plays in causing different injuries. Injury prevention has emerged as a salient topic since 1984, with the founding of the Performing Arts Medicine Association. I will consider how Mikimoto's method can prevent injurious tension and aid in rehabilitation should an injury occur.

## Chapter II

### A Brief History of Piano Technique

Throughout over 300 years of piano history, many pianists and piano pedagogues have tried to describe their approaches to technique, reflecting the trends of their time. Of all the method books and articles written on this subject, Gerig's *Famous Pianists and Their Piano Technique* is an excellent examination of the historical development of piano technique.<sup>6</sup> He covers three and a half centuries of technical literature, from *Il Transilvano* by Girolamo Diruta (circa 1600) to more recent pedagogical writings by Abby Whiteside (1889–1956) and William Newman (1912–2000).

Although there have been countless methods over the years, it is possible to find several tendencies in piano technique and to group them chronologically. Kaestner Robertson, in his dissertation, "*Arm-Weight and Weight-Transference Technique: Its Systematic Use as a Technical and Artistic Vehicle in Piano Playing*," divides the history of piano technique into three broad periods.<sup>7</sup> Robertson and others seem to agree that the first period emphasized pure finger action, as espoused by C. P. E. Bach, Muzio Clementi, Johann Nepomuk Hummel, and Carl Czerny. He views the second period as starting with the rise of arm and hand weight in piano technique, a method led by Ludwig Deppe (1828–1890). In the third period, relaxation became the dominant approach, especially in

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<sup>6</sup> Reginald R. Gerig, *Famous Pianists and Their Technique*, 4th ed. (Bridgeport, CT: Robert B. Luce, Inc., 1985).

<sup>7</sup> Kaestner D. Robertson, "Arm-Weight and Weight-Transference Technique: Its Systematic Use as a Technical and Artistic Vehicle in Piano Playing" (dissertation, Boston University, 1991).

the teachings of Rudolf Maria Breithaupt(1873–1945) and Tobias Augustus Matthay (1858–1945).<sup>8</sup>

George Kochevitsky presents a similar view of the history of piano technique, from finger technique to weight technique, in his book *The Art of Piano Playing* (1964). He describes how the basis of the first approaches to piano technique was concentrated on finger work only.<sup>9</sup> This finger technique was closely related to the light action in the early period of the development of the pianoforte as well as its predecessors. However, this finger–concentrated technique continued even with the development of the new piano action which had more resistance in the keys, and with the heightened demands of ever more complicated piano writing. These instrumental and musical changes forced pianists to adjust their finger technique, which involved applying a more rigid position of the body. The limitations of the old school would cause people to search for a better approach to dealing with the heavier instrument; this marked the beginning of the weight technique in the nineteenth century. The differences between the old finger school of teaching and actual concert performance had been pointed out by many piano pedagogues. Pianists were naturally involving their whole arm in piano technique. This involvement of the whole arm, which Kochevitsky called the “anatomic–physiological”<sup>10</sup> school, led to many current piano techniques.

Kochevitsky further discusses the existence of three modern tendencies in piano methods. The first tendency is conscious of the deficiencies of the finger school, and tries to add something new to its teaching while basically retaining the basic idea of the finger

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<sup>8</sup> Ibid. p. 4

<sup>9</sup> George Kochevitsky, *The Art of Piano Playing: A Scientific Approach*. (Evanston, Illinois: Summy–Birchard, 1967). p. 3

<sup>10</sup> Ibid. p. 9

school. The second tendency is animated and inspired by the ideas of the anatomic–physiological school, and is focused on the problems of weight and relaxation. Its adherents search for the most natural, correct movement forms, trying to determine which part of the arm and which group of muscles should participate in a given movement. The third tendency is the psycho–technical school, which looks for solutions of pianistic problems in the realm of intellect and psychology. Kochevitsky extensively discusses the role of the central nervous system and function of the motor cortex of the brain, which he believes is the most important part of mastering piano technique.<sup>11</sup>

Even though Kochevitsky cited the history of piano technique and these three modern trends more than 40 years ago, they provide a valuable historical insight and resonate in current piano teaching today in 2009. Mikimoto’s methods were created over a long period of time from her experience and research with her students and reflect a synthesis of those three trends that Kochevitsky discussed. Before discussing Mikimoto’s method, it is relevant to see the history of piano technique in more detail so that we can understand how her method reflects other approaches.

### **Finger Technique**

Early keyboard methods did not include any physical component such as coordination of muscular movement. Instead, the primary focus was on musical styles and interpretation. Most suggestions solely addressed proper position of the body and hand and also pure finger movement, which originated with harpsichords and clavichords. This pure finger technique became the primary focus in the Baroque and Classical periods.

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<sup>11</sup> Ibid. p.14

In the Baroque period, there were few printed pedagogical finger exercises. It was assumed that the development of finger technique naturally occurred simply by playing actual pieces. Some of the earliest study pieces were composed by J. S. Bach. The collection of small pieces called *The Little Clavier Book for Anna Magdalena Bach* (1725) and *Inventions and Sinfonias* (1722) are prominent as his most well-known didactic pieces. While these compositions are not complex in form or keyboard technique, they are quite melodic in their beautiful contrapuntal texture, which reflects the writing style of the Baroque era. In the preface to the *Inventions*, J. S. Bach suggested “learning to play clearly in two voices, proceeding with subsequent progress to three part obligato, all the while receiving good ideas (i. e., invention), and also utilizing them for the development of a cantabile style of playing”.<sup>12</sup> There are also advanced educational pieces that later became concert pieces. For example, the *Six Partitas BWV 825 through 830*, *Italian Concerto BWV 971*, *French Overture BWV 831*, as well as *Goldberg Variations BWV 988*, published together in 1735 as *Keyboard Practice* pieces, exhibit more complex writing while demanding more keyboard technique from the player. However, they do not include any mention of finger technique, such as scales and arpeggios. Bach’s interest here was not on finger training, but on understanding the composition and musical style.

There were other composers concerned with technical efficiency at the same time as J. S. Bach, and Jean-Philippe Rameau was among them. He provided short exercises for the five fingers in his didactic work, *Pièces de Clavecin* (1724). Another such composer was Francois Couperin, who composed eight preludes in his textbook, *The Art of Playing*

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<sup>12</sup> Johann Sebastian Bach, ed. Willard A. Palmer, *Inventions and Sinfonias: 2 & 3 Part Inventions* (Port Washington, N.Y.: Alfred Music, 1968). p. 1

*the Harpsichord* (1716). These composers provided exercise pieces as warm-ups which could provide flexibility for the fingers; however they are not nearly as demanding or mechanical as later exercises which became mainstream at the end of the 18<sup>th</sup> century stretching into modern days.

J. S. Bach's son, Carl Philipp Emanuel Bach (1714–1788), was the last important figure among the harpsichord and clavichord teachers. His *Essay on the True Art of Playing Keyboard Instruments*, published in two parts in 1753 and 1762, is regarded as the most important teaching guide of its time because of its well-organized manner. Many later composers were influenced by it, most notably Haydn, Beethoven and Czerny.<sup>13</sup>

C. P. E. Bach described in Part One what the fundamental knowledge behind *The True Art of Playing Keyboard Instruments* ought to be, focusing on three aspects: correct fingering, artistic embellishments, and good performance (ability to sing out or listen). However, he did mention physicality, if only briefly, which would resonate with more current teaching suggestions, such as good posture with the forearm slightly above the keyboard, fingers arched, and muscles relaxed. In Part Two, he dealt with practical performance issues, including the study of thorough bass, accompaniment, and improvisation, which shows that he was referring to the keyboard instrument as a common accompaniment instrument.

All the pieces and documents above demonstrate what keyboard study in the first two thirds of the eighteenth century was like for players of the clavichord, harpsichord, and early piano. Because of the limitations of sound and the actions of the keyboard instruments, musical education in the Baroque period emphasized mastering musical

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<sup>13</sup> Gerig, *Famous Pianists and Their Technique*. p. 25

interpretation, improvisation, and writing in different styles such as invention, variation, and concerto. The physical part of technique was apparently a secondary issue to the pedagogues of that time.

At the end of the eighteenth century, the piano became more popular than the harpsichord due to its ability to produce a wider range of sound. As the piano developed continually in the quality of its sound, action, and range of the keyboard, it required the players to have a more advanced keyboard technique. Technical exercises, called studies or etudes, appeared for the first time in the history of piano technique. These first studies were composed by teachers for students to develop their technical and interpretive abilities. At the beginning of the nineteenth century, technical discussions became a great part of students' instruction. Teachers believed that all five fingers must be equally strong and equally trained. Numerous mechanical training pieces were composed around this time, including many still used today. *Gradus Ad Parnassum* by Muzio Clementi (1752–1832), *Twenty-four Etudes Opus 70* by Ignaz Moscheles (1794–1870), and *Grosse Praktische Pianoforte Schule* (Great Practical Piano School) by Johann Baptist Cramer (1791–1858) are fine examples of prominent composers and their pedagogical works, wherein they developed suitable exercise pieces for the development of finger technique so that their students could conquer various difficulties, such as scales, arpeggios, chords, and octaves.

Among the composers of the time, Carl Czerny (1791–1857) was probably the most successful piano pedagogue, and his finger studies have been accepted throughout the world. He was a teacher of pianistic giants who later became influential piano instructors, such as Franz Liszt (1811–1886), Adolph Kullak (1823–1862), and Theodor

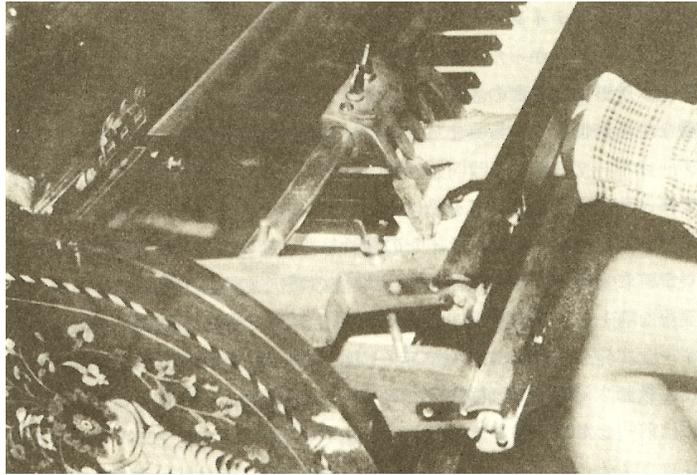
Leschetizky (1830–1915). The reasons for Czerny’s success and popularity stem from the sheer amount and variety of his systematic series of exercises that increase in difficulty in a gradual manner. Czerny composed over one thousand exercises covering various levels, from beginning to advanced, addressing all the facets of piano technique of that time, such as scales, arpeggios, trills, octave passages, and other technical figures. A good example is *The Art of Finger Dexterity* Op. 740, which contains fifty pieces. While relatively short and simple in harmony and form, each piece is virtuosic, intended to be played at a fast tempo, and marked with Czerny’s advice. For example, in No. 5, he notes “evenness in double passages” along with the tempo marking “Molto allegro, half note = 84.”<sup>14</sup> This particular study concentrates on scales with both hands in unison. The scales are quite advanced in technical difficulty, but due to their simple forms and harmonic structure, they are easy to memorize and drill. Their compositional simplicity allows the student to concentrate on technical development.

Early in the nineteenth century, around the time Czerny composed his exercises, piano technique was still based on the harpsichord and clavichord method. Because of the development of keyboard instruments, particularly the advent of the pianoforte, pianists had adjusted their technique to increase their finger strength. The piano pedagogues kept the old harpsichord and clavichord technique based upon finger playing, and thought that this would require an increase in finger strength. To this end, many mechanical inventions began to appear around this time. One example of this kind of mechanical device is the Chiroplast, as shown in Figure 2–1, which was invented by Johann Bernhard Logier (1777–1846).

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<sup>14</sup> Carl Czerny, *The Art of Finger Dexterity; 50 Studies in Brilliant Style, Op. 740*, rev. and fingered by Max Vogrich, ed., 6 vols. (New York: G. Schirmer, 1893). p. 18

**Figure 2–1: Chiroplast by Johann Bernhard Logier**



Source: Naotaka Sakai, *Pianist's Hand: Injury and Piano Technique* (Tokyo, Japan: Ongakuno Tomosha), 41.

This mechanical device had two adjustable rails parallel to the keyboard, and the wrist was placed between the rails to prevent any perpendicular motion of the hand. Additional devices called ‘finger guides’ were set on each finger so that it would be properly positioned and remain in close contact to the key. Later, in 1830, Friedrich Kalkbrenner (1785–1849) introduced a similar device called the Hand Guide, with a single rail running parallel to the keyboard on which the wrist and a portion of the forearm rested. This device prevented arm movement like the previous device, but allowed a freer finger motion in scales and arpeggios. For finger strength, Henri Herz (1803–1888) invented the Dactylion, a device with ten wires attached to ten rings. Since springs were fastened at the top of each wire, fingers were forced to lift higher when playing. The Digitorium, invented by Myer Marks, was a six–inch square box equipped with five keys regulated by a strong spring. The fingers simply pressed down the keys to develop their strength.

Figure 2–2 shows the advertisement from *The Etude* magazine of April 1890 for two models of the Brotherhood Technicon, a device similar to the Digitorium.

**Figure 2–2: Brotherhood Technicon**

**THE SCIENTIFIC METHOD**  
FOR RAPIDLY GAINING THE NECESSARY TECHNICAL ABILITY FOR  
**MODERN PIANO PLAYING.**

The inadequate results from technical exercises of the piano are well known to piano players, and form the great barrier to a proper advancement in piano playing.

Science, having investigated this subject, has discovered and can explain the reasons of such unreasonable results, and can now supply in a cheap cost a better and more direct process for developing and enlarging the technical dexterity of the hand.

Employed by eminent pianists in their teaching, and for their own personal use. Hundreds of teachers testify that it is invaluable to both themselves and their pupils.

As this new method makes a most important reform in technical teaching, all piano players should make themselves acquainted with its principles by reading a lecture delivered by Mr. Brotherhood, at Chautauque, N. Y., upon "SENSITIVE PIANO TOUCH, AND WAYS AND MEANS TO ITS ACQUISITION," sent free, on application to

**J. HOWARD FOOTE,**  
Sole Agent for the Brotherhood Technicon.  
307 and 309 Wabash Ave., CHICAGO.      33 Maiden Lane, NEW YORK.

**THE TEACHER'S TECHNICON.**  
PRICE \$20.00.  
DISCOUNT TO TEACHERS.

Source: James Parakilas, *Piano Roles : Three Hundred Years of Life with the Piano* (New Haven, [Conn.]: Yale University Press, 1999), 140.

The back pages of such piano magazines were once filled with advertisements for mechanical exercise devices, some for use at the piano and others, like the Technicon, intended to function independently. The appeal of the Technicon, as that of much modern body–building equipment, evidently relied in part on the variety of exercises that the buyer could expect to perform with a single machine.<sup>15</sup>

These devices reflected the obsession of the nineteenth century with finger technique. In both cases, the idea was to strengthen the supposedly weaker fingers to the level of the stronger ones for a more even touch.<sup>16</sup> Even though these devices might help parts of students' development, they neglect certain biomechanical facts such as the naturally unequal strength of fingers.

<sup>15</sup> James Parakilas, *Piano Roles: Three Hundred Years of Life with the Piano* (New Haven, [Conn.]: Yale University Press, 1999). p. 140

<sup>16</sup> *Ibid.* p. 141

The change from the harpsichord and clavichord to pianoforte was quite significant for finger technique, and yet the pianoforte itself experienced dramatic changes that further increased the demands on its players. Since Bartolomeo Cristofori's (1626–1731) pianoforte invention in 1709, the mechanical workings of the piano became heavier, requiring a heavier finger action. Pedals became diversified, the length of the strings was extended to produce more sound, and the iron frame was added to hold multiple strings in a stable condition.

In the nineteenth century, the piano underwent the most dramatic changes. Many prominent piano composers were searching for new sounds and demanded that piano makers adjust the workings to their satisfaction. It is easy to see the expanding horizon of sounds and technique springing from nineteenth-century composers; from Beethoven to Liszt and their contemporaries, these new demands caused new developments in the mechanism of the piano.

In Liszt's lifetime, the piano experienced great changes which led to the modern piano that we play today.<sup>17</sup> In 1823, the French piano Erard had seven octaves and a double-escapement action which made it responsive to a sensitive touch and allowed rapid repetition. In 1825, Alpheus Babcock, a Boston craftsman, patented the one-piece metal frame. Jonas Chickering, who had the business sense that Babcock lacked and who built pianos of every type, adopted the iron frame and made a commercial success of it, first in square pianos and then in the grand piano, which he became the first to build with iron frames in 1840. The iron frame meant that string tension could be increased, which could lead to heavier, longer strings, and strings made of stronger material.<sup>18</sup> Mid-

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<sup>17</sup> Derek Watson, *Liszt*, 1st American ed. (New York: Schirmer Books, 1989). p. 169

<sup>18</sup> Parakilas, *Piano Roles: Three Hundred Years of Life with the Piano*. p. 58

nineteenth-century industrialization allowed for an increase in piano production and affordability. Piano popularity expanded from the most privileged class to the middle class and, increasingly, to the working class. Liszt was the right person at the right time to bring the piano to the public stage as a solo concert instrument and to introduce virtuoso pieces to a mainstream audience, becoming an extremely popular figure, if not a cultural idol.

One of the reasons for Liszt's popularity was his piano technique. While many of his contemporaries, such as Schumann, Chopin, and Mendelssohn, also helped expand the piano's horizon by developing their musical and technical language, it is reasonable to say that Liszt was one of the most prominent figures in changing piano technique. His exceptional physical abilities were vividly reflected in his piano compositions with their demanding technical challenges. Examples of his extraordinary ability with piano technique include his virtuoso concert etudes. Although etudes historically were mainly exercise studies with an educational purpose, Liszt used the concert etudes to show off his technical ability in his performances more than any other composer. His gradually changing view of the etude is seen in the three revisions of the *Transcendental Etudes*. The first version was clearly influenced by his teacher, Czerny; in fact, it was dedicated to Czerny. All the pieces are short and their compositional elements are based on simple scale and arpeggio figures which resemble Czerny's Op. 740 exercises, but the second and third versions show dramatic changes in his style.

The progress of Liszt's piano technique was greatly influenced by the violinist Paganini. Liszt first heard Paganini, an extraordinary virtuoso violinist of that time, in 1831 at the Paris Opera House. This encounter began Liszt's search for a

“transcendental” piano technique. Liszt recalled that Paganini could play anything, the most rapid scales and arpeggios, and create every variety of bowing and tone-color.

Alan Walker wrote in *Franz Liszt: the Man and his Music* (1976) that after Liszt heard Paganini’s performance, he changed the course of his musical life. He described the nineteen-year-old Liszt’s thoughts:

“At age nineteen he already had a successful career. At this young age he had no rival as a pianist. Yet he knew that he was able to do more than simply play the piano better than others. Liszt realized that there were technical resources at the piano still to be explored, but in his mind he had no real incentive to pursue them. Then Paganini appeared. Liszt saw himself mirrored in Paganini and he perceived where his future lay.”<sup>19</sup>

The most virtuosic phase of his career came after the encounter with Paganini. He analyzed Paganini’s violinistic difficulties and transposed them to piano compositions, creating the second version of the *Transcendental Etudes* as well as the *Paganini Etudes*. In the second version of the *Transcendental Etudes*, he expanded all imaginable possibilities of the piano, and these etudes have gone down in history as the most difficult set of pieces written for the piano from that time period. This enlargement of piano technique in combination with the new developments in piano playing as seen in Liszt’s etudes definitely created a conflict with the old finger technique. Rapid octave and chord succession and deep fuller tones were not possible from the old finger training methods. Liszt’s super-virtuosic pieces pushed the boundaries of pure finger technique beyond the limit. His music, with its more orchestral textures, thick fast chords, and expanded arpeggio figurations, forced pianists to start using their arm weight.

As discussed above, in the nineteenth century, the piano’s development and composers’ new demands for sounds and techniques required that pianists have a more

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<sup>19</sup>Alan Walker, *Franz Liszt: The Man and His Music*, 2nd ed. (London: Barrie & Jenkins, 1976). p. 46

complex piano technique. Pianists were naturally aware of the changes in instruments and adapted their playing. Nevertheless, in piano schools, pure finger-oriented teaching methods remained in effect for a long period of time despite the many changes in instruments and piano literature. The Lebert – Stark school in Stuttgart was the most famous school where this high finger technique was promoted. By the mid-nineteenth century, many of the European conservatories, particularly in Germany, were teaching this percussive, stiff arm technique.<sup>20</sup> One example of this approach is found in *The Grand Theoretical and Practical Piano School for Systematic Instruction in all Branches of Piano Playing from the First Elements to the Highest Perfection* in four volumes, by Sigismund Lebert (1822– 1884) and Ludwig Stark (1831–1884), which appeared first in 1865. It included the following instructions, which seemed like a practical approach, but which created a “firm” rigid technique.

“Position of the arm: The arm must form a straight line with the hand, because, if it is held higher, we are apt to play with it, while, on contrary it should always be perfectly quiet...If the hand moves from the middle of the key-board in either direction, the fore-arm only must move it, while the elbow and upper arm should remain as near to the body as possible.”<sup>21</sup>

This suggested stationary position affected only finger movement, and might have helped with agility and speed. However, there were gaps between the practice regimen described in their method and actual virtuoso piano technique. In Liszt’s etudes, for example, simply playing finger exercises would help with only a portion of the technical difficulties, but could not develop the wide range of movement on the keyboard required by his etudes with their great variety of tonal colors and complex movement.

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<sup>20</sup> Gerig, *Famous Pianists and Their Technique*. p. 231

<sup>21</sup> *Ibid.* p. 232

As the finger tried to take over much of the work of the arms in the more sonorous literature of the Romantic period, fatigue came quickly along with tension and rigidity in the wrists and arms. One report of injury is given by C. A. Ehrenfechter, an English student of Deppe's. He observed, "Several young students at Stuttgart lost the use of the third finger through overstraining it."<sup>22</sup> Yet many of the nineteenth-century exercises continued to be written only for finger training without an understanding of the underlying physiology. Currently, those finger independence exercises are still widely used in many music schools to develop the kinesthetic feeling of finger independence. However, their current use is different from that in the nineteenth century, when hours of repetition of exercises were somehow believed to lead to excellence of piano technique, but which instead led to harmful practice habits.

### **Arm weight and relaxation**

Historically, one of the important developments in piano technique was to recognize the involvement of arm movement and weight. Even though finger technique was in the mainstream for much of the nineteenth century, many pianists at that time were naturally aware of arm weight in their playing. However, there were no teaching methods which involved the synthesis of other parts of the body, especially the arm. William Mason (1829–1908), Adolph Bernhard Marx (1795–1866), and Adolph Kullak (1823–1862) were forerunners who pointed out problems with the pure finger technique. Among them, Ludwig Deppe (1828–1890) was called the "pioneer teacher of an effective system combining both arm and finger technique."<sup>23</sup> He was the first pedagogue who

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<sup>22</sup> Ibid. p. 235

<sup>23</sup> Ibid. p. 236

described natural movement in actual performance. As he wrote in an article, *Arm Ailments of the Pianist*, in 1885, “tone must be produced, not by finger stroke—that is, not by requiring unnatural strength from the relatively weak muscles of the hand and fingers but coordinated action of all parts of the arm.” Also, he advised that “one who is very much concerned about sensitive tone production while realizing that the whole body in all its complexity must be involved in an adequate technical system”.<sup>24</sup> Deppe emphasized the fundamental importance of proper technique by using a functioning upper arm and shoulder muscles, of which the authors of the early piano methods were unaware. Deppe’s teaching may seem to be nothing new in this present day, but it was a vital and fresh observation in his time.

Unfortunately, Deppe did not leave behind any teaching method book. However, Deppe’s student Elizabeth Caland (1862–1929) published *Artistic Piano Playing as Taught by Ludwig Deppe* which introduced some of Deppe’s teaching and showed changes from the old finger-oriented school to modern piano technique. She stated that the finger and hand will not work individually; all the muscles from the upper arm and back and shoulder are involved to produce tone with arm weight. These muscles act one after the other, and for efficiency of finger action and tone production they must work in perfect rhythm. Caland called this harmonious work of the muscles “muscular synergy”<sup>25</sup> and the most important part of efficient piano playing.

Amy Fay was an American pianist who studied in Europe, and who also left a testimonial about Deppe’s teaching, which represented the change from the old finger school. At first, Fay believed that mechanical finger training was the most important

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<sup>24</sup> Ibid. p. 254

<sup>25</sup> Ibid. p. 256

aspect of piano performance and she went in 1873 to the European conservatories where it was widely taught. She described her earlier lessons with Louis Ehlert, at Tausig's Conservatory in Berlin, which represented the old finger school teaching:

You have no idea how hard they make Cramer's Studies here. Ehlert makes me play them tremendously forte, and as fast as I can go. My hand gets so tired that it is ready to break, and then I say that I cannot go on. "But you must go on," he will say. It is the same with the scales. It seems to me that I play them so loud that I make the welkin ring, and he will say, "But you play always piano." And with all this rapidity he does not allow a note to be missed and, if you happen to strike a wrong one he looks so shocked that you feel ready to sink into the floor.<sup>26</sup>

Later, she studied with various other teachers, and then with Deppe. She stated that his teaching style was different from the others:

.... But Deppe, instead of saying, "Oh, you'll get this after years of practice, shows me how to conquer the difficulty now. He takes a piece, and while he plays it with the most wonderful fineness of conception, he cold-bloodedly dissects the mechanical elements of it, separates them, and tells you how to use your hand so as to grasp them one after the other. In short, he makes the technique and the conception identical, as of course they ought to be, but I never had any other master who trained his pupils to attempt it.<sup>27</sup>

Fay's description of Deppe's teaching was very brief, yet it seems that Deppe was quite flexible in terms of the individuality of students' needs. He analyzed students' difficulties and helped them by considering more flexibility of the finger and arm movements. Caland's statement and those two by Fay show how Deppe's teaching contrasted with the major teaching styles at the end of nineteenth century, and mark the transition into modern pedagogical methods.

After Deppe's death in 1890, there was a continuous stream of publications on piano technique that emphasized physiology, especially around the turn of the century.<sup>28</sup>

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<sup>26</sup> Amy Fay, *Music Study in Germany, from the Home Correspondence of Amy Fay* (New York: Dover Publications, 1965). p. 21

<sup>27</sup> *Ibid.* p. 318

<sup>28</sup> Gerig, *Famous Pianists and Their Technique*. p. 329

Many pedagogues attempted to explain the relationship between the arms, hands, and fingers. These new findings in piano technique which involved the whole arm apparatus were related to the trend of the scientific approach in other disciplines in the second half of the nineteenth century. Among all the teachers with their teaching methods, Rudolf Maria Breithaupt (1873–1945) and Tobias Matthay (1858–1945) had the most significant influence on later piano teaching and attempted to organize the teaching of arm weight and relaxation.

Breithaupt was a student of Deppe's. He attempted to codify his teacher's method in a more systematic manner. His book *Natural Piano Technique* (1905) created a sensation and ran to five editions during the next sixteen years.<sup>29</sup> He was a strong believer in weight technique, and tried to explain the importance of relaxation in the arm, hand, and finger. To that end, he presented four primary physical actions of piano playing:

- 1) the longitudinal oscillation of the arm (vertical motion of the whole arm)
- 2) the extension of the fore–arm (proceeding from the shoulder and upper arm and producing a passive extension of the hand in order to remove the habitual stiffness and limber the elbow joint)
- 3) the rolling of the fore–arm (rotation of the fore–arm)
- 4) the free oscillation of the fingers (the free, loose swing of the fingers and the unimpeded descent of the weighted brachial mass).<sup>30</sup>

Breithaupt criticized excessive tension which resulted from stiffly holding the arms and hands, the exaggerated extension of the fingers, and the continual drilling of

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<sup>29</sup> Kochevitsky, *The Art of Piano Playing: A Scientific Approach*. p. 9

<sup>30</sup> Gerig, *Famous Pianists and Their Technique*. p. 344

each finger separately. These tendencies resulted in a complete or partial stiffening of the wrist or elbow–joint, which he believed unnecessarily wasted muscular energy. Instead, he suggested the free, natural oscillation of the arm: maintaining a loose arm, playing with weight–touch, and using fingers as passively as possible. He stated that as long as the fingers participate in the oscillation of the whole arm and hand, they may do anything; but the moment they perform their movements without participation of arm and hand, everything is wrong.

Breithaupt’s beliefs resonated with current teaching and methods, but he was extreme in his criticism of the old finger schools, which created many conflicts with other teachers. His tendency towards relaxation of the whole apparatus and the attempt to substitute oscillation of the arms for finger movement ignored the basic anatomy of muscle movement, which requires a certain amount of exertion and articulation of finger movement. However, his method gave teachers and students the opportunity to discuss the new approaches, and the concepts of weight playing and relaxation became standard teaching principles.

Tobias Matthay (1858–1945) was an extremely influential English piano pedagogue who also organized piano technique emphasizing arm weight and relaxation techniques. Beginning with his first major publication in 1903 entitled *The Act of Touch*, he produced a prolific series of publications covering methods for the young beginner to the advanced pianist, physical relaxation and exercises, as well as more philosophical aspects of musical interpretation. Even though his explanation of his method is very wordy and sometimes very difficult to understand (even his follower Ambrose Coviello

wrote a small undated volume entitled *What Matthay Meant*)<sup>31</sup>, he had a great understanding and thorough analysis of piano technique.

Matthay's approach to the piano was similar to Breithaupt's, in that it emphasized relaxation and involved the whole apparatus, including the arms. However, he also addressed sensitivity to sound, analyzed various finger touches, and paid greater attention to key resistance. In fact, one of his realizations regarding key resistance came by observing Anton Rubinstein's performance and was described thus by Jessie Matthay:

“...Naturally after hearing Rubinstein he had to attempt the C Major staccato study. He had been playing it on a piano with little key–surface resistance. On now changing for a reason to the Erard piano (which had been Rubinstein's instrument), he was told by the manager: “Ah, you will find it much easier to play this Etude on the Erard.” However, Matthay found to his surprise, when he began practicing on the Erard, that the new action, so far from helping him, entirely balked him, and that the C Major went from bad to worse.”<sup>32</sup>

In those days, the full weight of the Erard action was difficult to play for many pianists. Matthay must have applied the old finger technique to control this heavier action of the key, but he was unsuccessful and changed his approach to the piano. Playing the Erard piano, Matthay had to adjust for every note after reaching the key. He believed that key resistance was essential and that the sensation and timing of correct touch are always upwards by reaction from the key, against the knuckle and the wrist.

Matthay attempted to find the proper coordination between the arm, hand, and fingers according to key resistance. He described a variety of touches in a more systematic way, stating that there were three main muscular uses or “Species of Muscular–Combination or Touch–Formation.”<sup>33</sup> He discovered that for the key descent,

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<sup>31</sup> Ambrose Coviello, *What Matthay Meant, His Musical and Technical Teachings Clearly Explained and Self–Indexed* (London: Bosworth 1948)

<sup>32</sup> Gerig, *Famous Pianists and Their Technique*. p. 370

<sup>33</sup> *Ibid.* p. 385

the added impetus is required, which can be muscularly provided in the following three forms (which he called species) of touch–construction or formation:

1<sup>st</sup> species: finger–exertion alone, with passive hand and self–supported arm.

2<sup>nd</sup> species: hand–exertion behind the finger, with self–supported arm.

3<sup>rd</sup> species: momentary lapse in arm–support, behind the hand and finger exertions.

Matthay’s wording is rather challenging, but he meant that the muscular components which provide the act of touch are a) finger exertion, b) hand exertion, c) arm weight.<sup>34</sup>

Matthay went on to specify two basic opposing finger positions: the bent–finger or thrusting attitude and the flat–finger or clinging attitude. By combining these finger positions with the species described above, he came up with 42 different varieties of touches.

Another of Matthay’s unique teaching emphases was forearm rotation, which he believed to be always occurring to support tone production in both visible and invisible ways. Visible rotation is clearly observed, while invisible rotation was conceived as an extremely small movement or release of tension that occurs in the direction of the finger to be used with a small preparatory movement away from that finger. He purported that these invisible impulses take place even in rapid passage work.

Numerous rotation exercises and other finger exercises are included in one of his books, *Muscular Relaxation Studies* (1912), which covers all phases of his system. Here he suggested many exercises away from the piano as well as at the piano, designed to develop the student’s kinesthetic awareness of the complete apparatus, including the finger, hand, wrist, forearm, upper arm, and shoulder. Matthay believed that in order to

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<sup>34</sup> Ibid. p. 381

create a variety of different touches, pianists need to learn the fine execution of muscle control, and that warm-up exercises are always required for pianists to bring out the right balance between fingers and keyboard. He stated that many of his daily exercises away from the piano could reduce practice time to reach that goal.

Although Matthay had a great understanding of technique and numerous suggestions for exercises, he had some difficulty explaining actual execution because his ideas were based on kinesthetic sensation, not scientifically-exact studies. Different critics have taken issue with some of his descriptions of technique because they are not exactly correct from an anatomical or biophysical perspective. Nonetheless, his recommendations come from experience as a pianist, and they can be instructive in helping another pianist experience different sensations at the piano. It is this author's opinion that a useful description of a sensation may be all that is necessary to achieve a specific execution in piano technique, because it draws the correct motion out of the student, regardless of whether or not it is scientifically correct.

Despite the lack of clarity in Matthay's descriptions, his contribution to the literature of piano technique is significant. Matthay tried to systematize the functions of the finger, hand, and arm. He presumably knew the physical sensations of fine piano playing, and his technical thoughts on the invisible conditions of good muscular coordination and relaxation were certainly an advance in technical thinking. He encouraged the use of the arm and advocated sensitivity to key resistance as well as sensitivity in finger and arm coordination. Matthay's method contains many important suggestions and can help a great deal to correct students' technical flaws even today.

### Scientific and Physical Approaches

At the beginning of the twentieth century, many piano pedagogues attempted to adjust their methods to scientific studies, for example, Thomas Fielden (1883–1974), Otto Ortmann (1889–1979), and Arnold Schultz (1903–1972). Thomas Fielden was an English pedagogue who tried to explain his piano technique with input from physiology and neurology, which he published in 1927 under the title *The Science of Pianoforte Technique*. He discussed the similarities and differences between his method and those of Matthay and Breithaupt. He agreed with previous teachers' findings and stated: "The foundation stone of the discoveries of the two masters was the use of weight in the production of tone, and the use of relaxation both in producing that tone and avoiding stiffness in the hands and arms."<sup>35</sup> Nevertheless, he also advised: "...it is necessary to point out that neither of these men, Matthay less than Breithaupt, sufficiently emphasized the necessity for scientific knowledge of physiology, and the relations and coordination of muscular actions; nor did they insist enough on the knowledge of the laws of mechanics...."<sup>36</sup>

Fielden emphasized knowledge of the muscular processes and the study of the mechanism of the hands and arms. In his book, he analyzed the arm and finger muscles used in piano playing, and described the function of the finger, hand, and arm as a lever used in the act of touch. He discussed "controlled contraction" and "fixation," unlike Matthay and Breithaupt, and the importance of its timing:

"Stiffness in playing arises from too much contraction beforehand and ... too much relaxation before this movement on the other hand, leads either to flabbiness or to hard thumping tone. True suppleness lies in securing the full contraction at the right moment, neither before nor after: this constitutes perfect

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<sup>35</sup> Thomas Fielden, *The Science of Pianoforte Technique* (New York: St. Martin's Press, 1961). p. 10

<sup>36</sup> *Ibid.* p. 5

timing. Finally, at the point of contact the muscles are not in relaxation at all, as advocated by the devotees of relaxation: on the contrary, they are in contraction, but resilient, preparatory, if necessary, for relaxation, but most frequently using their resilience to carry the arm to its next movement.”<sup>37</sup>

Fielden also signaled the importance of the central nervous system as the basis for most of our activity:

“Knowledge of the muscular processes is desirable and a deep study of the marvelous mechanism of the hands and arms: and the goal should be the mental and nervous control of all the movements of which these wonderful implements are capable.”<sup>38</sup>

Fielden’s contribution is that he attempted to combine many studies of the human body (including physiology and even the central nervous system) to discover the best approach to piano technique. He included parts of the eminent old school by recognizing the importance of finger strength and combined it with the newer concept of arm weight. His method was functional in that it included even a series of gymnastic exercises for strengthening fingers and other muscles. Attempting to analyze piano technique in a scientific way, his approach was more logical, clear, and practical than previous piano methods.

Otto Rudolph Ortmann (1889–1979), professor at the Peabody Conservatory of Music in Baltimore, produced an even more comprehensive and scientific study of piano technique, *The Physiological Mechanics of Piano Technique* (1927). He examined the scientific fields of physiology, anatomy, and physics, and used mechanical devices to better measure all the physical movements used in piano playing. In his book, he described physiological mechanics applied to piano technique and studied the balance

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<sup>37</sup> Ibid. p. 66

<sup>38</sup> Ibid. p. 10

between the variations of force produced at the key surface which could be applied to general human skeletal and muscle systems.

Like previous recent pedagogues, Ortmann stated that the finger cannot work by itself, but rather that the finger, hand, wrist, and arm are interrelated in the work of piano playing. He further explained that the bones of the fingers, hands, arms, and their respective joints and surrounding muscles are working as an interconnected system of levers. In the body, bones are levers, the joint is a fulcrum, and muscle contraction provides the force to move a body part (weight). He presented three different models (or classes) depending on the position of the force, weight, and fulcrum. In the first model, the fulcrum lies between the force and the weight (or resistance) like a seesaw, whereas in the second model, the weight lies between the force and the fulcrum like a wheelbarrow. He stated that the third model of the lever system, where the force is applied between the fulcrum and the weight like tweezers, is the most important. The great speed obtained in arm, hand, and finger movements is achieved with relatively little muscular contraction, because in the third model of the lever system, the direction of the force can be manipulated more easily to create a shorter distance of movement.<sup>39</sup>

Ortmann also extensively described the skeletal and muscle systems in relation to piano playing. He precisely indicated the range of movement in all of the joints, including fingers, wrist, elbow, and shoulder, stating that “every actual movement made in piano playing involves simultaneous movement in various joints, the degree of participation varying as the movement continues.”<sup>40</sup> He further wrote that the best manner of making a movement to a certain point on the keyboard varies with the

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<sup>39</sup> Otto Ortmann, *The Physiological Mechanics of Piano Technique* (New York: E. P. Dutton and Co., Inc., 1962), p. 12

<sup>40</sup> *Ibid.* p. 33

individual skeletal structure, and that “the physiologically best movement is the one permitting motion near the middle of the range of the joints involved.”<sup>41</sup> Some students have limited movement in their joints; Ortmann said that “is usually the result of super-normally tight ligaments, excessive flesh around the joints or even muscular limitation.”<sup>42</sup> In order to expand the mid-range of movement, he discussed the value of stretching exercises. The pianists or students whose hands or fingers are limited by their basic skeletal span could benefit from stretching exercises or massage, which may help relax the ligaments and muscles and thus permit greater freedom in the joints.

Ortmann also addressed the importance of the muscle system that supplies the energy needed to activate the levers of piano playing. He analyzed muscular motion starting with the back muscles (which move the shoulder), continuing to the upper arm muscles (which control the movement of forearm), and then the forearm (which regulates the hand movements and some finger movements). Finally, he ends with the muscles in the hand, which exert the small muscle control in finger movement. From the analysis of muscle position and functions, Ortmann concluded that the complexities of joint movements require muscular coordination. Any movement involves more than one muscle, and one muscle may activate more than a single joint and assist in varied movements. The greater the distance or forcefulness of movement required, the greater the involvement or spread of muscle participation.

He further wrote that there are many problems with properly understanding muscular contractions, and that tension is always present in some form. For example, an absence of motion does not mean a lack of muscular activity. There are always opposite

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<sup>41</sup> Ibid. p. 33

<sup>42</sup> Ibid. p. 39

sets of antagonistic muscles that may be contracting against each other with equal force in order to hold various joints in stable positions. Gravity has a greater effect on muscular contraction for an upward movement than for a downward one.

Because of continuous muscular activity needed to hold various positions, even the smallest body movement will involve a complex muscular movement or tension. Ortmann asserted that total relaxation would not happen in any body motion, especially in piano playing. However, he cautioned that the player must properly handle the muscle contractions. Over-tension of the muscle across the joint occurs when there is more contraction than what is needed to conquer specified resistance in the keys. Several muscles and joints must operate simultaneously without unnecessary friction to achieve maximum efficiency.

Contrary to what Matthey and Breithaupt asserted, this contraction of muscles greatly influences the transfer of weight. Ortmann constructed mechanical arms to show how each joint system needs some fixation to hold the shoulder, arm, and hand in playing positions, and also presented the system of weight transfer. In order to merely maintain the finger-tip in a fixed position upon a key from the shoulder joint to the fingers, all other joints must be fixed at least to the point necessary to overcome the weight of the intervening parts.<sup>43</sup> In addition, the position of all the joints changes the center of gravity and could affect the force of finger impact. He described the following experiment to find the effect of arm weight and position of the shoulder, arm, and hands:

“Rest the cupped hand upon a balance so placed at the side of the body that the body may be moved forward and backward without exceeding the reach of the hand. Use the normal arm-relaxation of playing. If the experimenter is careful to avoid additional muscular contraction of the arm as the body moves, the dial on

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<sup>43</sup> Ibid. p. 126

the balance will show an increase in weight as the body moves backward, away from the hand, and a decrease as it moves forward toward the balance.”<sup>44</sup>

This description contradicts what common sense would assume, but Ortmann stated that this weight change reflects the muscular contraction exerting its own force. Thus, both gravity and muscular contraction create force in piano playing, which requires the pianist to learn how to control both types of force.

Ortmann explained the kinesthetic feeling of striking the key more clearly than Matthey, who vaguely stated that the motion is more upward than downward because of key mechanism. For the pianist, more complex muscle control is required in order to produce speed and tonal color. Naturally, pianists are aware of the action and reaction of the muscles and the keyboard. Any force moving down into the key is opposed at the point of resistance by an upward-acting force, at key contact. Ortmann wrote:

“[W]hat actually happens is that the player imagines the key resistance, and hence prepares the speed of muscular contraction, the necessary fixation of the joints, before the key is reached. Through experience and talent, this image can function very accurately, and upon its accuracy depends the question of whether or not the player will get the desired tonal result.”<sup>45</sup>

He also stated that there are two opposite types of movement: an active movement, caused by muscular contraction resulting from the player’s desire and conscious control; and a passive movement, resulting from the reaction of the key resistance, which is the stimulus from the outside of the body. Ortmann pointed out that “the differences in muscular coordination between these two types (active and passive) of movements have a most important bearing upon problems of piano pedagogy.”<sup>46</sup> If keyboard movement is well coordinated, it must meet the demands of each of these with as little waste of

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<sup>44</sup> Ibid. p. 130

<sup>45</sup> Ibid. p. 87

<sup>46</sup> Ibid. p. 90

physiological energy as possible. According to Ortmann, the “degree of muscular relaxation will transmit the desired force to the desired point in the proper time.”<sup>47</sup> Either too much or too little relaxation can lead to a lack of coordination. For example, the joints of the finger and hand must be rigid enough to support the weight of the arm resting on the keys.

Ortmann investigated how muscular coordination is affected by varying degrees of speed, force, and range of movement using a mechanical device which recorded muscular contractions. He found that muscular reaction and coordination change greatly with differences in speed, which affect the timing and the intensity of the contraction, and the contraction’s location within the range of movement. In a slow movement, there is less muscular force and intensity but there are more prolonged effects from gravity and other factors such as joint resistance. Also, the timing of the movement, such as start and stop, is easier to control, whereas in a rapid movement, the contraction will have to come earlier and will require stronger action.

In rapid movements, an understanding of inertia and momentum is very important. The initial whip-like action, followed by sufficient muscular relaxation and twitch-like action, can create inertia and momentum for the fast speed motions. The timing of the muscular contraction will occur a little bit before the point of key resistance. By the time the key is touched, muscular relaxation has already begun to set in. Ortmann wrote: “Time-relationship between muscular contraction and duration of stroke may, therefore, be considered a basic element of coordination... Muscular contraction does not parallel the range of movement as speed increases. The faster the movement, the more the muscular contraction approach (becomes like an) initial maximal twitch (a simple,

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<sup>47</sup> Ibid. p. 100

fleeting contraction) followed by relaxation.”<sup>48</sup> For proper piano playing, the body must act at the best mechanical advantage and in a coordinated manner. The functioning of small and larger muscles alike is also essential to create the best mechanical advantage. If the same movement can be made by both a large or a small muscle, it must be determined which provides the better coordination. Ortmann set down the principle that rapid movements and small-range movements naturally belong to the smaller muscles and joints; movements of power and those of wide range are better handled by the larger muscles and joints. In the latter case, the larger mass cannot move rapidly in various directions in a coordinated manner because of the problems of inertia and momentum involved. Where rapidly repeated movements or a quick change of direction are necessary, the small levers of the finger and hand should be used. At the same time, more small muscles will be used for passages of speed and lightness than in ones of speed and force. Ortmann stated that the performer who has great strength in these muscles will have a distinct advantage. If a large muscle has to be used instead of a smaller one because of lack of strength, the student will have to contend with a slower moving mass and a greater inertia problem. Ortmann emphasized that purely gymnastic training of the small muscles of the finger, hand, and forearm in order to increase their absolute strength is therefore, from a mechanical standpoint, highly desirable for piano technique.

Through extensive laboratory experimentation, Ortmann studied various physiological aspects in body movement at the keyboard. His findings clarified many ambiguous statements and practices in the older methods, for example, in teachings of relaxation and weight transfer. Ortmann believed there was some truth in the older methods. He found that some passages require only finger action with a quiet hand

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<sup>48</sup> Ibid. p. 112

motion, which was the teaching of the nineteenth-century finger school. On the other hand, other passages require arm participation depending on how skeletal and muscle systems adjust in the particular execution of tone production. In many cases, he stated, there is no total relaxation or total isolation; the finger, hand, wrist, and arms all work together. In order to create maximum performance, Ortmann emphasized the importance of coordination throughout his research. He argued that an understanding of the mechanical functions of all the skeletal and muscle systems is essential, avoids wasted time during practice, and even prevents injuries. He wrote:

“Knowing the location of a muscle and its various angles of pull will readily prevent the assignment of impossible mechanical conditions; it will make possible correct muscular drill; it will aid in distinguishing normal muscular fatigue from the fatigue of in-coordination; and it will economize in practice time and method.”<sup>49</sup>

Ortmann’s research and observations are very important in the history of piano technique, viewing the pianist’s body in a more objective and scientific way. Throughout his research he pointed to the physical complexity inherent in piano playing. Physical coordination will be different in a variety of musical situations, depending on tempo and tonal intensity. He believed the player’s attention should be directed to the coordination of both finger-action and arm movement. In this manner, Ortmann’s research previews many of Mikimoto’s ideas and approaches to piano technique. Indeed, the emphasis on musculature and the scientific approach to proper motion connect these two figures in a very interesting way. Mikimoto carefully observed the function of both skeletal and muscle systems used in piano technique and created numerous exercises designed to develop students’ strength and coordination, which seem in some sense, to follow Ortmann’s suggestions.

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<sup>49</sup> Ibid. p. 377

## **Psychological Approaches**

Broadly speaking, all of the physical suggestions found in piano methods require the inherent neurological processes of the brain. All coordination and timing of the actions must be carefully calculated in the brain, requiring complex brain functions at the conscious and subconscious level. Fielden and Ortmann realized the importance of the nervous system, but just briefly mentioned its effects in their writings. The relationship between physical movement and mental and nervous processes had been discussed many years beforehand. The German scientist Emil DuBois–Reymond (1818–1896) and the pianist and teacher Oscar Raif (1847–1899) both addressed the importance of the central nervous system in controlling the complex movements of piano playing. In a lecture given in 1881, DuBois–Reymond stated that complex movements require every sensation, including the visual, tactile, and kinesthetic senses. For improvement of skillful movement, those kinesthetic senses must work together with the mind to produce the desired movement. Furthermore, practice improves not only movement, but also those senses at the same time. He said that gymnastic finger exercises only improve strength and endurance, but do not necessarily aid in the execution of a complicated movement. He believed that the pianist’s talent and virtuosity resides not in the hand, but rather in the central nervous system.<sup>50</sup>

In 1898, Oscar Raif also argued that individual finger training alone is not sufficient, and he introduced an experiment showing the importance of the nervous system in piano technique by comparing the finger movements of pianists and non–pianists. He found that some people who had never played the piano could easily make

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<sup>50</sup> Naotaka Sakai, *Pianist's Hand – Injury and Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2002). p. 56

as many as seven movements with one finger in a second, whereas a number of good pianists were able to make only five movements.<sup>51</sup> He also observed how many finger strokes were performed by each finger in a two–octave scale. He stated that individual finger agility is not so important in scales, and concluded that there is probably no relation between individual finger agility and piano technique. Instead, precise timing of the successive movements of the fingers is key.<sup>52</sup> Overall, these papers by DuBois–Raymond and Raif seem to obviate gadgets and “mindless” finger exercises.

There have been many other pedagogues who emphasized the mental processes in piano studies, but George Kochevitsky is one of most well–known pedagogues to publish his studies on the psychological and neurological aspects of piano technique. In his book, *The Art of Piano Playing: A Scientific Approach* (1967), he asserted that the most important part of piano study is to understand the structure and function of the central nervous system. He described how consciousness and sub–consciousness (or the automated element) co–exist in piano playing. He stated that our motor activity at the piano has to be directed by our mind, which must focus on many elements simultaneously, including the control of any particular movement during the entire physical progression (starting with musical imagination, continuing through the movement, as well as adjusting to the actual sonority as it is heard).<sup>53</sup> Those continuous processes stimulate the brain and bring motor impulses into the sub–cortical centers of the midbrain and cerebellum, the so–called the extrapyramidal system, to accomplish the act of playing.

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<sup>51</sup> Kochevitsky, *The Art of Piano Playing: A Scientific Approach*. p. 12

<sup>52</sup> Edward Wheeler Scripture, *Studies from the Yale Psychological Laboratory* (Connecticut: Yale University, 1899). p.13

<sup>53</sup> Kochevitsky, *The Art of Piano Playing: A Scientific Approach*. p. 21

Kochevitsky also asserted that subconscious or automated skills in piano-playing reflexes are essential. The speed with which a player reacts to outside stimuli (in this case, key resistance or dynamic changes in acoustics) depends on the player's reflexes. He emphasized the importance of proprioceptive sensory elements, the sensations from motor activities conveyed and perceived in our central nervous system. This proprioceptive sensation determines how much energy is required to perform certain motions, and is particularly salient in the execution of more subtle skills. In addition, he discussed excitations and inhibitions, the fundamental processes of the nervous system. When a stimulus creates excitation, there is always an inhibition (reaction) to suppress superfluous impulses. Muscle contraction and relaxation are very dependent upon this process, and the balance between these excitations and inhibitions creates smoothness or awkwardness of movement.

The research and ideas of both Ortmann and Kochevitsky seem to be present in Mikimoto's method. Mikimoto strongly believes in the effects of brain functions on piano technique. Many parts of her exercises are designed to stimulate the fundamentals (kinesthetic awareness) of the nervous system, as well as to help the student better understand how it works. She believes that it is essential for players to train muscle movement; they must always be aware of these functions to develop their technique more effectively.

### **Current Teaching and Awareness of Physical Limitations and Injuries**

Current teaching methods are very diverse. Deppe can be seen as the father of the weight school of technique, which recognized the importance of arm movement and

weight and relaxation in piano technique. Many teaching methods have elaborated on his findings. In the early twentieth century, Matthay, Fielden, and Ortmann attempted to analyze piano technique from a scientific basis, which emphasized the mechanical aspects of muscle function. However, their approaches are different from each other, which Pamela Jo Parter pointed out in her dissertation, *A Comparison of the Techniques of Piano Playing Advocated by Selected Twentieth-Century Pedagogues*. “Matthay analyzed technique in terms of the sensations during playing, but Ortmann distrusted the performer’s feelings about what was occurring physically and measured kinesthetic reactions during playing in an objective way through the use of recording instruments.”<sup>54</sup> Later, in the mid-twentieth century, Kochevitsky extended the scientific basis introduced by Matthay and Ortmann to include the neurological control of muscle function, which also incorporated consideration of the role of human psychology. The practice of modern teaching seems to have absorbed many of these earlier studies without expressly referring to them. The question is, currently, how accurately those principles are put into practice.

Prater points out that pianists tend to reject the findings of Ortmann and other pedagogues simply because they appear to be overly analytical. She further states that many musicians seem to fear that an overly rational approach towards playing will destroy the spiritual aspect of musical expression.<sup>55</sup> However, attitudes change when pianists start teaching others with less ability and experience, or when they themselves face physical problems. It is at this time that the maligned technical methods gain importance as a source of ideas to confront these new challenges.

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<sup>54</sup> Pamela Jo Prater, "A Comparison of the Techniques of Piano Playing Advocated by Selected Twentieth-Century Pedagogues" (dissertation, The University of Texas at Austin, 1990). p. 123

<sup>55</sup> Ibid. p. 125

In 1981, the *New York Times* carried a story about Leon Fleisher's and Gary Graffmann's hand problems, titled "When a pianist's fingers fail to obey".<sup>56</sup> Even though there had been many reports about hand injuries, including Schumann's famous hand ailment, this *New York Times* article broadened the public discourse surrounding musicians' performance-related injuries. In 1982, the Performing Arts Medicine Association (PAMA) was organized and commenced publishing *Medical Problems of Performing Artists*. As a result of this discussion and awareness, teaching methods have developed to include injury prevention. Many instructors who believe that the core of piano technique lies in coordination and larger-muscle support argue against isolated finger exercises, such as the widely-used *Technical Studies* by Josef Pischna (1826–1896), *Preparatory Exercises, Op. 16* by Aloys Schmitt (1788–1866), and many finger-oriented exercises by Czerny. These instructors purport that finger-oriented exercises are a burden to the small muscles of the hand, which are more likely to be injured. On the other hand, many instructors still believe in the benefits of finger isolation exercises. According to them, the degree of usage is what matters; if used properly, these exercises help with the development of finger independence, which they view as the most important aspect of piano technique.

Brenda Wristen has compared these opposing viewpoints concerning the use of technical exercises. One view is held by Nelita True, professor at the Eastman School of Music, who "believes that developing technique apart from repertoire is valuable. By developing her technique separately, she was able to learn repertoire faster. Based upon

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<sup>56</sup> Jennifer Dunning, "When a Pianist's Fingers Fail to Obey". (New York: The New York Times, 1981).

her personal experience, she recommends that students cultivate technique apart from repertoire. She holds the opinion that this approach helps prevent injury.”<sup>57</sup>

In opposition to this viewpoint is Dorothy Taubman, a pedagogue currently instructing students in building injury–preventive technique. She holds that many motions used in piano playing are too small to be recognized visually. Most technical training exercises are based on the visible, not taking into account invisible motions which cause visible results. She claims that this has led to an overemphasis on training the fingers, and further asserts that technical exercises do not serve their alleged purpose. While practicing Czerny and other etudes may not do harm in and of themselves, she thinks that they are a waste of time. Singling out basic skills in an exercise will not solve problems encountered in repertoire, which are often related to their context: what comes before or after. Thus, Taubman purports that isolation will not fix the technical problem, and that practicing exercises often reinforces bad habits.<sup>58</sup>

How can we find the truth in these two opposing viewpoints? This is virtually the same question we faced when looking at the history of piano technique. Some pedagogues over–emphasized finger strength (in the early finger school or later finger gadgets), while others over–emphasized arm weight technique (as in the weight school) or a more mental and psychological approach. Again, it is very difficult to describe kinesthetic feeling when talking about piano technique. As a result, instruction can be misunderstood, and finger–oriented exercises may cause tension and fatigue. By the same token, forearm rotation and arm technique might create a lack of finger

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<sup>57</sup> Brenda G. Wristen, "Overuse Injuries and Piano Technique: A Biomechanical Approach" (dissertation, Texas Tech University, 1998). p. 53

<sup>58</sup> Ibid. p. 53

independence. However, both approaches have a different relative value on a case-by-case basis and can be applied to suit each student's particular needs.

It is this author's view that the best way to develop an effective piano technique is by utilizing all approaches. In the history of piano technique, there have been many fundamental concepts, such as finger exercises, arm weight, relaxation, and coordination, which maximized development. Instructor and student could make their studies more effective and enriching by considering those aspects mentioned above. Mikimoto's method is based on the physical training which many pedagogues have criticized in the past and present. However, her exercises are not mindlessly prescribed like old finger gymnastics, but instead utilize the best elements developed throughout the history of piano technique in order to lead students to an understanding of the many aspects crucial to improved performance.

## **Chapter III**

### **Mikimoto Method – Description – Unique features**

#### **Mikimoto's Beliefs on Piano Technique**

Around 1965, Mikimoto started to research finger training and to examine the hands of many concert pianists, including Vladimir Ashkenazy and Andre Watts. She found great muscle strength, agility, and coordination in their hands. Even though it is widely said that great pianists are born with their talent, she believes that more-average piano students can overcome their physical limitations through specific physical training and can even begin to approach the physical traits of the great pianists. According to Mikimoto, students frequently waste hours at the keyboard without developing their muscles properly, often reaching plateaus in their progress. Because of uneven muscle development, students can develop bad habits which can lead to injuries.

Mikimoto asserts that many of the students' technical problems are caused by failure to understand their physical weaknesses. She found that even though each student has the same bone and muscle structure, each develops technique differently. Perhaps because of this, many students do not understand how muscles work together, nor how to use them effectively. As a result, many develop uneven strength in various muscles needed for piano playing. She points also to physical variation between different students (for instance, some have weaker joints or tighter tendons) as a cause for uneven development in muscle strength, and resulting technical problems. She believes, like other pedagogues in the past, that the pianist needs to develop not only the finger, but also the wrist, forearm, upper arm, and even chest and back muscles in order to achieve

well-coordinated piano playing. But she further states that as students become aware of the physical/structural relationships within their bodies, especially the inherent weaknesses unique to themselves, they can tailor the practice regimen to match their individual needs. This tailoring of the practice session will accelerate each student's progress, result in more efficient practice, and possibly avoid unnecessary injuries caused by excess tensions.

Mikimoto has been teaching piano in Japan for over 30 years. Her early teaching method was first introduced in 1978 in *Clavier Magazine*. Here she introduced three important elements for the development of piano technique: 1. development of finger independence; 2. stabilization of finger joints; 3. understanding of the nervous system that controls muscles and joints. She asserted that many cases of failing finger independence come from the weakness of individual muscles and unwanted compensation, and that all compensation occurs because of characteristics specific to each student's nervous system:

“There are three main nerves which make fingers move, and when we strike the key using one finger we use about six different muscles. Almost no one can use all these muscles equally, depending on the individual's control of his or her nervous system, which differs widely. If a student has started using one specific muscle, he tends to continue using it – more or less ignoring the others. Thus, some muscles become highly developed and others remain as they were when the student was ten years old. Since the function of the muscles is closely related to the development of the nervous system, those muscles in which the nerves transmit the signals faster can easily be further developed.”<sup>59</sup>

Mikimoto's explanation is a little vague at this point, and further elaboration is helpful.

When she refers to the transmission of signals in the nervous system, she is stating that once a neurological connection is made when learning a specific movement (i.e. forearm

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<sup>59</sup> Sumiko Mikimoto, trans. Dorothy Packard, "More about Sumiko Mikimoto's System of Finger Exercises," *Clavier* (1972, June). p. 30

rotation), it tends to be used again, so that it becomes the dominant connection and the automatic movement for students when they execute that motion. The original movement and its connection supersede later connections that might require a slight physical adjustment to the original movement, such as a forearm rotation requiring more finger movement of the fifth finger.

She went on to explain that this tendency of the nervous system creates even more problems for weak joints:

“Students who have weak joints, particularly young students who try to play forte before their hands are ready for it, often compensate for this weakness by using the muscles of the upper arm and also those of the wrist, just to depress the key. This substitution becomes a habit; thus the correct muscles are not used enough when the students reach the age of muscular development. Also, when one finger is not strong enough, the student not only uses the muscles of that finger but often is assisted by the muscle of other fingers which don’t need to move. This means that the students do not develop the independence of their fingers.”<sup>60</sup>

Since that initial 1978 article, Mikimoto’s research and experience with students has greatly expanded. Her most current method is found in her 2004 book, *Correct Piano Technique*, which reinforces the 1978 *Clavier* article and contains many more ideas and practical exercises to address the various problems that piano students face.

Fundamentally, her beliefs have not changed over the years. Her main point still stands: physical training can alleviate weakness of the muscles and joints as well as develop more efficient piano technique. She states that an understanding of the nervous system is necessary to carry out her exercises for motor skill development and will aid in developing a more efficiently coordinated movement.

She believes that understanding the physical structure and exercising isolated parts of the hand and arm are essential to create the best coordination, because isolated

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<sup>60</sup> Ibid. p. 31

training increases the kinesthetic sense. Also, since all students have slight differences in their physical structures, simply playing Czerny and Hanon exercises might not develop technique the same way in all students, unless fundamental problems are addressed.

Customized exercises would be required to strengthen individual weaknesses effectively.

As stated earlier, students share essentially the same anatomic structure of muscles and bones, yet develop their piano technique differently. She explains that some students' slow progress is caused by variations in length, strength, and shape of the muscles, tendons, and bones, as well as the sensitivity of each student's nervous system, resulting in a unique kinesthetic sense in the muscles.

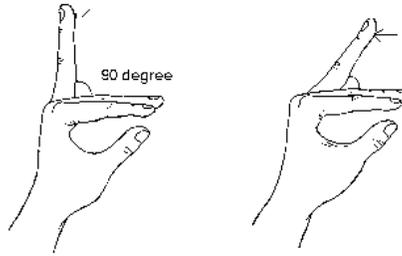
These physical differences can cause bad habits when students try to compensate for their inherent physical weaknesses, which are difficult to perceive through simple observation. Over the years she has found the following physical variables:

1. Some students have tight connections (tight tendons) between their fingers.
2. Some finger tendons can be shorter than others.
3. Forearm tendons and muscles, which stabilize the hands and finger joints, come in different lengths.
4. There are different lengths in the extensor and flexor muscles which lift the fingers.
5. There are slight differences in bone size and alignment. For example, some fourth fingers are slightly longer or shorter, which can affect playing in the open hand position.
6. Wider spaces between bone joints cause instability of the fingers, such as double-jointed fingers.

Among these physical differences, Mikimoto believes that an unstable joint creates the most problems in the development of piano technique. Unstable joints are caused by weak finger muscles or excess spaces between the finger bones of one finger. Once developed, finger muscles are sufficient to hold the finger joint to transfer the weight of the arms. However, especially for young students, if the surrounding finger muscles are weak, or if the student has a wider space at a joint, the finger joint is destabilized and unable to transfer the full arm weight into the key bed through the fingers. Mikimoto explains that because of unstable finger joints, the wrist and elbow tighten to compensate and hold the weight, creating excess tension in different parts of the wrist and arm. As previously noted in her 1978 article, she believes that this excess tension will become a bad habit later.

Mikimoto also asserts that tight and short tendons disturb the flexibility of finger movement, causing problems with finger independence and creating tension in the wrist and forearm. Flexibility is measured by the ability of a joint to move freely without any discomfort. If there is no flexibility in tendons, they require more force in their movement, which leads to tension problems in the hand and wrist. Each finger should have efficient stretch. Mikimoto says that the angle between the thumb and second finger, and angles between pairs of adjacent fingers (with one perpendicular to the palm) provide a good measure of their flexibility. Students with less than a ninety-degree stretch between the fingers, as shown in Figure 3–1, would likely have problems with wrist tension when they play.

### Figure 3–1: Finger Stretch



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 83.

Like Ortmann, Mikimoto points out that stretch exercises are the most effective solution for tight tendons and also give fingers more flexibility. In the same way that ballerinas stretch all the time to maintain extension and flexibility in their legs, pianists can experience the same effects in their fingers. In this vein, *The Encyclopedia of the Human Body* seems to corroborate Mikimoto’s statement that “activities that improve flexibility involve stretching and holding exercises, and ensure that muscles are supple and ligaments and tendons remain in good working order”.<sup>61</sup> She suggests several exercises for stretching tight tendons, which will be discussed in depth later.

In her 2004 book, in addition to the discussion of physical variability among students, Mikimoto addresses three fundamental areas where students should increase their knowledge before they apply her exercises: 1. the nervous system for motor activities; 2. relaxation and minimum contraction of muscles; 3. weight transfer for tone production. These three elements, discussed in detail below, are essential to create proper action in piano playing and can help students find and resolve the causes of their own weaknesses.

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<sup>61</sup> Richard Walker, *The Encyclopedia of the Human Body* (New York: DK Publishing, Inc., 2002). p. 73

## Nervous System

Mikimoto states, as have Kochevitsky and other pedagogues, that piano playing is an activity involving motor skills and the complexity of the nervous system. The action of playing the piano involves various muscle movements all controlled by the brain.

Mikimoto's description of the central nervous system is in line with those found in many other sources. For instance, *The Encyclopedia of the Human Body* offers the following:

“The nerve impulses that stimulate contraction are carried in nerves by bundles of wire-like motor neurons. As a motor neuron nears a muscle, it divides into several branches called axon terminals, each serving a different muscle fiber. Together, each motor neuron and the muscle fiber it stimulates are called a motor unit. The more neurons that ‘fire,’ the more motor units that shorten and the stronger the contraction.”<sup>62</sup>

Fingers have the ability to execute very precise movements. Finger movement is triggered by the motor cortex, which sends signals to muscles in the arm. Once it is underway, sensory signals travel back to the motor cortex, via the cerebellum and the thalamus, where they contract the muscle by exactly the right amount. Because of this fine feedback system constantly operating between the brain and muscles, fingers are able to control various precise movements.<sup>63</sup> This process is very important for piano playing. However, developing finger movement for piano playing is different from the mundane finger movements of daily life. Pianists, both students and professionals, do not naturally learn the kind of finger movement needed for piano playing because fingers are required to have more complex and rapid movement with greater independence than in daily life. Pianists must develop a specific kinesthetic sense, or neurological path, in the control system.

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<sup>62</sup> Ibid. p. 67

<sup>63</sup> Ibid. p. 93

Mikimoto states that there are different stages in motor skill development needed for piano playing, the first of which involves awareness of sensitivity (including finger independence) and the development of a kinesthetic sense of coordination in various muscles. The second stage involves speed control (fast finger movements), while the last stage involves tone production and requires muscle strength. She found from her teaching experience that these three stages should be taught step by step in certain age groups, so that students can develop their piano technique more effectively. The first stage of motor skill development can be taught to children between four and seven years old. Even though young students might have difficulty actually playing the piano (small children's muscles are not strong enough to depress the keys), it is possible to improve sensory skills, muscle movement, and coordination. Around eight or nine years old, they are able to start improving their agility and fast finger movement in individual fingers. Mikimoto believes from her experience that training to strengthen finger muscles should begin at ten years old or later to avoid developing habitual excess tension in the hand and arm.

As Mikimoto mentioned in her 1978 article and reinforced in her 2004 book, learning the kinesthetic sense for finger independence is the first step that students need to develop, quite often a challenging concept, especially for beginners. A common misconception about finger independence can create many problems in the future, as students frequently equate it with finger motions resulting from hand, wrist, and forearm motion. Often the movement of one finger involves excessively tight contractions of the wrist and forearm. To avoid incorrect development, the first step is to learn the kinesthetic sensation of each finger rather than to concentrate on finger movement alone.

Once students develop the kinesthetic sensation of finger independence (how to move individual fingers without excess tension), they become more aware of the proper amount of muscle contraction needed for finger movements, including releasing and pressing the keys.

Mikimoto points out that this first step, the developing of kinesthetic feeling (senses) in various muscles, can occur differently in each student. She states that even though the small muscles are capable of having a greater rate of repetition, the nerve impulses in general travel more easily to large muscles (which have more nerve fibers) than to small muscles. Mikimoto believes that this difference in the amount of the nerve impulses causes a delay in small muscle development. Once muscle activities are established by the nervous system, the same muscles tend to be used over and over again, even if for slightly different tasks. Over time, this habitual inappropriate reliance on certain muscles can result in unbalanced muscle strength. For example, some students develop wrist movement faster than finger movement, and therefore have a tendency to play various figures with more wrist and forearm movements. This tendency delays finger development which, in turn, causes a problem with more subtle control in tone color and evenness in fast finger work. In such cases, students may reach a plateau in their technical development.

Mikimoto provides a specific example of this unbalanced development in kinesthetic senses in the thumb muscles. The thumb has more muscles than other fingers, utilizing seven muscles for its various movements, so it has a tendency to contract more than other fingers. Besides, from infancy, children learn that the main function of the thumb is to hold, grab, and grip. This natural reaction of the thumb is passed on to other

activities, so with any finger movement, the thumb naturally becomes tense more easily. This excess tension of the thumb also delays the independence of other fingers and interrupts the development of finger agility. In order to avoid these problems, Mikimoto believes that students have to understand the difference between the natural tendency of muscles in a normal movement versus those movements involved in piano playing. It is important to develop the fine sensation in each finger in the first stage of learning. For older students, she suggests finding any unbalanced development of muscle strength, then training the weaker parts more effectively.

### **Relaxation and Minimum Contraction**

Mikimoto's second point is the difference between relaxation and minimum tension of the muscles, which was mentioned by Ortmann and other pedagogues as an essential distinction in the development of piano technique. Students are often told to relax the hands and arms, but this relaxation does not mean just stopping the contraction of the muscles. *The Encyclopedia of the Human Body* clearly explains the relationship between muscle contraction and body posture as follows:

“If its muscles were suddenly inactivated, the body would not only be immobilized but would also collapse. As well as moving the body, skeletal muscles hold it upright and maintain posture. To perform both roles, muscles pull the bones, to which they are attached by tendons, across a joint. When a muscle contracts, one of the bones to which it is attached – the insertion – moves while the other attachment point – the origin, remains fixed. Since they can only pull and not push, muscles work in antagonistic pairs to produce opposing movements. Flexor muscles in the forearm, for example, bend the fingers while their antagonists, the extensor muscles, straighten them. Muscles that work together to produce the same movement are called synergists.”<sup>64</sup>

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<sup>64</sup> Ibid. p. 73

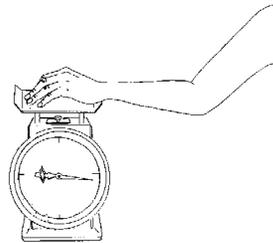
When students play the piano, they are generally using various muscle groups for two different primary actions. One action is to hold their arm in the playing position; the other is used for the actual movement such as finger motion. These muscles interact and work together, but many students cannot coordinate between these muscle groups and have more tension than is required for simply holding the arm in position. The proper amount of contraction should be the minimum contraction of muscles required to hold the arms in position and at the same time to help all the joints to be flexible enough to move in any direction. Also, if students cannot distinguish which muscles are required for movements, as opposed to holding the arms in position, most likely various muscles will become even tighter. The importance of muscle contraction was presented in Ortmann's research, but here Mikimoto uses the theory of muscle functions more practically and creates localized exercises to help develop a keen sense of each muscle. As well as developing an understanding of the right amount of muscle contraction, these exercises make it possible to coordinate between the various muscles necessary to produce all movements.

### **Tone Production and Weight Transfer**

It is commonly accepted that the right amount of arm-weight transfer is essential for good tone production. Ortmann pointed out the mechanism of weight transfer with his mechanical arm, stating that it is very difficult to transfer arm weight to the fingertips because of the nature of the joint structure. In order to create sufficient weight on the fingertip, some muscle contraction is required, yet it is actually very difficult to press the key through the fingertips with arm weight, without forcing the wrist and forearm

muscles. To better comprehend proper usage of arm weight and the transfer of arm weight to the fingers, Mikimoto uses a weight scale (which measures the force of up to 4 kilograms, 8.8 pounds) as shown in Figure 3–2.

### Figure 3–2: Scale Experimentation



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 25.

First, ask the student to relax the arm and measure the arm weight itself on the scale. Then in the same stage of relaxation, ask the student to press the weight scale with just the fingers. As Ortmann stated in his research, this usually results in a lower weight in the second instance though, ideally, the weight should be the same. However, when most students try to push down the same amount of weight with the fingers, they do so by tightening the elbow and wrist. Most people attribute this problem to a lack of coordination between the various muscles. But Mikimoto believes that, in many cases, a lack of sufficient muscle strength to hold the finger joints in place causes this excess tension in another part of the arm. In other words, if individual fingers have sufficient strength, the muscles holding the elbow and wrist in place can be in perfect balance with minimum contraction.

As mentioned before, the minimum contraction of the muscles holding the wrist and forearm in position allows a flexible and free movement in the hand and arm.

Mikimoto's experiment with the scale represents an easy, direct way to determine how

much contraction of the arm is needed to transfer the arm weight to the fingertips. To find out whether students are holding their arms with minimum or excessive tension, one can lightly tap the forearm from underneath while the fingers are pressing on the scale. If the arm is held with the proper amount of contraction, it is easily lifted up by the teacher due to its flexible condition. However, in most cases, the arm is held very tightly in position so that it will not move. This unwanted tension in the wrist and elbow stems from not knowing how to control the various muscles, and in many cases Mikimoto found that it is due to compensation for weak control of finger muscles and joints. This is one of other reasons that she believes in the importance of isolated finger exercises.

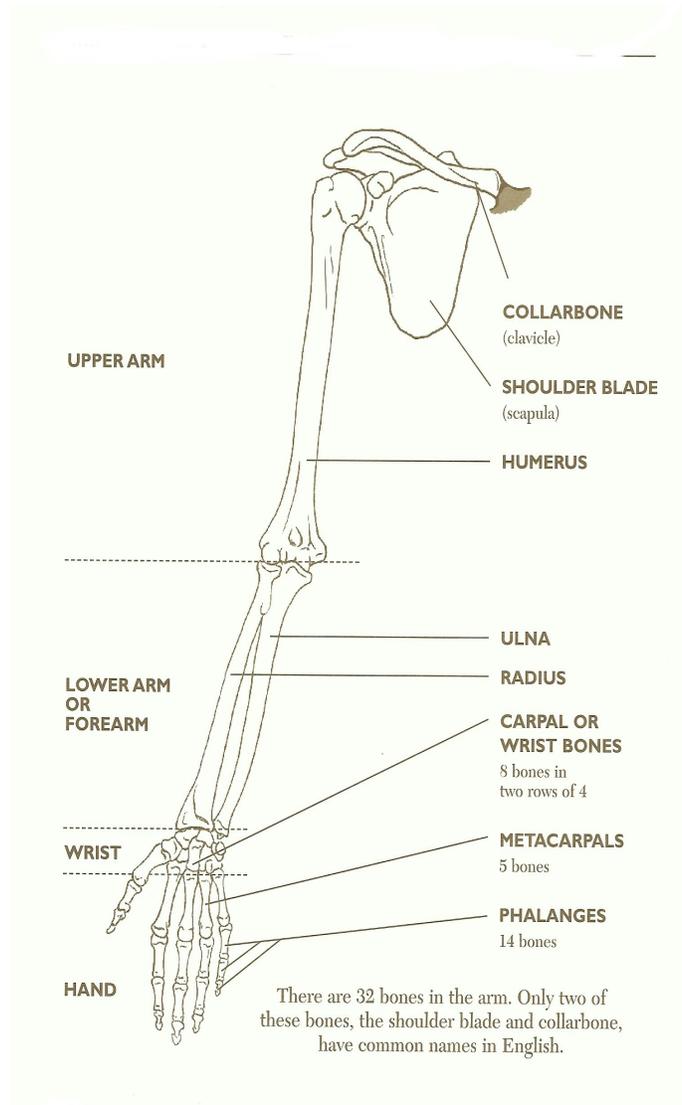
In summary, Mikimoto states that in the process of learning to play the piano, it is very easy to misunderstand and to misuse the three fundamental principles discussed above. In order to develop and execute them effectively, she advocates localized muscle training. Her specific muscle exercises, examined more closely in later sections, are designed to foster finger independence and strength, to control minimum contraction of the various muscles which control arm, elbow, and wrist movement, and to develop efficient kinesthetic sensation to better control the speed and power of the fingers.

### **Location of Bones and Muscles**

Mikimoto's exercises cover not only fingers, but also the back, arm, and wrist, to increase awareness of minimum contraction and to control movement. While she explains the location of the muscles and bones in her exercises, it is perhaps more helpful to observe the basic anatomy of the arms beforehand. The bone system of the arm is well known as the mechanism of the leverage system for piano playing, as discussed by

Ortmann and other piano pedagogues. It is commonly divided into four parts: shoulder, elbow, wrist, and finger. Figure 3–3 shows bone structure from the shoulder to the fingers.

**Figure 3–3: Bone Structure from the Shoulder to the Fingers**



Source: Thomas Carson Mark et al., *What Every Pianist Needs to Know About the Body: A Manual for Players of Keyboard Instruments: Piano, Organ, Digital Keyboard, Harpsichord, Clavichord* (Chicago: GIA Publications, 2003), 64.

The bone structures involved are quite simple. At the shoulder joint, the collarbone and shoulder blade meet the upper arm bone called the humerus. In the forearm there are two

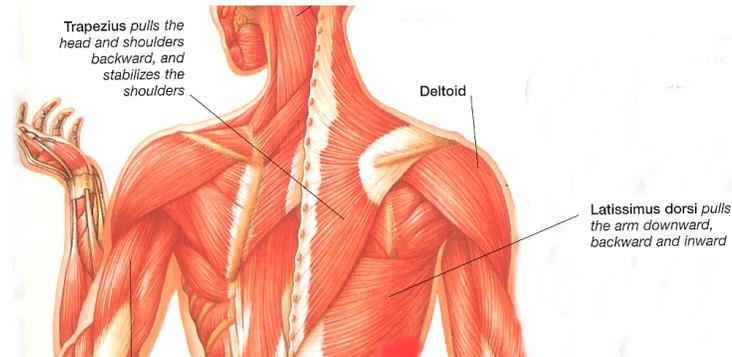
bones, the ulna and the radius, which make it possible to rotate the forearm. The wrist has carpal or wrist bones which contain eight bones in two rows of four. These small divided structures make flexible wrist movements possible. Finally, the hand has fourteen bones called phalanges. The whole arm, all four major joints, is the structure that allows ease in playing and brings about natural distribution of movement around the various joints, with no one part doing more or less than its share.<sup>65</sup> These four mechanisms and various bones are sometimes used separately, sometimes in various combinations.

Bones are not able to operate themselves, but instead rely on the various skeletal muscles. Every skeletal muscle is given a Latin name according to its relative size – *maximus* (largest), *minimus* (smallest), *longus* (long), and *brevis* (short) – or its action, flexor (bends a joint) and extensor (straightens a joint). Figure 3–4 shows some of the muscles involved in supporting finger movements for piano playing. For examples, *latissimus dorsi* pulls the arm downward, backward, and inward, while the *trapezius* pulls the head and shoulders backward and stabilizes the shoulders. At the shoulder, the *deltoid*, named for its triangular shape, is also involved in many arm movements. In particular, it raises the arm sideways, and swings it backward and forward. Attached at one end to the *clavicle* (collar bone) and *scapula* (shoulder blade), the *deltoid* pulls the tendons that connect its other end to the *humerus* (upper arm bone).

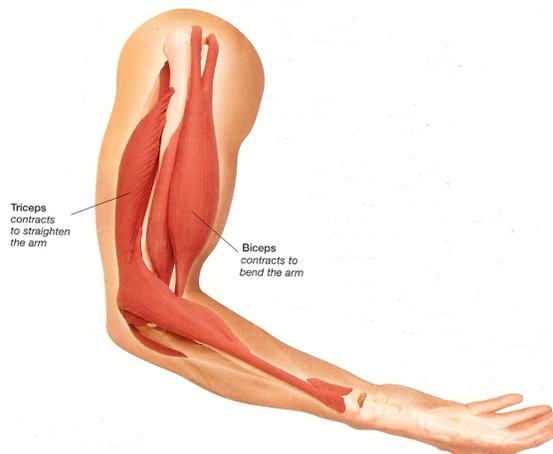
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<sup>65</sup> Thomas Carson Mark et al., *What Every Pianist Needs to Know About the Body: A Manual for Players of Keyboard Instruments: Piano, Organ, Digital Keyboard, Harpsichord, Clavichord* (Chicago: GIA Publications, 2003). p. 68

**Figure 3–4: Shoulder and Back Muscles**



**Figure 3–5: Upper Arm Muscles**



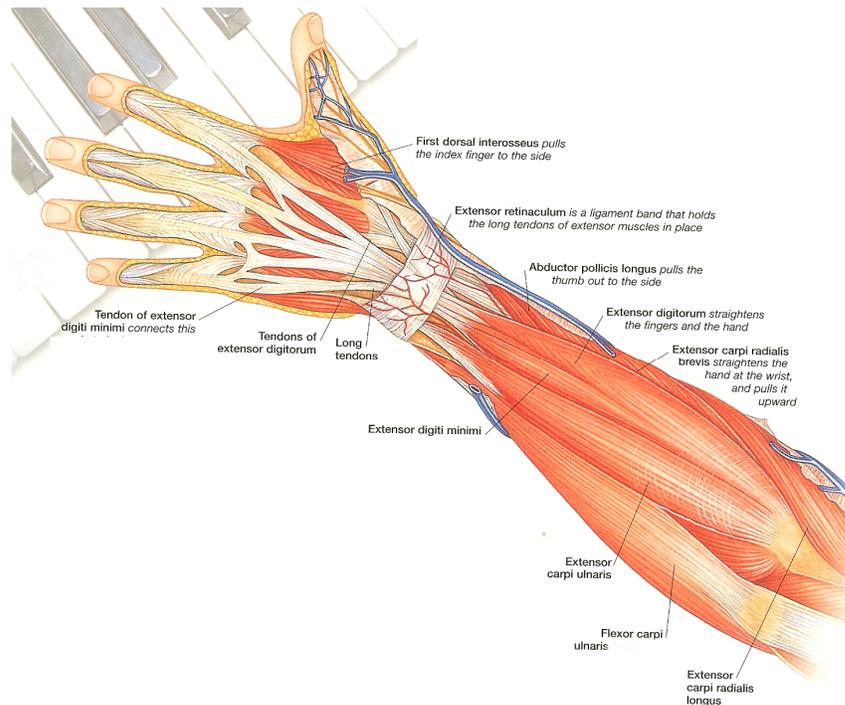
Source: Richard Walker, *The Encyclopedia of the Human Body* (New York: DK Publishing, Inc., 2002), 70.

At the upper arm level, *biceps brachii* bends the arm at the elbow, and *triceps brachii* straightens the arm at the elbow (Figure 3–5). In the forearm, there are two major muscle groups, extensor muscles and flexor muscles. The extensor *digitorum* straightens the finger and the hand, while the extensor *carpi radialis brevis* and extensor *carpi radialis longus* straighten the hand at the wrist and pull it upward. The extensor *carpi ulnaris* straightens the hand at the wrist, and the flexor *carpi ulnaris* bends the hand downward at the wrist (Figure 3–6).<sup>66</sup>

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<sup>66</sup> Walker, *The Encyclopedia of the Human Body*. p. 71

**Figure 3–6: Forearm Muscles**



Source: Richard Walker, *The Encyclopedia of the Human Body* (New York: DK Publishing, Inc., 2002), 71.

Many of the muscles controlling fingers are located in the forearm, taper into long tendons in the hand, and carry out the finger movements. In the hand, there are many small muscles between the fingers besides tendons, including the interossei and lumbricals which will be discussed later along with exercises.

The skeletal muscles described above are also called voluntary muscles because their contraction is caused by an individual's conscious decision to perform body movements. Yet in reality, everyday movements such as picking something up or walking generally happen without a person's conscious thought about moment-by-moment operation. The action of piano playing requires both conscious and subconscious movements. Even though pianists consider notions of speed, dynamics, and other nuances, they will not consciously think about which exact muscle to operate. Pianists must train almost all muscles to respond automatically, reflexively, so they can

make subtle movements to produce the sound and speed that they desire. This conscious and subconscious level of coordinated muscle movement needed for piano playing will be best achieved through step-by-step conscious control of isolated muscle movement.

### **Description of Mikimoto's Exercises**

#### **Finger Exercises**

As Mikimoto mentioned earlier, the first step of piano technique is to increase awareness of finger independence and its movements. She has developed exercises away from the piano both with and without her patented finger-board that she then applies to actual piano playing. She suggests the following five stages in finger training:

1. Developing a sense of independence of the fingers;
2. Developing agility and instantaneous power in individual finger movement;
3. Developing agility in alternating finger movement;
4. Stabilizing the finger joints;
5. Combine finger movements.

#### **Developing Awareness of Finger Independence**

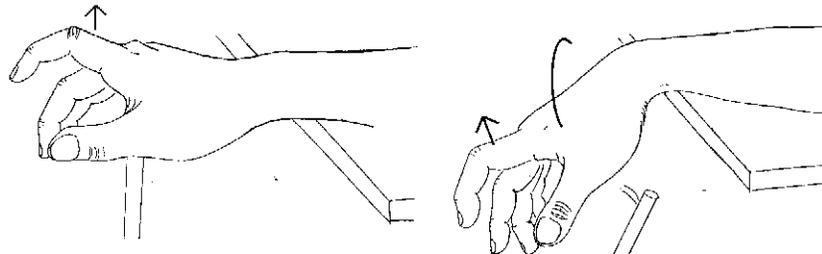
Mikimoto emphasizes that a common problem with finger exercises stems from students' misconceptions about finger independence. Learned movements of the hand and finger come from daily activities and always involve the fingers, wrists, and arms moving in concert. They do not isolate finger movements. For piano technique, students have to find individual finger sensitivity and movement, without excessive tension in the other fingers or parts of the arm, and wrist. Her approach is to increase the sense of

finger independence by using simple up-and-down motions. At first, students can practice lifting each finger. This exercise helps students to better detect the existence of excessive tension, because lifting the finger involves extensor muscles that generally create more tension in the hand than flexor muscles, which bring the finger into the palm. Mikimoto suggests the following exercise:

**Exercise 1:**

Place the arm at the edge of the table. Use the stick (or pencil) to hold the hand in a straight position and lift one finger. The stick is then removed. The finger should remain raised while the hand freely drops. Relax the wrist and rest it on the stick again, then lift each finger, hold seven counts and relax, and repeat with the other fingers. In this exercise, make sure each finger is lifted without creating tension in the other fingers (shown in Figure 3–7).

**Figure 3–7: Exercise to Lift Finger without Wrist Tension**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 59.

If the hand remains in a straight position in order to keep the finger raised without support of the stick, most likely the wrist has excessive tension. The first step to correct this excess tension is to develop the sense of independent finger movement and sensitize the nervous system through this exercise. This training not only strengthens the muscles for lifting the finger, but more importantly, it also reinforces the neurological connection between the brain and the muscles that control the individual fingers.

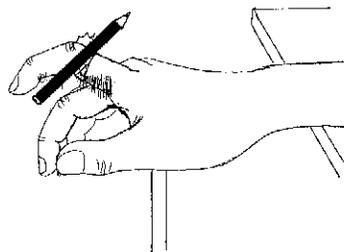
## **Developing Fast Individual Finger Movement**

Once students develop a sense of finger independence with lifting, they can practice the repeated–lifting movement with individual fingers. The motion of the finger should start slowly, then increase in speed while maintaining a controlled movement. Increasing the speed of movement will develop a clearer sense of finger independence as well as a quicker response from the subconscious commands needed for various finger movements. The following exercise is to lift one finger up and then relax, while increasing the speed of movement gradually. The rate of speed is measured by the metronome.

### **Exercise 2:**

Place the pencil above the finger. Lift the finger up from the knuckle so that it touches the pencil (shown in Figure 3–8) and repeat this motion.

### **Figure 3–8: Exercise for Increasing Speed of Finger Movement**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 59.

At first, find a starting speed that will be comfortable, then gradually increase the speed using the metronome. When the tempo increases, in many cases, the wrist will have excess tension. One can check the relaxation of the wrist by using a stick to hold the hand in position and then removing it as in the previous exercise while still moving the finger. Students can increase the speed of the fingers; an efficient speed would be 170 to 190 with two eighth–notes per beat. In this exercise, normally the left hand is slower,

around 10 counts less on the metronome, but if the left hand is more than 30 counts slower, the student should pay extra attention to improvement.

Mikimoto found that some students can move their fingers faster than others, at a metronome setting up to 180 to 200 with two counts per beat. However, these fast finger movements can cause some problem with control, resulting in uneven figuration and unstable tempos. If that is the case, rather than increasing the speed, students should concentrate on stable and controlled finger movement and practiced at slower tempos, around 80 to 120 with two counts per beat.

### **Increasing “Instantaneous Power” of Finger Movement**

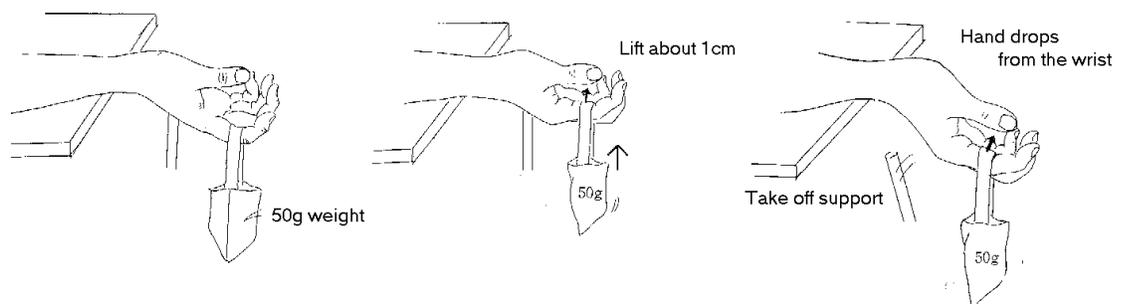
Once the lifting motion of the finger is developed independently, it is much easier to feel the opposite movement using the flexor muscles to bring the finger down to the palm side. Mikimoto states that developing this finger movement with instantaneous quick motion is particularly important along with finger independence. She believes each finger must have a quick motion, which she calls “instantaneous power” of the fingers. It has been said that use of the arm weight is the most prominent part of tone production, yet Mikimoto found that this fast speed of independent finger movement can provide power into the key, and will support clear tone production, especially in fast and loud figures. She shows the importance of this instantaneous speed and power in tone production through the following experiment. She drops a 40-gram rubber tennis ball with a diameter of 7 centimeters on the keyboard. It will not make any sound when dropped from 1 centimeter above. When dropped from around 20 centimeters above, it makes a small sound, but from 30 centimeters above, and when released with a snapping

motion of the wrist, it makes a loud sound. She explains that there are two factors in this experiment. One is the speed of the falling ball, which is equivalent to the motion of the finger. The other is the amount of air in the ball, which represents the strength of the finger joints. The ball has to have a certain amount of air in it to have solid contact with the resistance of the keyboard. If there is less air in the ball, there is less impact between the ball and the key, resulting in a smaller sound. From this experiment, she claims that the finger needs to have not only stabilization of the finger joints, but also instantaneous fast movement. The following exercises train several muscles located in the forearm as well as the *lumbrical* and *intreosseous* muscles located in the hands, all of which are needed for creating instant fast finger motion.

**Exercise 3:**

Place the arm on a table with the palm up, the wrist hanging over the edge, and a vertical stick beneath the hand. Hang a little bag containing a 50-gram weight (slightly above normal key resistance) on the finger at the second joint. Then raise the bag with the finger. Students must try to move just one finger, and pay close attention to avoid moving the other fingers. At first, students should exercise slowly with small movements and try to develop the sense of moving each finger independently. If the finger is working independently, then when the stick (which is holding the hand) is removed while raising the weight, the hand should fall from the wrist (as shown in Figure 3–9).

**Figure 3–9: Exercise for Instantaneous Power**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 61.

At the beginning, the feeling of independence must be mastered, then the student can gradually raise the speed of the movement. After much practice the weight will fly into the air from the instantaneous power. Typically, when the speed of the motion rises, the fingers start moving all over the place, and even the whole hand itself goes up. When this happens, the fingers are out of control, and the student must go back to the slow tempo and start over. Besides the wrist and each of the fingers, students must always pay close attention to the whole arm in order to avoid excess tension.

### **Developing Alternating Two-Finger Movements**

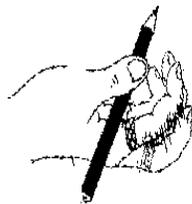
After mastering previous independent movement of the fingers, the student should practice alternating two-finger movements.

#### **Exercise 4:**

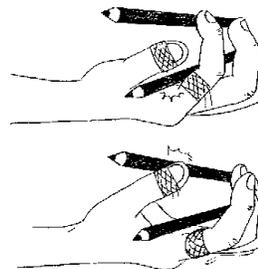
Place the hand with palm up on the table. Place two rings on the two exercise fingers 1 and 2, 2 and 3, 3 and 4 or 4 and 5 (any metal rings that are suitable to make a sound). Place a pencil in the palm as shown in Figure 3–10 (first and second finger exercise needs to have two pencils as shown in Figure 3–10 b). Tap the pencil in alternation between the fingers, using a rhythm of four sixteenths followed by a quarter-note. Start slowly and gradually increase the tempo, writing down a record of the metronome numbers.

**Figure 3–10: Exercise for Alternating Finger Movements**

a)



b)



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 63.

The target speeds for this exercise are as follows: finger combination 1 and 2 or 2 and 3 should be 120 to 160, finger combination 3 and 4 should be 150 to 170, and finger combination 4 and 5 should be around 120. As we might expect, moving the 4 and 5 combination is more difficult, so here students need to pay special attention to any excessive tension in other parts of the hand.

### **Stabilizing the Finger Joint**

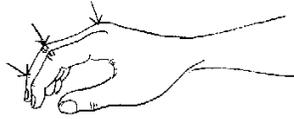
Along with the previous exercises which increase the awareness of finger independence, Mikimoto suggests stabilizing the finger joints. As she claims from her experiment with the rubber ball, the stabilization of the finger joints is very important for contact with the key. Mikimoto also links weak finger joints to a lack of finger independence, both of which can cause many problems with unwanted compensation in other parts of the hand, wrist, and arm. The following exercises not only develop the strength of the finger joints, but at the same time increase the sense of control and feeling of finger independence.

In order to have stabilized finger joints, both extensor and flexor muscles of the fingers need the right amount of contraction. The first exercise is simple: 1) push each finger joint, 2) feel the force of the push, and 3) stabilize against it. This exercise increases sensation in finger joints with the extensor muscles for the fingers.

### **Exercise 5:**

Place a relaxed hand on the table and push and release each finger joint as shown in Figure 3–11. Then concentrate on each joint and keep it stationary. Be aware that it is common for the wrist to tighten when the joint pushes against the force of the finger pressing it.

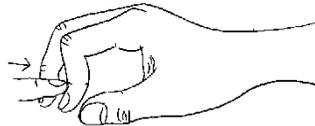
### Figure 3–11: Finger Joint Exercise (Extensor Muscle)



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 75.

A common problem with children's finger joints is to have weakness in the first joint, resulting in buckling, as shown in Figure 3–12. While it is more obvious in small children, this weakness of the first finger joint can be found in many older students as well, causing them certain problems with tone production and excess tension.

### Figure 3–12: Weak First Joint



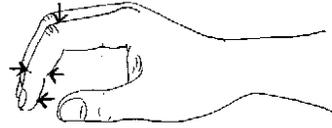
Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 105.

In order to increase awareness and strength with this kind of weak finger joint, push from three different directions: from the top or front of the finger to control the extensor muscles, and from behind to control the flexor muscles.

### Exercise 6:

Stabilize the second joint by pressing lightly, and use several fingers of the other hand to push against the first joint from different directions, either behind or in front of the joint, as shown in Figure 3–13. As you gently push from the front or back of the first joint, it should develop a quick resistance to the force of the pushing finger, without creating tension in other parts of the wrist, hand, or arm. The goal of this exercise is to develop better control of the first joint.

### Figure 3–13: Exercise for Stabilizing Finger Joint



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 105.

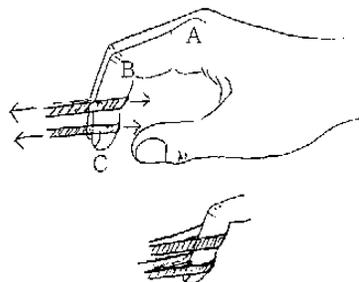
The following exercise is for the flexor muscles of the second joint. Again, this exercise increases the sensation of the finger joint and will also be very important for making efficient contact with the key in piano playing. These exercises are designed to increase the strength of each finger's second joint, as well as to develop flexibility in the third joint.

#### **Exercise 7:**

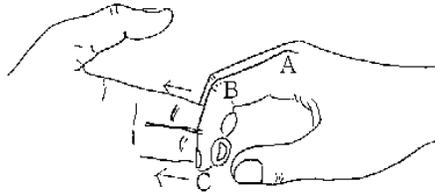
Place two rubber bands between the finger tip and first joint, or between the first joint and second joint. Pull the rubber band as shown in Figure 3–14 a, then release the pressure. If there is no rubber band available, the other hand can be used as shown in Figure 3–14 b.

#### **Figure 3–14: Finger Joint Exercise (Flexor Muscle)**

a)



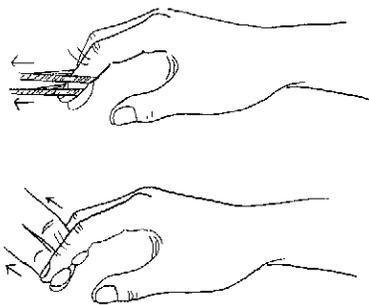
b)



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 105.

Finger strength can be assessed by the degree of resistance present in the rubber band or the other finger (for example, if the finger can hold position when being pulled). The important thing in this stage of finger training is to gradually develop the sensation of a stable joint by pulling the object, feeling resistance, and not over-tightening. Over time, the finger should be stable yet well controlled, and should maintain its position. If the finger does not have sufficient strength, it will be pulled or extended out of position by the directed forces as shown in Figure 3–15.

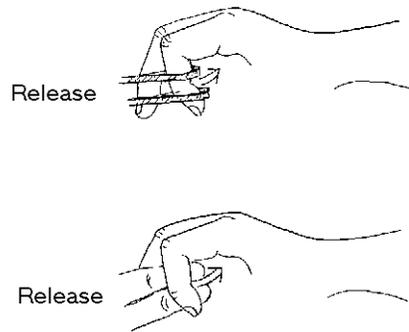
**Figure 3–15: Weak Finger Joints**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 105.

If a finger joint has excess tension, the finger will curl in, as shown in Figure 3–16, when the force of the rubber band (or the other hand) is released.

### Figure 3–16: Finger Joint with Excessive Tension



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 103.

The student must learn to control the kinesthetic sense needed to adjust to quickly–changing forces from the rubber band or the other hand. When the pulling force is released, the finger should stay in the same position, as shown in Figure 3–17.

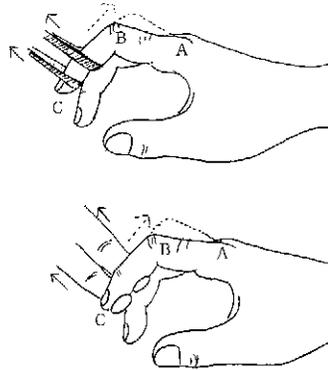
### Figure 3–17: Controlled Tension in Finger Joint



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 103.

During this exercise, the third joint tends to tighten. While students exercise to stabilize the first and second joints, however, the third joint should remain flexible. To find excess tension in the third joint, slightly add vertical motion, up and down, while pulling the fingers. If the finger is controlled correctly, students should be able to move it up and down from the third joint as shown in Figure 3–18.

**Figure 3–18: Flexible Knuckle Joint**

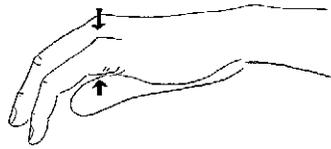


Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 105.

### **Stabilizing and Strengthening of the Fifth Finger**

Stabilizing the fifth finger needs extra attention. Not only children but also older students commonly have very weak fifth fingers. Even though students may master the coordination movements between arm rotation and finger movements, if they have weak fifth–finger joints, the transfer of force between arm movement and key resistance will be problematic. Generally, a weak fifth finger means weakness in the third joint, which may result in a stiff wrist and even excess tension in the whole arm. Mikimoto says that the third joint (the knuckle) of the fifth finger must be stabilized to transfer the force from the arm movement and receive the key impact properly, without any excess tension in the hand, wrist, or arm. In Figure 3–19 the down arrow represents force from the arm, while the up arrow represents key resistance.

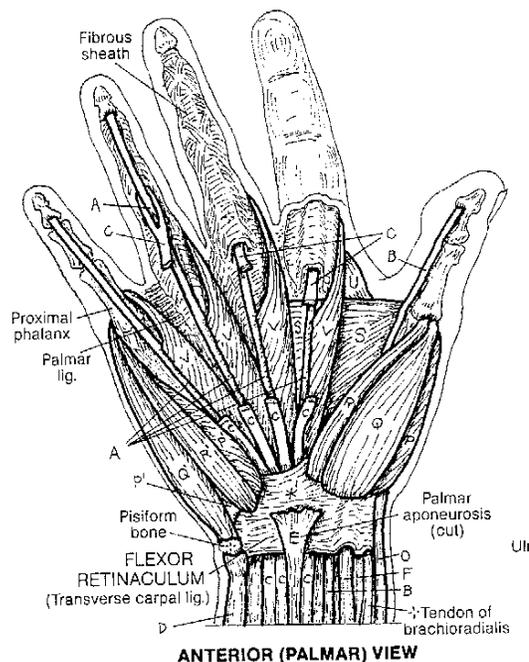
### Figure 3–19: Stabilization of Fifth Finger



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 109.

Mikimoto states that in order to stabilize this joint, students should train the muscle group beneath the fifth finger, referred to as the *hypothenar eminence*, which contains three small muscles: *opponens digiti minimi* (shown in Figure 3–20 as letter P), *abductor digiti minimi* (shown as letter Q), and *flexor digiti minimi brevis* (shown as letter R).

### Figure 3–20: Muscles that Move Fifth Finger



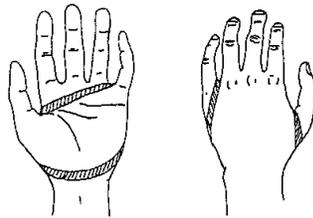
Source: Wynn Kapit and Lawrence M. Elson, *The Anatomy Coloring Book*, 3<sup>rd</sup> ed. (San Francisco: Benjamin Cummings, 2002), 59.

She suggests several exercises to develop these muscles, the first of which develops the muscles to raise the third joint of the fifth finger.

**Exercise 8:**

Place the rubber band around the first and fifth fingers, as shown in Figure 3–21, and raise the fifth finger, third joint. Excessive tension must be avoided in the wrists and other fingers in order to activate these small muscles.

**Figure 3–21: Exercise Raising Fifth Finger Knuckle**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 121.

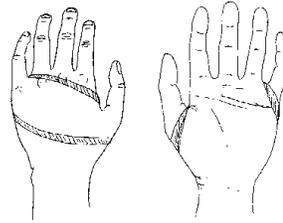
Even though it is very difficult to raise the fifth finger third joint, or even feel that part of the muscle, the muscle will gradually develop over time. To do so Mikimoto suggests some relatively simple methods. As an example, students can wear the rubber band and exercise their finger while engaged in other common activities such as walking. She believes that with constant awareness, the student can begin to move it independently, and this will help stabilize the third joint of the fifth finger.

The second exercise to develop these small muscles is the opposite movement, which is an inward motion in the third joint of the fifth finger.

**Exercise 9:**

The training can be done with a rubber band as in the previous exercise. Place rubber band between the first and fifth fingers as shown in Figure 3–22. This is different from the previous exercise; the rubber band should be placed above the third joints of the second, third and fourth fingers.

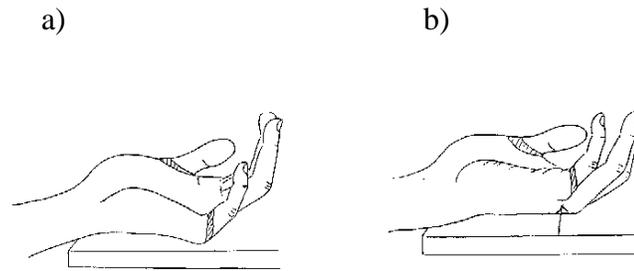
### Figure 3–22: Placement of Rubber Band



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 123.

Then place the palm on the table facing upwards, and raise the third joint of fifth finger about 1 cm, as shown in Figure 3–23b.

### Figure 3–23: Exercise with Third Joint of Fifth Finger in Inward Motion



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 123.

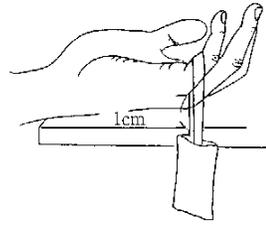
At first, the joint should not be lifted too high, or excess tension of the wrist may occur. A small movement may be more effective, as long as the small muscles beneath the fifth finger are properly activated and recognized by the student.

Once students properly recognize these small muscle movements, Mikimoto suggests that students next develop their muscle strength by using a weight.

### **Exercise 10:**

As in the previous exercise, place the hand on a table with palm side up, and place a small bag with weights inside between the second and third joint of the fifth finger. Then lift the weight using the same muscle as in the previous exercise, as shown in Figure 3–24.

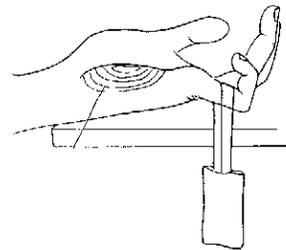
### Figure 3–24: Strengthening of Muscles Beneath Fifth Finger with a Weight



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 123.

In this exercise, students again must be aware of which muscles to use when lifting the weight. The entire fifth finger should be lifted from the third joint, as shown in Figure 3–24. If the first two joints are in a curled position as shown in Figure 3–25, this indicates an show improper usage of the flexor muscles in the forearm.

### Figure 3–25: Common False Finger Movement Found in Third Joint of Fifth Finger Exercise



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 123.

Mikimoto found that an untrained muscle group may only be able to lift 100g, but after a period of training (around 6 months), a strengthened muscle group can lift over 1kg.

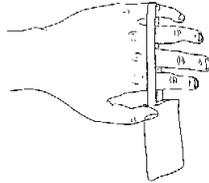
For additional strength training of the fifth finger, Mikimoto suggests lifting the weight sideways with the same muscles.

### **Exercise 11:**

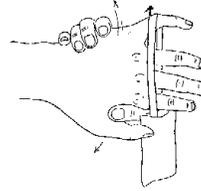
With the back of the hand facing the body, place the weight on the second joint of the fifth finger as shown in Figure 3–26. Then move the fifth finger up away from the fourth finger.

### Figure 3–26: Lifting Weight Sideways with Fifth Finger

a)



b)



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 111.

Since this motion is very unfamiliar to most students, they may not be able to lift the fifth finger at all. Mikimoto recommends that students start training this side motion by moving the fifth finger away from the fourth finger without the weight, or by first using a rubber band.

#### **Exercise 12:**

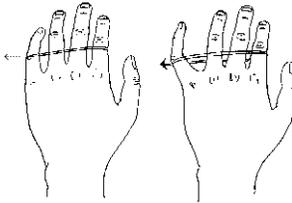
Hold the second and fourth fingers with other hand, then open the fifth finger away from the fourth finger, as shown in Figure 3–27a. Hold seven counts and release. As a variation of this exercise, put a rubber band around the second and fourth fingers, as shown in Figure 3–27b, then open the fifth finger away from the fourth finger. Hold 7 counts and release.

#### **Figure 3–27: Fifth Finger Sideway Motion Exercise**

a) Using Other Hand



### b) Using Rubber Band



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 111.

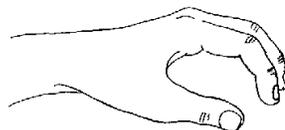
In either scenario, students must pay attention to excessive tension in the wrist, which can be checked by moving the wrist sideways with the other hand as the fifth finger holds its sideways position.

### Importance of Recognizing the Strength of the Finger Joints

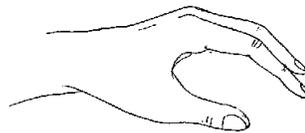
Mikimoto asserts that it is important to recognize different types of fingers in order to choose the proper exercises for each student's hands. Different hand shapes may result in differences in finger joint strength. She has observed two common contrasting hand shapes as shown in Figure 3–28a and 3–28b in her students and other pianists whom she has encountered.

**Figure 3–28: Two Common Hand Shapes**

a)



b)



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 87.

Figure 3–28a depicts a hand with thicker rounded fingers, which tend to have stable joints, whereas Figure 3–28b shows a hand with pointed thin fingertips, that tend to have weak joints.

According to Mikimoto, many students find it difficult to achieve individual joint control. However, neglecting joint–training exercises creates bad habits with unbalanced tension in the hand and other parts of the arm. When students repeatedly practice the piano with tense wrists and knuckles, the upper part of the flexor muscle in the forearm often becomes tense. This results in many common endurance problems, such as the feeling of forearm fatigue while playing a long etude with continuous figures. Mikimoto believes that when students find weakness in their finger joints, they should not overlook it. She recommends consistent awareness and finger–joint training.

### **Mikimoto’s Finger–board**

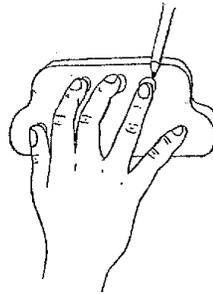
For further development of finger independence, Mikimoto advises using her finger–board, which she originally invented for herself when she did not have access to a piano. She then started to use this finger–board with many of her students, and discovered great improvement in their finger development. Mikimoto found that it is often difficult for students, especially beginners, to understand the relationship between finger movement and sound production at the piano. But on the finger–board, they are able to vary finger strength because the stable unmoving surface will better focus concentration on the fingertips. For instance, students can start lightly and then gradually increase the force of the finger movement, thereby feeling how much force can be tolerated without bending the finger joints. The finger–board practice may develop better

finger sensation and joint habits later when students apply it to actual piano playing. First, I will discuss how to prepare the finger-board and several basic finger movements, and how to isolate finger movement from excess tension in the wrist and elbow.

### **Low-Pegs Finger Exercises on the Finger-board**

Mikimoto's finger-board has two sides with different functions. One side is a flat surface where seven cylindrical pegs will be glued according to the following procedure. Place the student's fingers lightly and mark where the finger tips fall, as shown in Figure 3-29.

#### **Figure 3-29: Marking a Template on the Finger-board**



Source: Sumiko Mikimoto, *Finger-board User's Manual* (Tokyo, Japan: Ongakuno Ressunno Tomosha, 2004), 12.

Using the marks as a template, evenly space six of the seven pegs across the side of the finger-board without the screw holes. The fingertips of both hands should cover five of the six evenly spaced pegs with one peg as a gap between the thumb and index finger. This gap will obviously be on opposite sides for the right and left hand. Then paste the seventh low peg on the left inside as shown in Figure 3-30.

**Figure 3–30: The Side of the Finger–board with Seven Low Pegs**

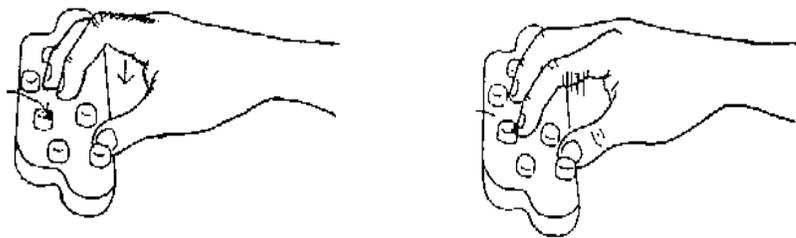


The first exercise is called the “low scratch” exercise. Tap the finger against the finger–board, and allow the nail to lightly scratch the side of the peg as the finger descends down onto the finger–board. This gives some sense of resistance against the fingers, which is later experienced with the action of the piano key. For kinesthetic reasons, it is important not only to develop the movement of the fingers, but also to experience the sensation of touching the peg.

**Exercise 13:**

Hold the finger–board with one hand or place the finger–board on a table or desk. Rest fingers in a curved position in front of the pegs, so that the knuckle (the third finger joint), wrist, and elbow sit at the same horizontal level. From 1 centimeter high, the finger should drop down quickly and lightly scratch the peg, as shown in Figure 3–31. “Scratch” means that the fingertip should graze the top of the peg and end up against the flat surface. This scratching action simulates, to a lesser degree, the resistance of the keys.

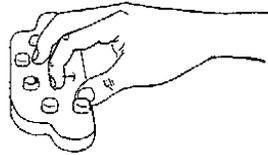
**Figure 3–31: Low Peg Exercise**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 85.

The finger motion should arise primarily from the third joint, with the first and second joints stabilized. If all three finger joints are not properly used together, the first and second joints will curl up, as shown in Figure 3–32. It is essential to understand which muscles control the finger movement, because a common problem arises in the scratch exercise when students use the first and second joints instead of the third joint as the primary mover.

**Figure 3–32: Curling Finger on the Finger-board**

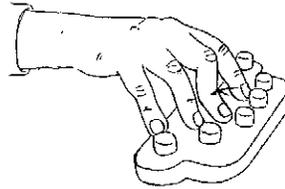


Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 85.

At first, move just one finger, scratching down multiple times using the rhythm of four eighth notes followed by a half note. When the finger touches the board, try to concentrate on the finger tip and produce a light knocking sound. The ability to make such a sound depends upon the fingers’ “instantaneous power” (discussed previously) and stabilization of the finger joints rather than on pushing from the wrist and arm. Fingers with weak joints generally have difficulty in making this light knocking sound. The tip and second joint of the finger should be stabilized like one solid stick or bar in order to make this sound. Students can check the stability of the finger right after it touches the board by pushing lightly against the first joint with the other hand. Even though the finger appears to be stable in position, the first joint of the finger may be very weak and will be flattened when it is lightly pushed, as shown in Figure 3–33. If this is

the case, students should again pay attention to their weak finger joints and repeat the previous strength exercises.

**Figure 3–33: Weak First Joint in Finger–board Exercise**

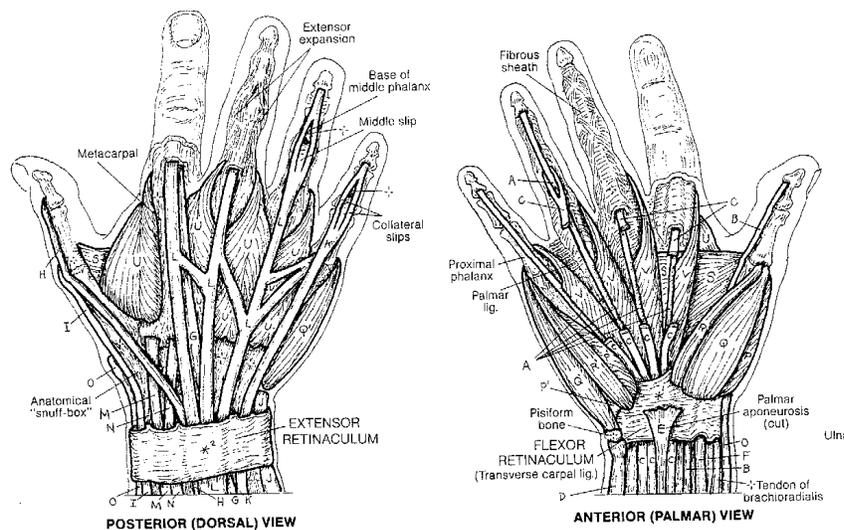


Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 87.

**Finger Exercises and Over–use of Large Muscles**

The sensitivity and fast movement of the finger will be properly developed by controlling the small hand muscles located between the fingers as shown in Figure 3–34, which are the *lumbrical* (marked by the letter U) and *interosseous*, (marked by the letter V). Many finger–board exercises are designed to activate and increase awareness of those small muscles.

**Figure 3–34: Lumbrical and Interosseous Muscles**



Source: Wynn Kapit and Lawrence M. Elson, *The Anatomy Coloring Book*. 3<sup>rd</sup> ed. (San Francisco: Benjamin Cummings, 2002), 59.

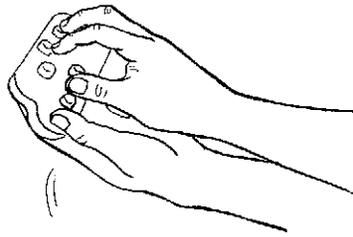
As Mikimoto stated earlier, if students fail to develop these small muscles early in piano study, they will form the habit of using larger muscles in the forearm when they execute technical difficulties. Mikimoto calls this kind of poor technique “overused muscle syndrome.” Some students, especially male students who have strong muscles, can endure fatigue from overuse of the muscles, even building up their ability to play with excess muscle tension. Even though many students are able to play a great number of pieces mainly using other larger muscles in the forearm, their sound can become very harsh, and it is very difficult to bring out different nuances and colors. There is also the danger that their technique will decline dramatically as they grow older. Mikimoto believes that this tendency of overused muscles is caused by earlier training in which excessive tension in the hand, wrist, and arm is not correctly detected. In order to achieve all-around muscle development, especially in those small muscles, and not create an imbalance between the large and smaller muscles, it is important to avoid excessive tension in the early stages of training. By means of finger-board exercises, especially the low peg exercise, Mikimoto found that students can detect their own tendencies and bad habits with finger movement, along with overuse and tension in the wrist and arm muscles. This awareness of excess tension enables them to better develop the small muscles in the hand.

### **Detecting Excessive Tension in the Wrist and Elbow**

In order to develop the correct sense of finger independence, almost every finger movement on the finger-board must be isolated from excessive tension of the wrist and elbow. Unwanted wrist and elbow tension can be detected more easily using the finger-

board than from actual piano playing. Use the other hand to move the finger-board slightly up and down while doing the scratching exercise or any other exercises as shown in Figure 3–35 (The force for the wrist movement should come from the other hand, not from the wrist itself). The scratching motion and its sensation must be consistently independent from the wrist movement. If the scratching is difficult or feels forced when the wrist is moved, this is a sure sign of excess tension.

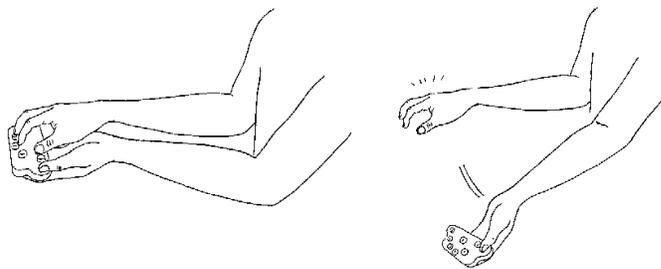
**Figure 3–35: Detecting Excess Tension in the Wrist Using the Finger-board**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 95.

Excessive tension of the elbow can also be recognized by pulling the finger-board out from underneath the hand during the low peg exercises. If there is unwanted elbow tension, the arm will not drop and the hand will stay locked in position as shown in Figure 3–36.

**Figure: 3–36 Detecting Elbow Tension**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 93.

### **Finding Weight Transfer Using the Finger-board**

Similarly the finger-board can be used to learn correct weight transfer. Arm weight can be detected by the hand which holds the finger-board while executing the finger exercises. If the wrist and elbow are relaxed and properly hold their position, arm weight can be efficiently transferred into the finger-board and some pressure can be felt in the hand holding the board. If students cannot sense their own arm weight while holding the board, then the teacher or another person can assist by holding the board and pointing out how much weight can be felt on it.

Mikimoto recommends another way to develop the sense of this weight transfer by using the finger-board: simply rest the fingers on the finger-board and then pull it out from underneath the hand. If the elbow is correctly held and flexible, the entire arm drops downward with its own weight, as shown in Figure 3-37b. This shows no excess tension but instead a well-coordinated weight transfer to the finger-board.

**Figure 3-37: Correct Arm Weight Transfer in Finger-board Exercise**

a)



b)

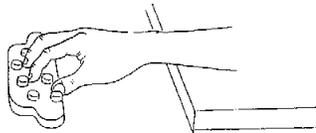


Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 93.

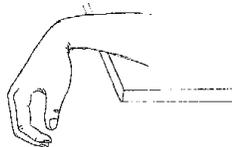
Mikimoto also suggests that students develop and control the sense of weight of the hand, which is possible by developing wrist flexibility. If students can control flexibility of the wrist and elbow, they can use hand weight alone to create different levels of quiet sound. To develop the sense of the proper hand weight, students can rest the forearm on the table and the fingers on the finger-board. Then pull the finger-board out from underneath the hand. If the wrist is flexible and the weight of the hand is correctly distributed, the hand will fall from the wrist as shown in Figure 3–38b. However, if students have too much tension in the wrist, their hands remain in the same position, as shown in Figure 3–38c.

**Figure 3–38: Hand Weight and Wrist Tension in Finger-board Exercise**

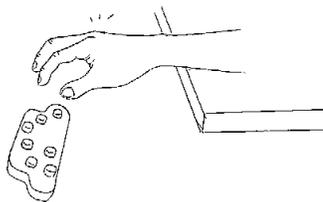
a)



b)



c)



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 93.

If students use too much tension to press down the finger-board, their hands will lose flexibility. To diagnose this type of excess tension, the finger-board can be raised and slightly rotated by the other hand, as described before. The hand will move freely and easily with the finger-board if the students are distributing the right amount of hand weight to the finger-board.

### **Training Individual Fingers**

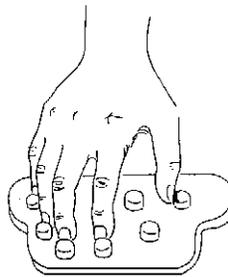
Having discussed the preparation of the finger-board, the execution of several basic finger movements, and detection of excess tension in the wrist and arm, we can turn our attention to the training of individual fingers and combinations of finger movements on the finger-board. As with any other exercises, the speed of finger movement on the finger-board reflects the development of agility and sensitivity. Mikimoto found that students generally can begin the low scratch exercises at the speed of around quarter note equals 70, with two scratching motions (or two eighth notes) per beat. If students have very weak joints, especially small children, Mikimoto suggests that they start more slowly within a range of quarter note equals 50. For these students, attention should be focused on avoiding excess tension in the arm, wrist, and other non-exercised fingers.

She asserts that over time, students' fingers will develop within a range of speeds, and the goal should be somewhere between a metronome speed of 120 up to 180 for the second (fastest) finger. Other fingers are almost invariably slower than the second finger, although the speed of the third finger is close to that of the second finger. The fourth finger is usually 10 to 20 metronome points slower. If the fourth finger is more than 30 points slower, then the student should pay closer attention to fourth finger movement.

Simply developing the habit of moving the fourth finger more during the day can increase awareness of its movement. The fifth finger movement is also slower, and will benefit similarly from extra attention.

The movement of the thumb will be different from the other fingers because of its placement on the side of the hand and its wider range of motion. For thumb motion with the finger-board low scratch exercise, the thumbnail should touch the side of the peg and scratch down, and the third joint of the thumb (attached to the wrist) should face outward, as shown in Figure 3–39.

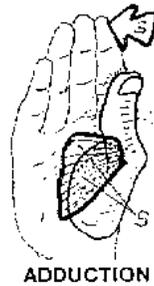
**Figure 3–39: Thumb Exercise with Finger-board**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 87.

Mikimoto states that correctly controlling the position and movement of the thumb is particularly important for releasing hand tension. The thumb shows a tendency to have excess tension, and it is easy to misunderstand the proper thumb position and motion needed in piano playing. The most common problem occurs when the thumb moves inwards to the palm side of the hand, as shown in Figure 3–40.

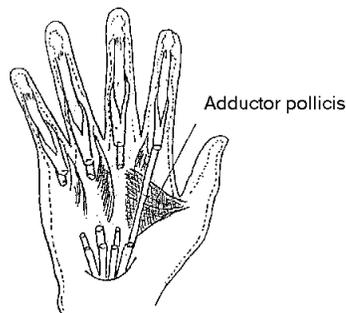
### Figure 3–40: Tendency of Thumb Movement



Source: Wynn Kapit and Lawrence M. Elson, *The Anatomy Coloring Book*. 3<sup>rd</sup> ed. (San Francisco: Benjamin Cummings, 2002), 59.

The physiological basis for this unnecessary tension resides in the muscle called *Adductor pollicis*, shown in Figure 3–41.

### Figure 3–41: Adductor Pollicis Muscle

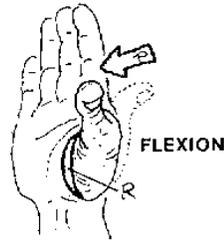


Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 91.

This muscle is used primarily for grasping objects in daily life. It has developed a natural tendency to try to support any finger movement, even when the hand is not grasping, hence the tension. Mikimoto, like many other pedagogues, believes this to be a reason why many students have a tendency to over-tighten the thumb when playing the piano.

Students must understand proper muscle usage. The most efficient muscle to use for thumb movement (for striking the key or, in this exercise, the peg) is the flexor *digiti minimi brevis*, as shown in Figure 3–42 (marked by R). This muscle creates vertical motions with its pivot point at the root of the thumb.

**Figure 3–42: *Flexor Digiti Minimi Brevis* Muscle and Thumb Vertical Motion**



Source: Wynn Kapit and Lawrence M. Elson, *The Anatomy Coloring Book*. 3<sup>rd</sup> ed. (San Francisco: Benjamin Cummings, 2002), 59.

It might be difficult to feel exactly which muscle is moving. Nevertheless, if students pay careful attention to the root of the thumb, bring it out a little from the rest of the hand (as shown in Figure 3–39), and try not to over-tighten the *adductor pollicis* muscle, the *digiti minimi brevis* muscle will be activated.

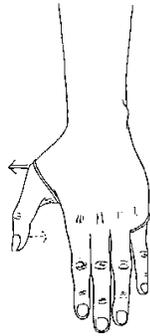
When students misuse the thumb muscles and habitually move the *adductor pollicis* muscle, it is readily apparent in their thumb position when they play the piano or exercise with the finger-board, drawn to the inside of the palm. Mikimoto states that this habit of pulling the thumb toward the palm is very common among students, but it should be corrected in the early development stages, specifically before the age of ten. Around this age, students start to develop their agility in piano playing, and if they begin to play fast passagework with an unnecessarily tightened thumb, they will never develop proper piano technique. For this reason, Mikimoto suggests the following rubber band exercise in addition to the finger-board.

**Exercise 14:**

Place the rubber band around the thumb and fifth finger, and stretch the thumb away from the palm for 6 to 7 seconds as shown in Figure 3–43a. Then relax as shown in Figure 3–43b and repeat the exercise several times. This motion should be a very subtle one, and at first should be done very slowly so as to avoid engaging other muscles in the hand and arm.

### Figure 3–43: Exercise to Develop Proper Thumb Position

a)



b)



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 91.

Once students learn the correct position and movement of the thumb, they can develop its speed on the finger board more easily. Many students find that thumb movement is slower at first, but if they exercise it regularly with correct position and motion, its speed will increase to match that of the other fingers.

Another common problem of thumb movement is too much involvement with forearm rotation. In many cases, a fast forearm rotation can compromise the thumb movements, in the execution of quite fast passages on the piano. However, if students form the habit of using only arm rotation instead of thumb movement, the speed of the thumb will never develop. This causes many technical problems in pieces with double-note figures and trills, such as Chopin's *Etude Op. 25 No. 10*. Mikimoto purports that consistent low peg exercises can develop the thumb's clear sense of independence and fine movement to execute such technical figures. She recommends that students set a goal for a metronome speed of quarter note equals 170 with two motions per beat.

### Training Alternating Fingers

After mastering the correct movement for individual fingers, the next exercise is the trill, using fingers combination 1–2, 2–3, 3–4, and 4–5. At first, use a short rhythmic figure such as two sixteenth notes and one eighth note, and put a slight accent on the last note, making a little tapping sound on the board. Once it becomes comfortable, lengthen each rhythmic figure to four 16<sup>th</sup> notes instead of two. The 1–2 or 2–3 trill exercises should develop up to a speed of quarter note equals 180 to 190. With the 3–4 and 4–5 trill exercises, the speed will be slower, within the range of quarter note equals 130 to 170. If the speed is slower than a quarter note equals 100, there maybe a problem with the student’s finger movements, and the student will most likely come to rely on forearm rotation instead of finger movement in actual playing, if he or she is not already doing so. There are also students who may discover that even though one finger can move individually at a fast speed, two fingers in combinations sometimes cannot move as quickly. It is possible that the previous one–finger exercises were not done properly, which with tension or unneeded movement. In this case, Mikimoto recommends additional slow practice with a focus on the exercising finger and the elimination of tension in the other fingers, wrist, and forearm. After the two–finger trill exercise is properly mastered, finger combinations can be changed to three–, four–, then five–finger alternations, such as 2–3–4, 3–4–5, 2–3–4–5, 1–2–3–4–5, or other various combinations.

The exercises for finger combinations can also expand to the double fingerings 1–3 and 2–4, 2–4 and 3–5, or 1–4 and 2–5. These exercises are very beneficial to prepare for the double–third and double–sixth figures required in such pieces as Chopin *Etudes Op. 25, No. 6* and *Op. 25, No. 8*. When students play these etudes, many complain of

forearm tightness because they do not execute the double finger movements well. Students generally cannot control the third joint adequately when they move two fingers simultaneously. They have a tendency to continually push fingers against the key with the whole hand instead of the more efficient motion of raising the third joints and dropping them immediately to relax. If the fingers are raised but not relaxed properly, the continuous pulling of the extensor muscles on the two fingers' tendons can cause extra tension in the knuckle joints, wrist, and forearm, which results in slow finger movement. Students must learn how to execute double finger movements from flexible knuckle joints without any extra pressure from the wrist and forearm. With the finger-board exercises, students can feel the movement of the fingers more closely because of the lighter touch involved. Once students learn the finger movement properly, they can then increase the speed of these difficult double figures more easily.

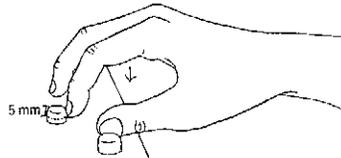
Mikimoto points out that while some students are born with natural finger speed, most are not. Furthermore, once finger speed is achieved, it must be maintained by exercising or playing many fast speed pieces. Mikimoto believes that if students' repertory does not contain many fast finger movements, the finger-board exercise could be a substitute or supplement to sustain finger agility.

### **Producing Uniform *Piano* or *Pianissimo* Sounds**

Finger-board practice is effective not only for fast finger movement, but also for controlling sound, dynamics, and tone quality, especially when coordination between finger movement and wrist, forearm, and upper-arm relaxation comes into play. To develop a bigger variety of soft sounds or colors, Mikimoto recommends different type of

low peg exercises. For example, with *piano* or *pianissimo* sounds, students can increase their fine motor control with a tiny scratching motion about 5 millimeters from the bottom of the peg without touching the board, as shown in Figure 3–44.

**Figure 3–44: Small Scratching Motion on the Finger–board**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 87.

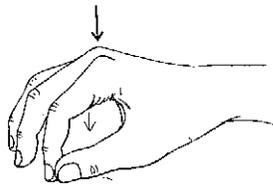
The smaller the movement, the more active the *lumbrical* and *intersosseous* muscles have to become. For students who always use forearm flexor muscles, this exercise is very difficult and the speed of the finger moments is slower than with the bigger scratching motion. Mikimoto found that even if students can move fingers in the regular finger exercises (2 centimeters vertical motion) at quarter note equals 180, two eighth notes per beat, often the finger speed for the  $\frac{1}{4}$  peg motion (5 millimeters vertical motion) drops to less than a quarter note equals 100. This shows that larger muscles like the flexor muscles in the forearm cannot control these small movements.

Generally, controlling small movements can be quite a challenge, and these exercises require intense concentration. Students should attempt the exercise in short intervals, two to three minutes per finger, and scratch different lengths, such as 6 millimeters, 4 millimeters, and 2 millimeters. Mikimoto found that students quite often tense up the hand and the wrist for this exercise. This tension can be detected by observing the position of the bridge and third finger joint. If the bridge or third joint is

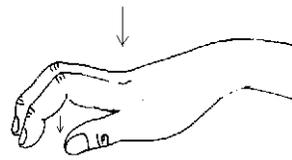
collapsed down, as shown in Figure 3–45a, that is the sure sign of hand and wrist tension. To achieve better control of the finger movements in this exercise, it is important to exercise with the proper hand position, shown in Figure 3–45b, so that the small muscles will be activated.

### **Figure 3–45: Position of the Third Joint**

a) High position



b) Low position



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 95.

In addition, Mikimoto recommends a light push of the nail against the peg while scratching down, a subtle action which will strengthen and stabilize the finger joints.

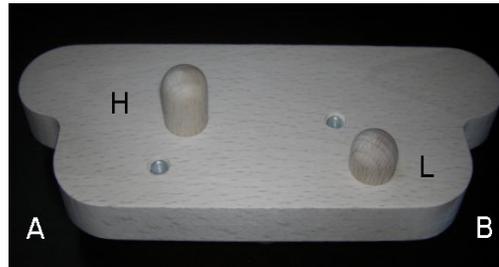
As with the regular low peg exercises, once students become comfortable moving individual fingers in 5 millimeters vertical movements, they may begin trill exercises with two–finger combinations with the same restricted 5 millimeters movement. If the individual finger is not correctly trained, it will not be possible to perform fast trills. The effects of training can be confirmed by the evenness of the trill on an actual piano, playing with *piano* or *pianissimo* dynamics. When the training is completed correctly, students will feel free, comfortable finger movements in playing.

### **Stretch and Jump–over Exercise**

Mikimoto found that when students continuously practice the low peg exercises discussed above, some experience difficulty with increasing the speed, which may be a

result of tight finger tendons. To increase flexibility of the finger tendons, for these students, Mikimoto suggests exercises using the other side of the finger-board where there are two pegs, one high and one low, as shown in Figure 3-46.

**Figure 3-46: Other Side of the Finger-board**



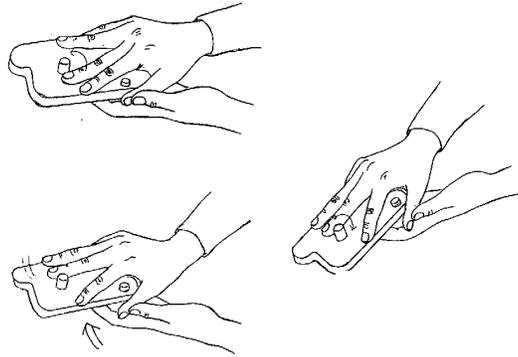
A simple stretch exercise can be done by spreading two fingers around the high and low pegs. The stretch between second and third, third and fourth, fourth and fifth fingers can be developed in this manner by using the high and low pegs. The stretch between first and fifth and second and fifth fingers may be developed by placing them at the corners of the finger-board, points A and B. The fingers should be held in a stretched position for seven counts, but the stretch should be not forced nor create any excess tension in the hand nor arm.

Once the tendon is warmed up, its flexibility can be further developed with the side motion exercise: jumping over the peg with a flat extended finger, as shown in Figure 3-47.

**Exercise 15:**

Place the board underneath the hand in the long direction and rest the ball of the hand on it while extending the fingers out (see Figure 3-47). Raise the knuckle so that the hand forms a slight pyramid shape with fingers outstretched in a straight line. Perform the “jump-over” exercise with one finger. The other fingers should rest on the finger-board. Wrist tension may be checked using the other hand to gently move the finger-board while the primary hand continues to perform the “jump-over” exercise.

**Figure 3–47: Jump–over Exercise**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 83.

When one finger jumps over the high peg, it is common to observe finger movement resulting from undesired tension. For example, when the second finger jumps over the peg, the base of the thumb tends to shift position inwards, towards the palm. When the third finger jumps over the peg, the second and fourth fingers also move even if the student does not intend them to do so. In addition, most students tend to tighten the wrist in order to move their fingers. To avoid this unwanted tension, students must first exercise slowly to avoid other finger movements and tension as well as to feel the independence of each finger.

Mikimoto found that many students have difficulty with the fourth finger jump–over exercise. Although the fourth finger can jump over the peg, in many cases the student cannot hold the third or fifth finger still, and the wrist becomes very tight. Generally, the fourth finger movement is very limited because of the structure of the tendons. This jump–over exercise, while not an easy task, demonstrates the flexibility of the fourth and its tendons, which are essential in piano playing. As mentioned before, Mikimoto believes that flexibility of finger tendons can be achieved through the stretch exercises. For students who have difficulty with the “jump–over” exercise, Mikimoto

recommends consistent practice of the side stretch exercise with the finger-board, along with the following simple vertical stretch exercise:

**Exercise 16:**

Gently pull up on each finger with the other hand and let it stretch upwards on its own. The other fingers should rest in a down position; and hold this position for six to seven seconds.

After students are able execute the jump-over exercise without any tension in the wrist or other fingers, they should check the speed of their finger movement using the metronome, which will reflect the extent of their flexibility. They can count finger speed using eighth notes as the basis of the counts. When the finger is on the left side of the peg, it counts as “one,” and when the finger is on the right side, it counts as “and.” Mikimoto states that for the second and third fingers, a sufficient speed would be faster than 160 equals a quarter note. If initial speeds are slower than 100, students need improvement and consistent training. She found that after several weeks of exercises, most students can develop their velocity. Some students who have fast finger movement can achieve 180 after the training.

For the fourth finger, movement will be slower; jumping over the high peg at a speed of a quarter note equals 50 to 80. If the third and fifth fingers move around during the training of the fourth finger, students can hold them lightly with the other hand. Mikimoto found that students who had slow finger movement due to tight tendons could move their fingers faster by 6 to 10 metronome points immediately after the stretch exercises. Mikimoto asserts that if students do not see any improvement after the stretch exercises, they may have a problem with the sensitivity in their fingers. If that is the case,

she recommends scratch exercises with the low peg to help increase sensitivity in the small hand muscles that control the speed of finger movement.

### **Additional Stretch Exercise for Tight Tendons**

The “jump-over” exercises described above are designed to develop flexibility of the tendons and the side motion of the fingers controlled by the small muscles in the hand. According to Mikimoto, the most effective way to activate these muscles is to raise the finger from the third joint. However, students who have short extensor tendons or tight tendons may have trouble raising their fingers high enough to train these small muscles. Mikimoto recommends the following exercises to achieve flexible finger movement, in addition to the other stretch exercises described previously.

#### **Exercise 17:**

Curl one finger under the hand and into the palm as shown in Figure 3–48, leaving the other fingers outstretched. Maintain this position for seven counts and relax.

#### **Figure 3–48: Additional Stretch Exercise**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 115.

After each finger tendon is stretched, Mikimoto suggests measuring the speed of this movement. Her research revealed a range of 120 per two movements (in and out) for slower students, up to 180 for faster students. After students feel comfortable moving

individual fingers, she also recommends training a combination of two fingers moving in alternation, as shown in Figure 3–49.

**Figure 3–49: Additional Stretch Exercise in Alternating Fingers**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 115.

Second and third, or third and fourth fingers, can generally move at a speed of around 170, while fourth and fifth fingers move at only 80 to 100. These are generally applicable speeds, but Mikimoto discovered that some students could not perform the exercise in the normal range of speed because their tendons were too tight.

Mikimoto observed that students with tight tendons in their hands also have tight tendons in other parts of the body. Generally, it is easy to determine a person's flexibility from other general stretch exercises such as touching one's toes. If students find tightness in their bodies, they should pay close attention to flexibility in the finger tendons. For these students, sufficient stretch exercises can improve the necessary flexibility to allow greater speed and dexterity.

Mikimoto also found that the growing process of the body makes tendons tight. As the hands become larger, tendon growth does not match the speed of growth of the bones in many cases, which may cause problems with piano technique. Some students between the ages of twelve and seventeen show a decline in speed and coordination of

finger movement even though they practice. In this case, students should make a habit of stretching regularly to avoid further tightening of the tendons.

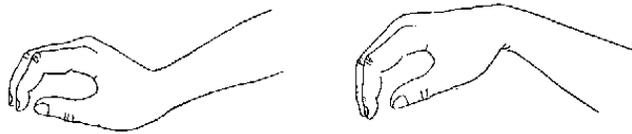
### **Summary of the Finger-board**

In the history of piano teaching, there have been many devices invented that were believed to develop students' fingers. Compared with many of the nineteenth-century mechanical devices discussed in the previous chapter, Mikimoto's finger-board is much more of a free-form apparatus that simply guides finger movements. Her finger-board is not for increasing the brute strength of the fingers, but is more useful for the development of sensation in the fingers and other parts of the hands and arms. There are many ways to improve piano playing using the finger-board exercises described above: exercises for finger agility, double notes, soft sounds, and control of wrist and elbow tension. In addition, the finger-board is particularly beneficial when a student has been away from the piano for a while or has not played fast pieces regularly, for the low-scratch exercises help to sustain finger agility. If students press down instinctively with tension in the wrist or forearm, it is easy to feel with the other hand which is holding the board. The low-scratch exercise helps to alleviate this tendency because it allows students to concentrate on the light touch of finger movement. The finger-board is used to gain a kinesthetic feeling for finger, wrist, forearm, and elbow movement, not to strengthen finger muscles, which was the main purpose of the older devices described earlier. As small and simple as it is, Mikimoto's finger-board is a remarkably useful apparatus that can benefit students at all levels as well as advanced pianists.

### **Position of the Hands and Fingers**

Once students develop a good sense of finger movement from the exercises previously mentioned, Mikimoto suggests combination finger exercises at the piano for further refinement of finger agility. Before applying the finger movements to the piano, students should check their body and hand posture when they play, as Mikimoto observed several common errors in the positions of hands and fingers. Figure 3–50 shows two examples of incorrect wrist placement, which generally creates excess wrist tension and disturbs the weight transfer from the arm.

**Figure 3–50: Extreme Position of the Wrist Joint Falling or Rising**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 65.

**Figure 3–51: Extreme Position of the Third Joint: Rising or Falling**



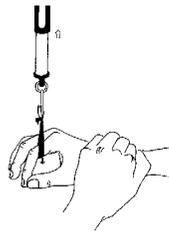
Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 65.

Instead of the incorrect placement of the third joints shown above in Figure 3–51, Mikimoto states that the third joints should be naturally arched, which can generate more resistance than a flat position. Mikimoto presented the following experiment to compare the effectiveness of these different hand positions. In this experiment, any of the finger

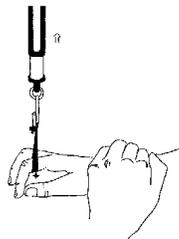
joints can be placed on the spring of a weight scale as shown in Figure 3–52. The spring scale should be raised while holding the wrist with the other hand. When the finger can no longer resist the force, the weight reading on the scale should be noted.

**Figure 3–52: Knuckle Positions with Weight Scale**

a) High Knuckle Position



b) Low Knuckle Position



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 125.

From this experiment Mikimoto found that the arched position can hold as much as 3 kilograms, while the flattened position shown in example 3–52b cannot hold more than 1.5 kilograms. In other words, fingers can resist a force twice as great just by changing their position. Mikimoto concluded that the arched position of the fingers can more efficiently withstand the force between the weight of the arm and the impact of the keys.

Figure 3–53 shows the incorrect placement of the second joint of the finger. For the best finger movement, the first and second joint of the finger should be stabilized and the finger should be moved from the third joint.

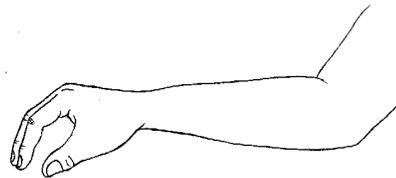
**Figure 3–53: Extreme Position of the Fingers Curling or Extending**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 65.

Mikimoto says that the ideal position of the hand allows the pianist to feel the center of gravity; simply relax the forearm and place the elbow, wrist, and palm in almost a straight line on the keyboard, as shown in Figure 3–54.

**Figure 3–54: Ideal Hand Position**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 65.

By keeping the hand and arm in the correct position, students can control more efficiently the weight of the hand and wrist and more effectively practice the following exercises.

**Developing Finger Agility with Combination Finger Movement on the Piano**

In order to achieve fast finger movement, the motor cortex of the brain must be trained to have more rapid communication with the muscles. Mikimoto asserts that playing short repeated patterns reinforces this rapid communication, and consequently

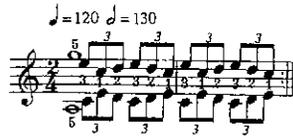
introduces over a hundred various combinations of short figural exercises. Each of the following sample exercises has the same finger combination and rhythm, and was designed to develop finger agility at the piano.

The first exercises of four triplet figures can be played hands together or separately with the same fingering.

**Exercise 18:**

Hold the fifth finger down silently and play the finger combination 3, 1, 2, 3, 2, 1 as shown in Music Example 1.

**Music Example 3–1: Finger Combination Exercise (for Fingers 3, 2, 1,)**

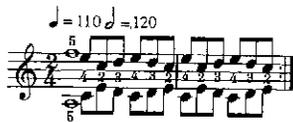


Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 67.

**Exercise 19:**

Hold the fifth finger down and play the finger combination 4, 2, 3, 4, 3, 2 as shown in Music Example 2.

**Music Example 3–2: Finger Combination Exercise (for Fingers 4, 3, 2,)**

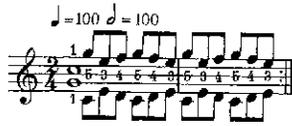


Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 67.

**Exercise 20:**

Hold the first finger down and play the finger combination 5, 3, 4, 5, 4, 3, as shown in Music Example 3.

### **Music Example 3–3: Finger Combination Exercise (for Fingers 5, 4, 3,)**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 67.

The exercises should be played in tempo without any mistakes ten consecutive times.

Mikimoto determined that students can usually start playing Music Example 1 with the metronome at 120 to the quarter note after doing the finger-board. Music Example 2 is generally played 10 points slower because of the weaker fingers involved, and Music Example 3 can be played slower than Example 2. Since the left hand is generally slower than the right hand, she suggests that the exercise be done by each hand separately at first. After students are able to play each exercise 10 times or more without any mistakes, raise the metronome number by 4 points at a time. Mikimoto states that one can see some students learn and adjust their finger patterns quickly, as students with a good sense of coordination are able to play 10 points faster after practicing only 10 minutes. Once students master the finger patterns described above, she suggests changing the patterns of the notes or finger alternations as shown in Music Example 4.

### **Music Example 3–4: Additional Finger Patterns**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 67.

Mikimoto found that when the pattern of the figure changes, students react differently: some can play more rapidly, but most play much more slowly than in the previous exercises.

Mikimoto points out that it is interesting to see students processing information at different rates. There are so many patterns in actual music that students who can process information instantly learn naturally simply from playing pieces. On the other hand, students who cannot process information promptly take much longer to learn many patterns in the pieces, and as a result have to take longer practice time. However, Mikimoto asserts that consistently practicing the many different combinations shown above will help such students greatly. She found that if students continue to practice these exercises and other different short figure exercises every day for six to twelve months, with two sets of ten minutes each, most will develop not only fast finger movements but also the ability to process different patterns more quickly. Junior high and high school students showed especially fast progress and better results in their playing.

Mikimoto also noted differences in progress between the right and left hand. In general, the left hand is 10 to 20 metronome points slower than the right hand in the same figures. However, when some students play both hands together in the same finger number patterns, the hands start to coordinate and sometimes the left hand becomes faster in order to adjust to the right hand speed. For developing coordination between the right and left hand finger movements, Mikimoto suggests changing the note patterns between the right hand and left hand. These exercises create more challenge for the brain to adjust to new finger movements. Over time, this kind of challenge will develop the brain's ability to adjust to new patterns more quickly. She developed the following exercise for this training purpose, as shown in Music Example 5.

### **Music Example 3–5: Different Rhythm Patterns Between the Hands**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 67.

### **Exercise 21:**

Keep one hand playing the same pattern of Music Example 1, and play the different rhythm in the other hand.

After practicing exercises 17 through 19, playing the same fingering with both hands, the students will find exercise 20 very difficult, and at first they may only be able to play in very slow tempos.

The problem arises with new patterns of figures that the brain tries to analyze, interrupting mastered, reflex-like motor skills. For this reason Mikimoto believes that finger development involves not only muscle strength but also development of the nervous system. The step-by-step exercises described above, starting with the sense of finger independence, moving on to fast individual movement, and then coordination with basic three-note finger patterns help not only to train evenly distributed muscle strength but also to develop adequate brain functions.

Given the stages of physical and brain development, Mikimoto discovered that students' finger agility in these kinds of repeated figures improves most dramatically between the ages of eleven and seventeen. In order to develop most effectively around these ages, Mikimoto believes that younger students should not be forced to play too loudly or too fast in actual piano pieces. If younger students practice exercises and play

actual piano pieces with a light touch, using “instantaneous power” of the fingers without unneeded muscle tension, then by the time they are in junior high or high school, they can develop sufficient technique to be able to play advanced pieces such as the Chopin *Etudes* and the Liszt *Transcendental Etudes* more easily.

In addition, Mikimoto has been consulted by college students who have bad habits of playing with tightened finger and wrist muscles and who find it very difficult to play these kinds of etudes. In order to overcome these challenges, students should go back to the basic exercises outlined earlier. These students should concentrate on movement rather than sound, and start within the range of volume obtained without any tension. Like the younger students, college-level students can develop their finger agility using the independence and simple figure exercises described above, relearning finger movement without excess tension. Once students become comfortable executing these movements at a fast tempo, they can train for sound production.

Mikimoto’s exercises show students where points of tension exist and can help to correct bad habits. Her method shows the connection between tension and various aspects of technique such as tone and agility more specifically than many nineteenth-century and current methods, distinguishing itself with its specific solutions to distinct problems.

### **Developing Larger (supportive) Muscles**

#### **The Forearm Exercises**

In addition to the finger exercises previously outlined, Mikimoto details exercises for the larger muscles of the arm, shoulders, and back. As addressed in an earlier section,

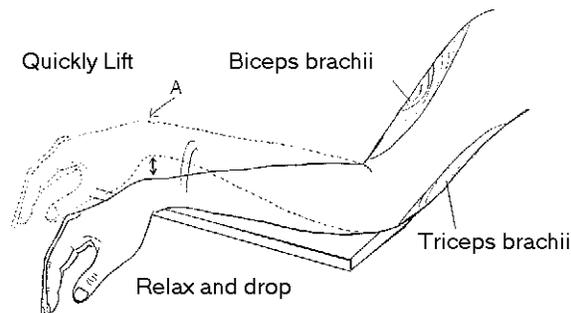
the involvement of wrist and arm movement is essential for piano technique as it supports finger movement and gives fingers maximum efficiency and sound-producing capability.

The first two exercises have the goal of producing a flexible elbow joint and forearm motion without tension.

### **Exercise 22:**

Place the forearm on a table and use minimum effort of *biceps brachii* muscle between the shoulder and elbow and to raise the forearm 3 or 4 cm as fast as possible. Then relax and drop as shown in Figure 3–55. At the starting position, wait 2 seconds to feel complete relaxation and then repeat the movement.

**Figure 3–55: Exercise for Raising the Forearm without Tension**



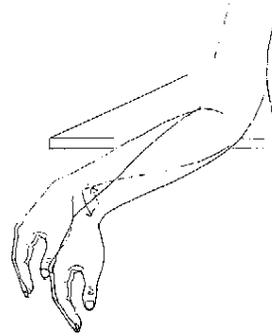
Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 35.

The second exercise develops awareness of forearm movement using *triceps brachii* muscle, which helps in playing fast octave passages.

### **Exercise 23:**

Drop the arm loosely from the shoulder (the elbow can be loosely supported on the edge of a chair or table), twitch the whole arm with a slight movement, then relax as shown in Figure 3–56. The wrist and hand must be relaxed during the whole exercise.

**Figure 3–56: Exercise for Moving the Forearm Using *Triceps Brachii* Muscle**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 37.

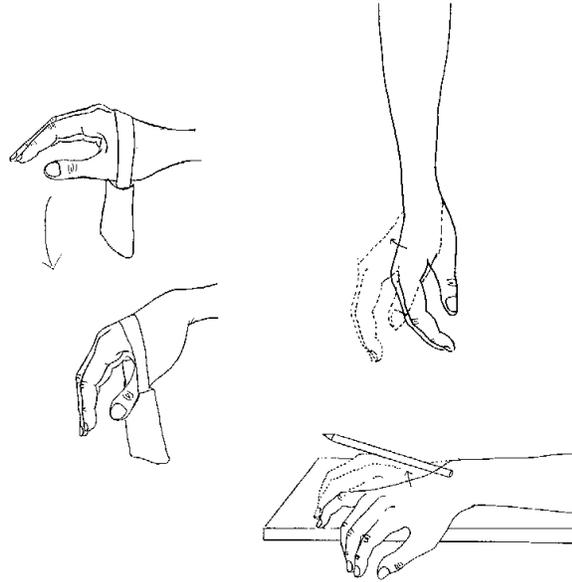
### **The Wrist Exercises**

Mikimoto claims that the wrist is the second most important physical component of piano playing followed by the fingers, and must be very flexible to allow for hand and finger movement, especially fast movement. When students become fatigued while playing repeated octave figures, it is generally caused by sluggish wrist movement creating excessive tension. The following exercises develop awareness of the wrist movement, illustrated in Figure 3–57.

#### **Exercise 24:**

Place the forearm on a table so that the wrist hangs over the edge. Twitch up the hand and relax. The right amount of movement can be measured with an object such as a pencil held above the hand. A small weight hanging from the hand can be used to enable the student to feel the movement of the wrist more clearly. This exercise can be also practiced while standing up, with the hand hanging down loosely. Quickly flex the wrist and then relax.

**Figure 3–57: Wrist Exercises**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 31.

Mikimoto found that students will understand and feel the contractions and relaxations more clearly after performing these three exercises for two to three months.

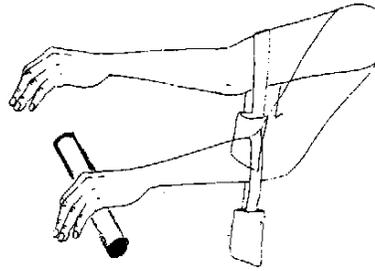
### **The Upper arm and Back Muscles Exercises**

The next exercises Mikimoto created are designed to develop upper arm and shoulder movement, which is very important for tone production. Even children with unstable fingers can produce proficient sound if they incorporate arm movement from the shoulder into their playing. First, to learn effective use of the whole arm, students have to feel the muscle movements engaging the upper arm and shoulder.

#### **Exercise 25**

Lift the upper arm from the shoulder and position the hand 10 centimeters over an object, such as a paper cardboard cylinder taken from a roll of paper towels, or another person's hand. Relax the forearm, and drop it quickly, and allow it to slap the object as shown in Figure 3–58. (Children's arms are very light, so in order to get a clearer feeling of arm weight, they can add extra weight on the upper arm.)

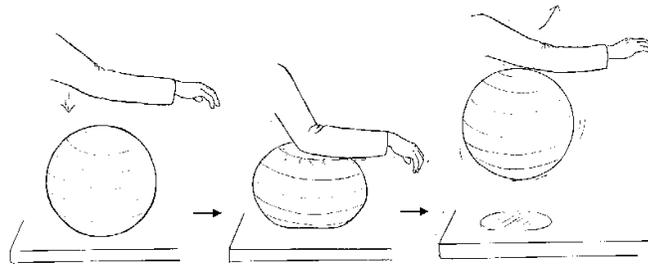
**Figure 3–58: Arm Exercise**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 101.

Another effective exercise to feel forearm and upper arm movement is to bounce a big exercise ball (around 40 centimeters diameters) with the whole arm as shown in Figure 3–59.

**Figure 3–59: Arm Exercise Using Exercise Ball**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 103.

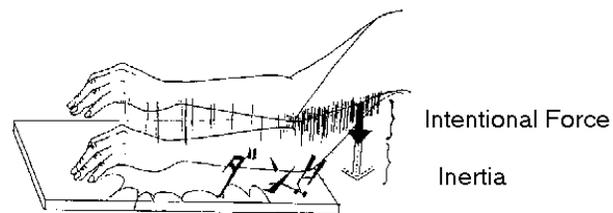
In this exercise, the speed of the movement is crucial, for if the falling arm is slow or forced down too strongly, the ball will not bounce back. Using a fast arm movement will benefit students who have underdeveloped arm muscles or physical shortcomings such as slender arms or fingers.

Once students understand the movement of the arm, then they can further develop a controlled movement of the *deltoid* and *latissimus dorsi* muscle.

### **Exercise 26:**

With the forearm on the table as in a playing position, lift the forearm from the shoulder joint outwards by 5 centimeters, feeling the deltoid, then drop down halfway using the *latissimus dorsi* muscle. Use intentional force in the first half of the motion and then allow the forearm to drop on its own, as shown in Figure 3–60. This timing is very important to put more weight in the arm movement and to avoid excessive tension. The goal is to avoid a rigid striking movement; instead, one should throw quickly and release to allow momentum to complete the movement.

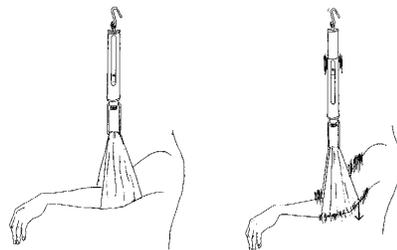
**Figure 3–60: Exercise for *Deltoid* and *Latissimus Dorsi* Muscle**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 35.

Mikimoto uses hanging weight scales, as shown in Figure 3–61, to measure the strength of the *deltoid* and *latissimus dorsi* muscles. She found that students who do not have experience exercising back muscles can only pull down 7 to 8 kilograms. Once they understand how to use the back muscles effectively, at an efficient speed with proper momentum, they will be able to pull down 15 to 18, even 25 kilograms.

**Figure 3–61: Measuring Strength of *Deltoid* and *Latissimus Dorsi* Muscles**



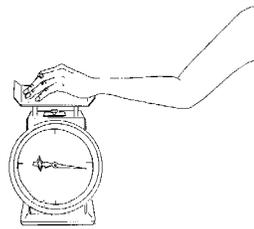
Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 37.

Mikimoto also found that control of the *deltoid* muscle helps with the creation of a beautiful and full soft sound. She describes the following exercise to increase the awareness of the *deltoid* muscle.

**Exercise 27:**

Relax the arm, use the *deltoid* muscle to raise the arm, and place the heel of the palm on the scale. Then gradually allow the *deltoid* muscle to relax while transferring the weight to the palm, as shown in Figure 3–62. Keeping the palm on the scale, gradually raise the arm using the *deltoid* muscle and note the change of weight on the scale.

**Figure 3–62: Transferring Weight Using the *Deltoid* Muscle**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 27.

For all of these exercises, Mikimoto cautions not to use extra muscle tension. The most important aspect of these exercises is to control muscle contraction. Many students habitually over-tense muscles, but repeating these exercises reinforces the feeling of contraction and relaxation. Once students learn efficient muscle usage, she also recommends measuring the speed of the movements, which can reveal the degree of development, or conversely, the weakness of muscle usage. Eventually, when students have sufficient speed, they will have more efficient muscle contraction.

**Exercises for Coordinated Movements**

Coordinated muscle movements are challenging tasks for students. Once an individual muscle contraction is learned, most students can develop adequate speed in

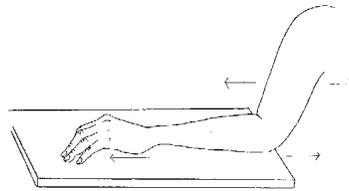
single movements. Yet, it is common in actual performance that when students use two different motions simultaneously, such as up and down motion with side or forward motion, they experience awkwardness and the speed of the movement decreases. Mikimoto suggests that students exercise using a single movement of the arm in forward and side motion and of the wrist, then subsequently combining arm and wrist movements together.

**Exercise 28:**

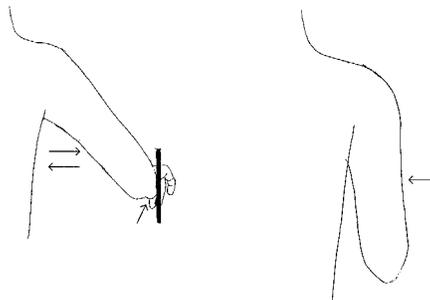
Lightly place the forearm on the table. Use the *deltoid* muscle to slide the arm forward and away from the body, then bring back in position as shown in Figure 3–63a. Or stand by a wall, open the arm from the shoulder, and touch the wall as shown in Figure 3–63b.

**Figure 3–63: Exercise for Arm Motion**

**a) Forward Motion**



**b) Side Motion**



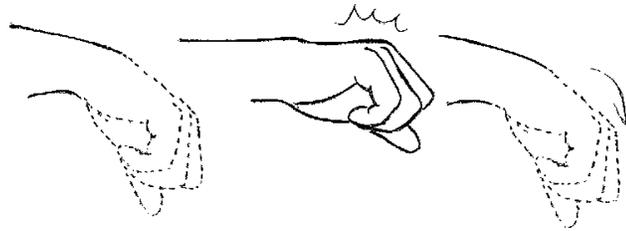
Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 43.

Once these movements become comfortable, combine with wrist movements as shown in exercises 28 and 29.

### **Exercise 29: Combining Wrist Movement with Forward Arm Movement**

Place the hand under the table and use a wrist movement to knock the table while moving the arm forward and back as shown in Figure 3–64.

**Figure 3–64: Combined Wrist and Forward Arm Movements**

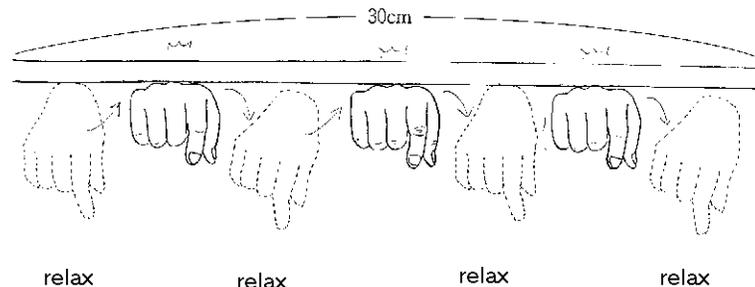


Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 45.

### **Exercise 30: Combining Wrist Movement with Side Arm Movement**

Place the hand under the table as in the previous exercise, moving the hand from side to side 30 centimeters while continuing to knock as shown in Figure 3–65. Make sure each wrist movement is alternated with complete relaxation.

**Figure 3–65: Combined Wrist Movement with Side Arm Movement**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 45.

Mikimoto points out that in many cases students who take a long time to master pieces have problems in these combined muscle movements. In order to monitor self-improvement, the single movements can be measured first and then compared to the speed of the combination movements. If the single movements are much faster than the combination movements, students can improve the speed of the latter with these exercises.

## **Training for Specific Physical Conditions**

### **Importance of Children's Training**

Mikimoto states that many technical difficulties and even piano-related injuries are often the product of a long history of accumulated bad habits that may extend back to childhood. For this reason, children's finger training requires close attention, especially in the beginning. The instructor must also pay attention to the role of brain function in developing motor skills and must help children form proper neural patterns in the brain from early training onward. She believes that two brain reactions, called extension and restraint reactions, are closely related to the development of children's piano technique.

### **Extension and Restraint Reaction**

Extension and restraint reaction is a fundamental nervous activity in muscle movement. While Mikimoto does not directly quote any scientific literature regarding this nervous system activity, a more detailed explanation can be found in Kochevsky's *The Art of Piano Playing: A Scientific Approach*.<sup>67</sup> When the cerebral cortex is stimulated by an outside stimulus, it signals the nerve cells with a small electrical impulse. The electrical impulse travels through the brain cells' synapses and through the nerve branches to each muscle in order to create movement. Once the stimulation reaches the muscles there are two reactions. One is called "extension," whereby the nerve stimulation excites all the nerve cells in its path, even those not directly needed for that particular motion. The other reaction is "restraint reaction," which acts to control "extension" and prevent unneeded muscle movement. More extension signals cause more restraining reactions. Understanding both reactions is very important when

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<sup>67</sup> Kochevsky, *The Art of Piano Playing: A Scientific Approach* p. 25

mastering motor skills, as they form a sort of balancing act. Mikimoto, like Kochevisky, believes that the young brain has not quite developed the “restraining reaction,” so that movements can be very clumsy. This phenomenon can be seen when babies hold onto some object; they move every part of the body, including the whole arm and all the fingers. When they get older, they learn to balance these reactions and refine their movements.

From her extensive experience, Mikimoto has come to believe that the restriction and extension signals are balanced differently among children, causing them to have varying levels of strength and weakness of muscle movements. While this question will need to be resolved more clearly in the scientific literature, Mikimoto’s experience with her own students seems to point towards this explanation. For example, in combination movement exercises like moving the wrist and arm simultaneously, some students will have difficulty executing the two movements at the same time. In her view, this shows that the “extension” and “restriction” signals are imbalanced resulting in very slow combination movements in these exercises. For the same reason, the speed of finger movement exercises is different, depending upon whether a student’s arm is moving or fixed in one position. Mikimoto strongly believes that if students start proper training at an early age, they can control these reactions more effectively and increase the speed of all the exercises.

Physically, proper piano playing requires minimum muscle movement to avoid tension and to attain fast finger movement. This minimum muscle movement is achieved through mental focus that helps limit the brain’s extension signals. Difficulty with controlling extension signals can be observed in beginning piano students. Mikimoto

found that they struggled to play the piano with correct finger movement when their brains were in the middle of development, especially between the ages of five and six. This difficulty of controlling muscles creates problems in small children's individual finger movements. Most frequently, they push down the wrist and forearm, or the other fingers become stiffly extended or curled up. Mikimoto states that it is easier for small children to develop the proper balance between extension and restriction signals with restricted movements of one body part, such as finger movement. This prevents over-stimulation of the brain and subsequent imbalance between neural signals. Often, students receive too many instructions while they are playing the piano, but practicing just one part of a physical exercise away from the piano can help achieve goals quickly.

As we all know, each student shows different physical and technical strengths in piano playing due to differences in physiological and muscular makeup. Mikimoto theorizes that part of the reason may be that the reactions of the brain vary between individuals during childhood. She believes that children under ten years old may not have completely developed the restriction signal (connection between muscles and the brain), which can be seen in awkwardness at the piano and tension in other parts of the hands and arms. When these students are asked to create a loud sound, they always use the tension of the wrist and elbow joints, a habit very difficult to correct when they get older. She believes that the instructor should be careful not demand too many technical skills even if the individual child seems able to perform them. Instead, the teacher should base expectations on what is appropriate for the student's physical development.

Mikimoto found that this overall approach to teaching children (awareness of brain functions and physical development) is very effective, even for older students who

cannot control their fingers freely for musical expression because of bad habits lingering from childhood. Wrist and arm tension are good examples. They interrupt finger fluency. The first step in the process of fixing the problem is to work away from the piano, concentrating on moving just one part of the muscle, avoiding unneeded tension, as in Mikimoto's exercises. Once students understand both the concept and the feeling of finger, wrist and arm movement, they can apply it to playing the actual piano. Correcting old bad habits takes time and concentration to avoid their reoccurrence, but this process will retrain the balance between extension and restriction in the brain and help students find the proper amount of tension and coordination between the muscles. When developed correctly in this manner, students find that their piano playing becomes much easier and freer and that they can greatly control a variety of tone colors and qualities.

### **Guidance for Octave Playing**

In addition to all the physical and mental training outlined above, Mikimoto discusses preparation for octave playing, which she believes requires special attention. She states that octave playing is one of the technical challenges that cause students to develop habits of excess tension, which not only interferes with development but can even cause injuries. At around ten years of age, even though students can reach the octave, they still tense up their wrists when they are forced to open the first and fifth fingers to play. Typically, young students tense the muscles, the *extensor carpi* and *flexor carpi*, which control wrist's vertical and horizontal movement. If that tension becomes a habit, the students will continue to tense the wrist later when their hand grows larger, even though they can easily reach an octave.

Mikimoto suggests that when students reach six to seven years of age, they should have preparatory exercises for the octaves to avoid excess wrist tension, and she advises using broken octave (Music Example 6) to check for its existence.

**Music Example 3–6: Broken Octave**



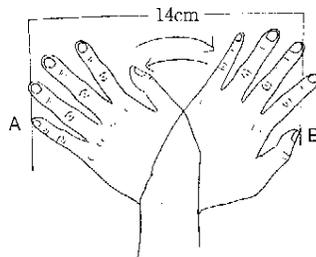
Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 105.

In order to play this figure, most students tighten up the wrist to reach the alternating notes, and Mikimoto recommends the following exercise.

**Exercise 31:**

Place the forearm on a table and relax the hand and arm. Then open the hand comfortably (not wide open) and move the wrist from right to left across a span of 14 centimeters, as shown in Figure 3–66. Measure the speed of the movement.

**Figure 3–66: Exercise for Wrist Side Motion**

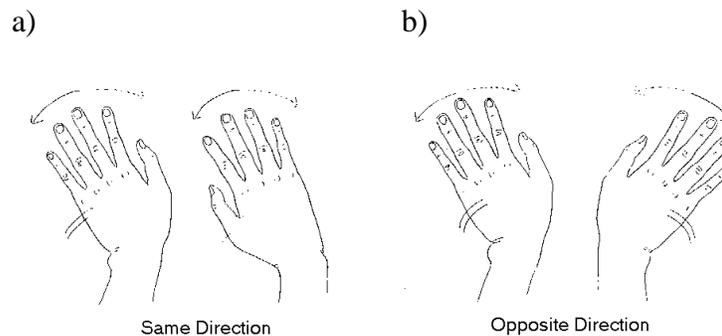


Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 109.

Mikimoto says that at first the wrist moves at a metronome rate of 80 to 90 for each movement. After one month of daily practice, most students should be able to move at more than double that speed. In fact, she discovered that small children trained properly are able to move their wrist faster than older students who have fallen into bad

wrist habits. To develop adequate side wrist motion, students should on average set the goal speed of 150 or faster. Here Mikimoto cautions both the student and the teacher on several points. As with finger exercises, the right and left wrist motions develop differently. Depending on whether the student is right-handed or left-handed, the frequently used hand will develop faster. However, both hands should be trained equally. After practicing with hands separately, practice moving both hands in the same and then opposite directions, as shown in Figure 3–67.

**Figure 3–67: Direction of Wrist Motion**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 109.

Mikimoto found that most students can perform this exercise at faster rate when they move their hands in opposite directions. Presumably, the brain can more easily process coordinated motions in which both hands use the same muscle groups. The slow left hand can move faster when it is led by the speedier right hand. When both hands move in the same direction, the slower left hand will determine the speed of both.

The second caveat that Mikimoto issue is to watch for excessive tension. The forearm and elbow should remain relaxed even though they may move slightly during wrist exercise. She elaborates that children love to exercise at a fast speed when they are encouraged, but this obviously causes tension, so they should be careful not to tense up

the elbow. She suggests that the teacher hold the elbow lightly and shake it gently to check for tension while observing these exercises. Her last point is that some students have inflexible wrists in the horizontal movements of this exercise, which will slow the speed of wrist movement. If this is the case, they should do a stretch exercise, bending to both the right and left sides, holding on each side for 6 to 7 counts.

### **Increasing the Speed of the First and Fifth Fingers in Octave Movement**

Once students are comfortable with wrist movement for octave playing, Mikimoto suggests exercising the first and fifth finger movements.

#### **Exercise 32:**

Hold the wrist 2 centimeters above the table with the first and fifth fingers opened lightly. Raise one finger 1.5 centimeters and then quickly drop it to the table, making a light tapping sound. Alternate movement between the first and fifth fingers and measure the speed. To obtain a clear sense of the first and fifth finger movement, hold the second, third and fourth fingers lightly with the other hand to prevent them from moving.

According to Mikimoto's research, most young students are capable of performing this exercise at a metronome speed of 100 in two motions. When they practice consistently every day, their speed will increase to 150 to 200. Once students learn clean movement of the fingers, Mikimoto recommends that they try the same finger motion on the actual piano using C and G rather than a full octave. The hand may move in a slightly vertical motion, but it should be relaxed, with the first and fifth fingers moving individually. Consistent practice away from the piano, followed by applying these skills to the piano will produce an increase speed without excessive tension.

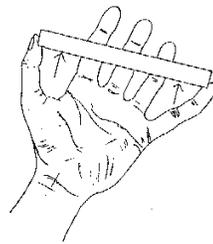
Mikimoto found that even though students learn various muscle movements individually, they often have problems applying them to actual playing due to the

coordination challenges of moving multiple muscles simultaneously. For example, students who have learned wrist movement with efficient contraction and speed may still feel difficulty and become fatigued while playing repeated octave figures at the piano. Two possible reasons are a weakness of the first and fifth fingers, or a lack of coordination between the wrist and first and fifth fingers. Whether caused by a lack of strength or an imbalance of strength between different muscles, Mikimoto suggests the following exercise to check coordination between the wrist and first and fifth fingers, and to detect excessive tension in them.

**Exercise 33:**

Hold a stick (14cm long and 1cm diameter) between the first and fifth finger and move the wrist up and down as shown in Figure 3–68.

**Figure 3–68: Exercise for Coordination of the Wrist and Fingers**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 41.

Students who have a problem with octave figures usually over-tighten the wrist so they should practice using less or minimal contraction to hold the stick and gradually learn to move the wrist properly.

For further training of octave playing, Mikimoto suggests adding arm rotation, which is essential to support fingers movement. She found that even students who master the two exercises above experience a decline in speed when they add arm rotation to finger movements due to the fine coordination skills required. This problem, often

shared by older college students, results from the same effects of the extension impulse and restraining reaction on individual finger movements mentioned earlier.

Mikimoto states that if the extension impulse and restraining reaction are in balance, students can move individual fingers more smoothly and avoid tension when depressing the keys. Optimally, the restraining reaction inhibits motion in the wrist and arms so that the finger can move properly but if there is too much of this restraining reaction it will adversely affect combination movements involving finger, wrist, and arm by slowing them down.

Mikimoto documented that there is a wide range of ability among young students to perform combination motions involving rotation of the upper arm and forearm and finger movements. In fast rotation of the upper arm and forearm, some students can rotate at metronome speeds of 160 to 200 in two motions. However, when they try to combine finger movement with rotation, their speed declines to 100.

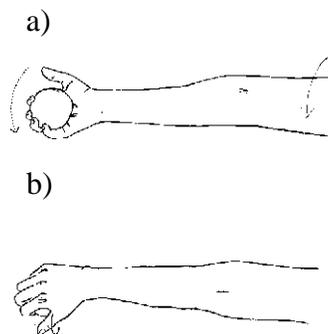
Mikimoto asserts that these combination movements between finger and arm rotation are crucial for children's future study. The technique which requires the combination of arm rotation and finger movement are used in many advanced pieces such as Chopin's *Etude Op. 25, No. 11*, and countless others. Mikimoto also states that combination movements are especially important for students with small hands and slender arms when they need to create louder sounds. However, a lack of coordination will force students to use excessive wrist and forearm tension to press the keys and produce a louder sound. This excessive tension can prevent students from sustaining a clear sound throughout an entire piece and it leads to muscle fatigue, in which case

students may fail to play through the entire piece. To develop coordination between wrist rotation and finger movements, Mikimoto suggests the following exercises.

**Exercise 34:**

As shown in Figure 3–69a, hold the ball lightly, with the thumb raised away from the ball. While rotating the forearm and upper arm, slide the thumb down around the ball quickly, as shown in Figure 3–69b. Then bring back to the original position as shown in Figure in 3–69 a. Repeat 10 times and measure the speed of the movements.

**Figure 3–69: Coordination Exercise (First Finger and Arm Rotation)**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 111.

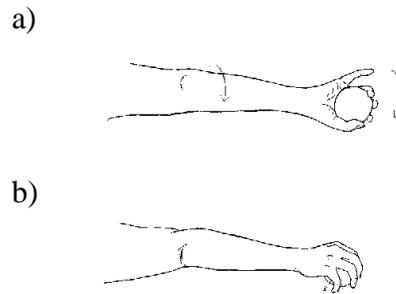
Mikimoto determined that a slow speed is 80 for 2 motions per beat, while a fast speed can be up to 160. Even if students have very slow movements, with daily practice over the course of two to three months, they can increase the speed 40 to 60 points above they started.

After the first finger and arm rotation exercise, Mikimoto suggests practicing the fifth finger and arm rotation combinations.

**Exercise 35:**

With a relaxed arm, hold the palm away from the body, and grasp the ball with a lightly raised fifth finger as shown in Figure 3–70a. While rotating the arm, tap the ball with the fifth finger, as shown in Figure 3–70b. Then bring back to the original position as shown in Figure 3–70a. Repeat 10 times and measure the speed of the movements.

**Figure 3–70: Coordination Exercise (Fifth Finger and Arm Rotation)**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 111.

Mikimoto says that the arm should not be rotated too much, because in actual piano playing excessive rotation is not required. This combination exercise will be slower than the previous exercise (the first finger and arm rotation exercise) with a difference of 10 to 20 metronome points. If the difference is greater than 10 to 20 points, she suggests practicing the fifth finger and arm rotation exercise further.

Mikimoto discovered that it is very difficult for many students to perform proper arm-and-finger combination movements without excessive tension. She finds it very regrettable that students do not understand that these coordination problems cause technical difficulty with certain types of piano passages. Being unaware of real physical problems and simply playing the same passage over and over while trying to overcome technical challenges is just wasted time for the student. She believes that students can use time more wisely if they think carefully, find their physical problem or weakness, and then correctly use the appropriate exercises described above on a daily basis. In this manner students will experience faster improvement of their piano technique, leaving more time for interpretation of the music.

### **Additional Exercises for the Playing Chords**

The following exercises for octave playing are drawn from Mikimoto's own experience. She recalls her struggles with having very small hands that could stretch only to the interval of a ninth. When she was younger, she had difficulty playing the middle note of a chord like F, A-flat, and F (as shown in Music Example 7) with her second finger.

#### **Music Example 3-7: Octave on F with a Third (F, A-flat, and F)**



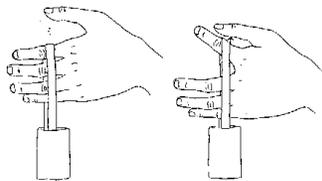
Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 113.

In order to play this figure, Mikimoto had to tilt her hand. It was impossible to play large chords in *forte*. She started to train not only the first and fifth fingers as described above, but also the second finger to increase the sound of the chord without having excess tension in the wrist and arm. She developed the following exercise to increase the strength of second finger using weights, as shown in Figures 3-71.

#### **Exercise 36:**

Hold the hand sideways and place the weight between the second and third joints. Raise the second finger, and hold for 7 counts, and release.

#### **Figure 3-71: Second Finger Side Motion Exercise**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 113.

Mikimoto reveals that at first, it was very difficult to feel the independence of the second finger. The thumb always tried to compensate for it, and as a result became tense. Even if the second finger was able to move independently, it could barely lift 100 grams at first. After the training, Mikimoto says that she can now lift 800 grams without any tension in her thumb. She also says that this kind of opening finger exercise applies to the fourth finger as well. Simply stretching the fourth finger toward the fifth finger, while holding the second and third fingers without any stiffening of the neighboring fingers, can give a clear sense of the independence and strength in the finger.

Mikimoto mentions that the exercises described above enable her to open her fingers with a minimum amount of wrist tension and to play octaves much more easily. Even though she still feels some limitation from her small hand in producing the full rich sound that she desires, she is able to play the chord F, A flat and F (Music Example 7) with less effort. Mikimoto stresses that these individual finger exercises are highly beneficial and should be practiced daily for optimal results. If students neglect this daily practice they will lose muscle strength quickly. For sound production in chords and octaves, these exercises help to stabilize the fingers, so that students may efficiently transfer the weight of the arm when they lift the back side of the hand, hold the wrist joint freely, and use the upper arm, forearm, and wrist speed to produce a full and clear sound without harshness. If students master this kind of coordinated playing without pushing the key with too much muscle tension, they can play and avoid any muscle fatigue.

### **Expanding the Reach of the Small Hand**

Mikimoto describes exercises to prepare for octave playing along with exercises for the second finger and chord playing. In addition, she has a specific suggestion for students who have very small hands or reach, especially between the second and fifth fingers: tilt the hand and arm towards the fifth finger and use the outside of both fingers to press the keys. The following experiment compares the regular position with the tilted position.

The hand should be held in a straight position, as it is when playing the piano, and then placed on a piece of paper. The second and fifth fingers should be opened without any tension in the wrist and elbow as shown in Figure 3–72, and the position of the fingers should be marked on the page.

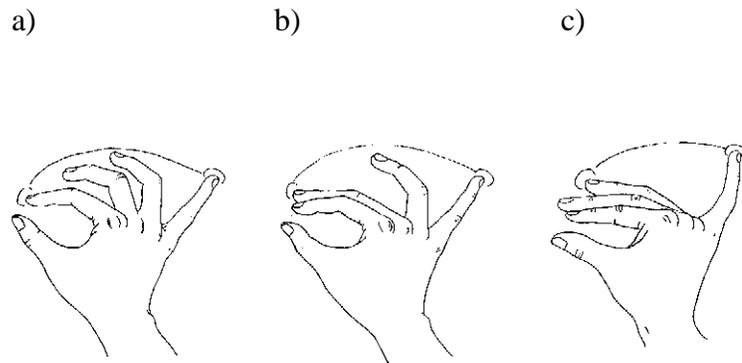
**Figure 3–72: Natural Hand Position and Finger Placement**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 119.

Then the hand should be tilted toward the fifth finger while the second finger is brought towards the thumb, as shown in Figure 3–73. The position of the second and fifth fingers should be marked.

### Figure 3–73: Tilted Hand Positions and Finger Placements



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 119.

Students will find that the second and fifth fingers reach further in the tilted position.

When students with small hands play with the hand in the regular position shown in Figure 3–72, they will generally have stiff wrists and a harsh sound.

Mikimoto uses that her own hands as an example of a small reach between the second and fifth fingers. However, when she utilized the second position as shown in Figure 3–73a, she could expand her reach by 1.5cm. The same result occurs with other finger combinations when the hand is tilted towards the fifth finger, such as the third and fifth combination (as shown in Figure 3–73b), and the fourth and fifth finger combination (as shown in Figure 3–73c). Even the fourth and fifth fingers can reach 3cm more in this tilted position as compared with the regular position.

Mikimoto cites three specific cases in which students with small hands will benefit from tilting the hand towards the fifth finger. The first is Chopin’s *Etude* Op. 10, No. 10 (Music Example 8). The right hand E–flat and D–flat can be reached more easily in a tilted position.

**Music Example 3–8: Chopin’s Etude Op. 10, No. 10**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 119.

The chords in Music Example 9, C, E flat, C and C, E, C, can be played by small hands in the tilted position, not in the regular position.

**Music Example 3–9: Octave on C with third (C, E flat, C and C, E, C)**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 119.

A third instance where tilting the hand may be helpful is found in Music Example 10, broken octave followed by 7<sup>th</sup> figure. In this case, the second finger turns and moves over the first finger.

**Music example 3–10: Broken Octave Followed by Seventh Figure**



Source: Sumiko Mikimoto, *The Correct Piano Technique* (Tokyo, Japan: Ongakuno Tomosha, 2004), 119.

In any situation, the tilted fingers' knuckles (third joint) have to be stable and strong in order to create sufficient sound. This is easier for the second finger than for the other fingers. Students will find that the knuckle (third joint) of the second finger comes down close to the key. However, Mikimoto agrees that this indented position is satisfactory for the second finger because it has a strong joint, unlike the fifth finger. Even in this indented position, the second finger can produce sufficient sound without injury.

### **Summary of Mikimoto's Physical Approach to Piano Playing**

Mikimoto believes that to develop the most proficient piano technique, students have to recognize how to strengthen the proper muscles in order to move the finger, hand, wrist and arm efficiently. From her experimentation and research, she has developed numerous exercises to increase the efficiency of these movements. During exercises, Mikimoto emphasizes avoiding excess tension in various muscles and joints, which causes deficiency of individual joint movement, creates problems in the coordinated movements needed for piano playing, and interferes with the development of piano technique. A lack of finger agility and limited tonal colors are symptoms of this excess tension, which in the worst cases may lead to injuries. After teaching many students and observing their hands, Mikimoto realized that technique must match the individual's hand in a natural way, so that excessive tension in the body can be avoided.

Mikimoto found that many pianists and teachers believe that fingers will follow naturally if one searches for good tone and phrasing. However, only those fortunate enough to be equipped with well-built physical and neurological structures will succeed. There are many piano students who struggle with finger technique even though they have

many musical ideas and expression in their playing. Mikimoto also points out that in many cases this struggle may be caused by inadequate training in childhood. She warns of danger that small children will develop bad habits easily, possibly because children's brain development and formation of neural patterns is much faster than that of adults. At the same time, children's flexibility in the brain can readily develop efficient fast finger work and other coordination movements more easily than adults.

Mikimoto asserts that the best way for children to develop their technique is to play fast exercise pieces in a softer dynamic level (with a lighter touch, avoiding excessive force) and to wait for the growth of their hands and arms; only then should they gradually expand into louder and larger pieces. From her experience teaching her own exercises, Mikimoto found that junior high and high school students usually will develop the ability to play technically challenging pieces (with some variability based on each student's innate ability) such as Liszt's Etude "*Feux Follets*," and Chopin's *Etudes*, Op. 10 No. 2 or Op. 25 No. 6.

As we all know, technique should be a natural part of the pianist's music-making, otherwise music will not flow. However, reaching a high level of efficiency in piano technique is not achieved overnight. In many cases, piano students struggle to find the solution to their technical deficiency. Many ideas and exercises have been promoted throughout the history of piano playing to help pianists and piano students, but Mikimoto's method offers an approach that is more practical than most because it is rooted in the physiological and neurological systems of the body. Her method offers us many new insights into how the pianist's body functions, and therefore can greatly

promote the development of a healthy and efficient technique as well as aid those suffering from injury.

## Chapter IV

### A Comparison of Mikimoto's Approach with Some Other Methods

Mikimoto's technical training emphasizes an awareness and incorporation of the human nervous system. In the history of piano technique, many pedagogues have put forth different approaches to achieve technical excellence, but many of their methods did not incorporate the functions of the nervous system directly. As Alban Bridges describes in his dissertation *A Cognitively Oriented Concept of Piano Technique* (1985), older piano techniques are based largely on gut feeling, instinct, or tradition.<sup>68</sup>

As discussed in an earlier chapter, Kochevitsky addressed the nervous system's role in the development of piano technique in great detail in *The Art of Piano Playing*. Kochevitsky stated that all acts related to piano playing (including all muscle movements) should be executed with an awareness of the nervous system. There are various similarities between his approach and Mikimoto's, and both discuss the relationship between the nervous system and many problems that piano students face, such as a lack of awareness of their state of relaxation, finger independence, and finger dexterity.

In this chapter I will further discuss elements of Kochevitsky's approach to the nervous system which greatly affect pianistic development: the feedback system in the brain called the pyramidal system and extrapyramidal system; kinesthetic awareness of the state of a muscle, called proprioception; and the natural action and reaction of the nervous system's control of muscles called excitation, irradiation, and inhibition. Knowledge of the aspects of nervous function helps students avoid excessive tension and

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<sup>68</sup>Alban Kit Bridges, Jr., "A Cognitively Oriented Concept of Piano Technique" (dissertation, Northwestern University, 1985). p. 11

achieve the proper balance of muscle contraction and relaxation needed for piano playing. Subsequently, I will examine how different pedagogues suggest exercises to master proprioceptive awareness of finger independence, dexterity, and strength.

### **Kochevitsky and Mikimoto's Awareness of the Pyramidal and Extrapyramidal Nervous System**

As discussed previously, muscle movements for piano playing are controlled by complicated neurological functions. All activities involve complicated processes in the brain which occur constantly, both consciously and unconsciously. Even though pianists may consciously visualize a large pattern of notes, in well-coordinated piano playing, they do not think about each individual movement every second. Kochevitsky maintained that although learned motor activity may involve consciousness, in many cases it operates without the participation of consciousness.<sup>69</sup> Athletes and pianists alike need the ability to make very fast decisions and move in a reflexive way. In any sport which involves quick movements, rapid reactions are essential. In many cases, athletes face situations with little or no time to make a conscious decision about exactly how to move. Their brains work unconsciously, triggering the right movements before becoming aware of having decided what to do. In piano playing, when students start to practice a new piece, they will be conscious of every movement. However, once they learn the notes, their finger movements become automatic, similar to a reflex. There is no time to think about each note and which finger to employ. One musical example is found in the opening two measures of chords found in Liszt's *Transcendental Etude No. 10*. This etude requires a long period of slow conscious practice at the beginning, but

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<sup>69</sup> Kochevitsky, *The Art of Piano Playing: A Scientific Approach*. p. 22

once the piece is learned, the finger movements become automatic, and those two measures pass by in just one and a half seconds.

The decision to move, for instance, to position the hands or depress the keys, is perceived by the somatic sensory area of the brain, which then gives a signal back to the motor cortex. Once the motor cortex is alerted or stimulated, electrical signals pass through the pyramidal motor system known as the corticospinal or pyramidal tract, a massive collection of axons (nerve fibers) traveling between the motor cortex of the brain and the spinal cord. This principal neural pathway for voluntary movements runs from the motor cortex, located on the surface of the brain, through the corona radiata, internal capsule, cerebral peduncles, pons, and medulla, into the spinal cord. Through a series of complicated chemical and electrical events, the signal eventually triggers a muscle contraction.<sup>70</sup>

Yet, in order for muscles to learn how much contraction is needed to produce coordinated finger, wrist, and arm movement, the brain must constantly receive feedback from the muscles. This adjustment is a process in the secondary (lower) tract called the extrapyramidal system, which targets certain neurons in the spinal cord involved in reflexes, locomotion, complex movement, and postural control. By means of the extrapyramidal system, repetitive practice enables the muscles to learn more precise and finely-tuned movements, and pianists achieve an almost reflex-like muscle movement.

While Mikimoto does not specifically address this pyramidal and extrapyramidal feedback system in her method, her exercises indicate that she is aware of these systems. Because her exercises isolate specific muscle movements, it is much easier for students to

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<sup>70</sup> Wynn Kapit and Lawrence M. Elson, *The Anatomy Coloring Book*. 3<sup>rd</sup> ed. (San Francisco: Benjamin Cummings, 2002). p. 79

concentrate on and to control these movements, thus eliminating excessive tension and developing kinesthetic awareness, which aids the nervous system to function efficiently during these performance tasks.

### **The Role of Proprioceptive Sensations in Kochevitsky, Mikimoto, and Other Methods**

Another important part of brain function emphasized by Kochevitsky and Mikimoto's approach is called proprioceptive sensations. Kochevitsky states that "sensations from movements of parts of our body which are conveyed to our central nervous system are called proprioceptive (self-perceiving) as opposed to exteroceptive (tactile) sensations".<sup>71</sup> These sensations are produced by the sensory receptors associated with the muscles and joints involved in the movements, and then sent to the brain. Kochevitsky continues "proprioceptive sensations and our whole experience with these sensations in the past are of extreme importance for the direction of movements and degree of energy put into them, as well as for the construction and mastery of new movement.... Proprioceptive sensations are necessary for acquiring motor skills. When aiming for the most efficient piano practicing, we have to take care that our proprioceptive sensations are clear and distinct".<sup>72</sup> He suggested that slow practice and slight exaggeration of movement are beneficial in providing more vivid proprioceptive sensations.

In the field of sports, proprioception (proprioceptive sensation) and its functions are widely discussed in order to create efficient movement and to prevent injury.

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<sup>71</sup> Kochevitsky, *The Art of Piano Playing: A Scientific Approach*. p. 24

<sup>72</sup> Ibid. p. 24

Suzanne Nottingham provides an excellent explanation of proprioception and its function on her fitness website, *“Training for Proprioception and Function.”* “Proprioception is an automatic sensitivity mechanism in the body that sends messages through the central nervous system (CNS). The CNS then relays information to the rest of the body about how to react and with what amount of tension. Human beings train for proprioception in the quest for efficient everyday movements.”<sup>73</sup> She quotes Greg Niederlander, an exercise physiologist, who states that “proprioception is unconscious initially, but can be enhanced with training.... Specialized sensory receptors in the muscles, joints and connective tissues enable the body to process information from a variety of stimuli, and turn that information into action.”<sup>74</sup> Paul Chek, founder of the Chek Institute in Encinitas, California, describes proprioception in actual movement as reflexive movement intelligence, using the example of skiing at high velocity. “When skiing down a mountain at a high speed, all at once you must be able to sense the position of your limbs relative to the rest of your body, the position of your body relative to the earth and gravity, and interaction with the skis and terrain.”<sup>75</sup> Nottingham makes the point that one’s body automatically coordinates with stimuli obtained from the immediate experience and turns them into physical action. Here, this concept of proprioception in sports training shares many similarities with piano technical training.

Nottingham states that movement intelligence is created when clients (or students) become consciously aware of their movements and of the information their bodies are absorbing. She recommends creating stimuli to elicit movement reaction through

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<sup>73</sup> Suzanne Nottingham "Training for Proprioception and Function," ed. Suzanne Nottingham <http://www.coachr.org/proprio.htm>, (2007). p. 1

<sup>74</sup> Ibid. p. 1

<sup>75</sup> Ibid. p. 2

different tasks or exercises, elaborating that “the proprioceptive trace is an after–effect of the immediate proprioceptive experience.... In this situation, the body’s memory kicks in to produce a certain predictable amount of force/effort when it no longer needs it. For instance, if you’ve ever gone backpacking with 40 pounds of weight, then removed your pack, you’ll remember feeling feather–light.”<sup>76</sup> She states that movements that challenge clients’ (student’s) normal range of motion, are great ways to cross–train for proprioceptive adaptation, as are activities that require heightened balance, coordination, agility or power. The training goal is to shorten the amount of time that it takes to mentally react, and to physically move to accomplish the task.<sup>77</sup> The activities that she mentioned: coordination, agility and power, are essential to piano technique. Mikimoto’s exercises are designed to improve those proprioceptive adaptations. Her exercises that involve the finger board and other arm movements will increase students’ coordination and agility in the finger and arm. In addition, the exercises that involve the weight and the rubber band create sufficient resistance to develop proprioceptive adaptation that strengthens piano playing.

This developing proprioceptive adaptation is also seen in other piano methods. One of Kochevitsky’s exercises is a good example. He recommends that students raise their fingers high to exaggerate motion during practice to feel greater finger independence, and thus heighten their proprioceptive sensation. How high should the finger be raised? In the history of piano technique, many pedagogues have criticized high finger action because they believe it causes harsh tone and tension in hand, wrist, and arm. Kochevitsky specifies that while practicing, the finger should be raised to

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<sup>76</sup> Ibid.2

<sup>77</sup> Ibid.2

obtain the most distinct sensations from its action, but only as much as is needed for this purpose. As a rule, the first joint of the finger should never be raised higher than the back of the palm: lifting higher would overstrain the muscles concerned. As Kochevsky states, it is essential to understand the purpose of the training, and moderation is the key to success.

Another example of adding resistance to improve proprioceptive adaptation is seen in Seymour Bernstein's book, *With Your Own Two Hands*. He describes placing an exercise weight (with the brand name "Tone-O-Matic") on the wrists while playing the piano, which results in extra pressure on the finger pads. He then advises students to roll their arm around and to feel their arm weight centered on these pads. They should then choose a passage from some piece – one for the right hand and one for the left – and transfer this pressure from finger to finger. After this exercise, when students remove the weights, Bernstein claims that they will feel supple and light so that they will want to soar through the most difficult passage in their repertory.<sup>78</sup> This exercise may prove effective for students who otherwise have difficulty with the proprioceptive sensation of bringing arm weight to the finger tips. Yet, as Mikimoto has mentioned, if the student has weak finger joints, this exercise may not solve the real problem and instead may cause excessive tension in the wrist and arm.

There is also a recently patented device, called Finger Weights, that adds resistance to finger movement in order to develop a desirable level of proprioception. According to the product's website, when individual weights are placed on each finger, "Finger Weights target the extensor and flexor muscles, the tiny muscles that open and

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<sup>78</sup> Seymour Bernstein, *With Your Own Two Hands: Self-Discovery Through Music*. (New York: Schirmer Books, 1981). p. 128

close the fingers. The extensors (speed muscles) determine how quickly the musician can move from one key or string to the next. The flexors close the fingers and are essential for purity of tone”.<sup>79</sup>

This description of training muscle speed and strength is rather vague. There are many different kinds of extensor and flexor muscles which vary in size, so it is unclear to which muscles it refers. Mikimoto’s exercises, in contrast, are more specific to each finger muscle and movement, and make distinction between finger agility and finger strength (finger stabilization). Mikimoto’s approach seems to suggest that simply wearing the Finger Weights while playing the piano may not be enough to develop specific muscles and may also lead to the danger of excessive tension.

It is noteworthy that in the history of piano technique, there have always been new mechanical inventions claiming to help in the development of muscle movements. However, there is always the danger that used improperly, they will not effectively support piano technique. Perhaps because of this reason, pedagogues argue against any exercises involving weights or other “gadgets”. György Sandor is one of them. While he recognizes the importance of understanding the working parts of our body (which he called “the equipment we constantly use”), he believes that piano playing is not a matter of muscular strength and endurance, but of coordination.<sup>80</sup> If pianists can activate larger muscles properly, they do not need to strengthen the weaker ones. He compares piano playing and sports: “Forcing muscles may be needed in athletics, where not only coordination but extreme strength and endurance are essential. In music, however,

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<sup>79</sup> "Finger Weight" [http://fingerweights.com/Music\\_Model.html](http://fingerweights.com/Music_Model.html), (2007).

<sup>80</sup> György Sándor, *On Piano Playing: Motion, Sound and Expression* (New York: Schirmer Books, 1981). p. 4

coordination is the ‘name of the game;’ the strength that is already available in our muscles is sufficient, and pianists must consciously strive to conserve their sensitivity.”<sup>81</sup>

According to Sandor, whatever gains might result from strengthening muscles will be offset by lesser coordination in playing as well as by poorer tone production. Instead, he believes that understanding muscle function and the range of activities of the playing apparatus (such as fingers, hand, forearm, upper arm, and shoulder) will naturally lead to the correct position and desirable motion patterns. For Sandor, identifying and applying all the necessary motion patterns will facilitate effortless and expressive piano playing and will eliminate any potential problems with muscle and tendon inflammation and resultant injuries. He suggests five different motion patterns: 1) free fall, 2) five-finger figures, scales, and arpeggios, 3) rotation, 4) staccato (octaves), and 5) thrust. In his opinion, once students learn these basic motions, they can conquer all the difficulties of piano technique. To classify all piano-playing movements in this broad way may be a useful approach for many students.

However, this approach is based on Sandor’s assumption that all students have the same structural strength in their bodies and therefore can create the same movements. Unfortunately, not every student is equipped with the same muscle and joint strength or the same sensitivity to proprioception. This failure to take into account individual weaknesses seems to miss a critical stage in developing piano technique with certain students. As Mikimoto states, students and their teachers should find weaknesses at an early stage and correct them then and there. Her exercises are designed to focus on these fundamental muscle movements and thus should precede Sandor’s motion patterns. From Sandor’s standpoint, many of Mikimoto’s exercises with weights and rubber bands

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<sup>81</sup> Ibid. p. 6

might be misinterpreted. Her use of resistance is not intended to develop muscle strength in the same sense as a body-builder might. The main goal is for students to become more aware of their small muscle movements and develop their proprioceptive sensations in actual piano playing. Mikimoto's exercises enable students greatly to enhance and deepen their proprioceptive experience, and thus to develop their techniques more efficiently.

### **Relaxation**

The proprioceptive sensation is the well-defined awareness of the stage of muscle contraction and relaxation. As previously discussed, relaxation has been a major topic in piano technique since at least the middle of the nineteenth century, as it is essential for the development of such performance components as dexterity and tone production. Early use of the term seemed almost cult-like in its constant invocation, yet it ignored the fundamentals of body function since so called "total relaxation" is not possible. In modern technical thought, we know that muscles always work with many levels of contraction. Natural and "controlled tension," as Bernstein described it, would be a more appropriate definition of "relaxation" in piano playing.<sup>82</sup>

Bernstein writes that "if you wish to learn to control tension at the piano, you must first recognize the sensation resulting from contracted muscles.... This is more easily said than done, for you may not even be aware that certain muscles are contracting involuntarily".<sup>83</sup> He suggests that the conscious tightening and relaxing of muscles will increase awareness and control. He also observes the athlete's sophisticated system of

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<sup>82</sup> Bernstein, *With Your Own Two Hands: Self-Discovery Through Music*. p. 130

<sup>83</sup> *Ibid.* p.130

controlled tension and makes a comparison: there is no difference between pianists who have mastered the instrument and athletes. Through practicing, athletes learn to contract their muscles in proportion to the effort expended – no more and no less. Bernstein calls this “economy of motion” and believes that pianists should know how much contraction is needed.

His suggestion to tighten the muscle consciously and then relax it may indeed increase awareness of tension; however, since tension occurs to different degrees, lesser levels may be difficult to detect, especially when finger movements are involved.

Mikimoto describes how this “controlled tension” can be achieved more easily through an understanding of the “excitation and restriction action,” part of the nervous system processes discussed in Chapter 3. She believes that controlling these processes can prevent excessive tension in all piano technique.

Kochevitsky, with his concern for the neurological basis of muscular movement and relaxation, seems to be an unstated influence on Mikimoto. He refers to Mikimoto’s excitation and restriction action processes as “excitation and inhibition,” and asserts that these fundamental processes of nervous activity are an important aspect of technical development. When a stimulus creates an excitation, the result is a discharge of impulses, while inhibition suppresses superfluous excitation.<sup>84</sup> These two processes create the proper amount of muscle contraction for defined muscle movements, whereas an imbalance between these processes produces unwanted contraction and uneven finger movements. Kochevitsky believes that since fast and even piano playing is the result of a precise balance between these two basic processes of nervous activity, they can and

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<sup>84</sup> Kochevitsky, *The Art of Piano Playing: A Scientific Approach*. p. 25

should be modified by constant training.<sup>85</sup> He recommends slow and extremely even playing in exercises or passages, and stopping or retarding before strong beats or towards the end of a passage. He believes that these exercises will develop not only clear proprioceptive sensations, but also a strengthening of the inhibitory processes.

Matthay did not describe any neural functions, but he certainly recognized that a balance between tension and relaxation is part of the neurological process. In his book, *Pianoforte Muscular Relaxation Studies*, he states that “it is a common experience of most players that some preliminary time has to be spent each day in ‘getting one’s fingers in’.... This usually means that the player cannot at once accurately recall the requisite mental muscular discriminations. Now unless he does recall those to which he is, or should be accustomed, he cannot feel perfectly ‘at home’.”<sup>86</sup> As Matthay explains, pianists spend some warm-up time playing exercises to bring a comfortable feeling to the body. This state of ease is possible by maintaining a good balance between muscle contraction and relaxation. Like Mikimoto, he suggests that performing exercises with and without the piano can reduce the time to needed to “get one’s fingers in”.

There are many exercises introduced in Matthay’s book. Among them, the following set of four daily exercises depicts his fine observation of muscle usage which definitely helps to understand and control subtle muscle contraction and relaxation.

### **Exercise 1: Freeing or Balancing Exercise**

Place the hand on the table or the piano. Raise the wrist and arm up gradually until finger cannot stay on the surface of the table or piano, then gradually bring down the wrist and arm and relax.<sup>87</sup>

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<sup>85</sup> Ibid. p. 25

<sup>86</sup> Tobias Matthay, *Relaxation Studies in the Muscular Discriminations Required for Touch, Agility and Expression in Pianoforte Playing* (London: Bosworth, 1908). p. iii

<sup>87</sup> Ibid. p. 4

The purpose of this exercise is to eliminate contrary exertions of the hand and finger, to give them freedom in their movements.

The second exercise focuses on accuracy in aiming or directing the act of touch through arm movement.

### **Exercise 2: Aiming Exercise**

Hang the hand loosely over the key or table, with three of the fingers bent, ready for an easily stretched chord such as C, E, and G. Then drop (lapse) the hand and arm easily. As soon as the wrist reaches its playing position, release the arm still further, finger and hand coming into responsive action, so that the arm –weight thus released, may take full effect upon the keys.<sup>88</sup>

The purpose of this exercise is to develop exact timing of the ceasing all the weight and exertion at the very movement of tone production.

The third exercise practices the elimination of arm–force, the isolation of the finger and hand from the arm.

### **Exercise 3: Throw off Exercise**

Take a little run or arpeggio at good speed, and at the end of this allow the arm, hand and fingers, as it were bouncing off the keyboard some inches into the air. Do this either with “throw off” action, producing quite a sharp *forte* accent, or with gentle “floating–off” action, providing more than a gentle *pianissimo*.<sup>89</sup>

Matthay explains that even though it may not be noticeable, arm muscles naturally work downwards in everyday life, which causes a disadvantage for piano playing. In contrast this third exercise develops a sense of upwards motion in the arm, which helps produce more free movement in the finger and hand.

The fourth exercise is comprised of two rotation exercises for practice away from the keyboard at first, one for the first finger side of the hand, and the other for the fifth finger side of the hand.

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<sup>88</sup> Ibid. p. 11

<sup>89</sup> Ibid. p. 25

#### **Exercise 4a : Rotation Exercise for the First Finger Side Rotation**

Rest the hand, supported by the first finger, on the edge of a table. Place the hand in its usual level position, as at the keyboard—or better still, tilt it up considerably at its fifth finger side. After balancing the hand and arm in this position for a few moments, allow the fifth finger side of the hand to drop or tilt down without moving the elbow itself. Then roll or tilt the fore–arm, hand, and wrist back again towards the first finger and thus resume the first position.<sup>90</sup>

#### **Exercise 4b: Rotation Exercise for the Fifth Finger Side Rotation**

Let the 5<sup>th</sup> finger support the hand upon the table. As before, after balancing the hand and arm, allow the hand to roll over or tilt towards the thumb. Then roll the hand back to its first position.<sup>91</sup>

The purpose of these exercises is to comprehend the sense of alternating relaxation and exertion of the forearm muscles which control rotation of the hand. Therefore, weight can be equally distributed to each finger.

These four exercises have several variations. In Exercise 2, for example, Matthay suggests playing in different dynamics, *pianissimo* and *forte*, and also successive chords with the same hand motions but in different dynamics. In Exercise 3, he suggests playing with the whole arm, or just the forearm or hand, which he terms the “three species of touch–formation.”<sup>92</sup> Matthay asserts that these exercises will develop the most important muscular discriminations (conditions) required in piano playing such as:

- 1) The relaxation of the arm–supporting muscles – to obtain the effect of weight;
- 2) The elimination (or relaxation) of all ‘contrary exertions;’ and
- 3) Accuracy in timing the cessation of the required exertions; hence primarily the elision of all unnecessary and harmful exertion.<sup>93</sup>

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<sup>90</sup> Ibid. p. 34

<sup>91</sup> Ibid. p. 34

<sup>92</sup> Ibid. p. 72

<sup>93</sup> Ibid. p. iv

Like Mikimoto, Matthay suggests exercises for proper contraction and relaxation of the hand, forearm, upper arm (whole arm), and shoulder, as well as exercises that combine forearm action with upper arm inaction. Matthay addresses that the sensation and function of those muscles must be related to the impact on the keys. He provides four simple exercises which feature the succession of lifting, holding and relaxing. He explains purpose of these exercises as:

“This main purpose is not so much the exercise of the particular muscles concerned – for the sake of gaining strength – but on the contrary, it is to teach us and to remind us how to let those particular portions of the limb give way; in a word, to teach us how to omit exertions of the contrary muscles – the exertion of which would unfailingly prevent our gaining, or retaining technical efficiency. Or again, differently put, these exercises are not so much designed to teach us certain exertions, as to teach us accuracy in omission of these, and how this feels.”<sup>94</sup>

Considering how old Matthay’s method is, it is remarkable that he understands and develops the theory and exercises for proprioceptive adaptations. Even though some of his descriptions of exercises are criticized as wordy and quite difficult understand, his observations are notably detailed and insightful in explaining how to use the various muscles more properly. His contributions greatly influenced many later pedagogues, most probably Mikimoto and Kochevitsky, as well as others.

Each pedagogue has a theory of relaxation or control of tension reflected in the different exercises they devise. Kochevitsky’s recognition of the role of neural function in the contraction and relaxation inherent in piano technique definitely parallels that of Mikimoto. Kochevitsky and Bernstein both recognized the importance of tension and relaxation, however; unlike Mikimoto, they did not implement exercises for specific muscle movements. Matthay’s relaxation exercises are similar to Mikimoto’s in being

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<sup>94</sup> Ibid. p. iv

more specific than those of Kochevitsky and Bernstein, but instead of addressing specific muscle weakness and the need for strengthening, they focus on awareness and the coordination of the entire apparatus: finger, wrist, arm and shoulder.

### **Finger Independence**

As stated earlier, awareness of proprioceptive sensation in finger independence is a crucial aspect of piano technique. Mikimoto purports that if students do not understand proper independence of the fingers, they may encounter tension problems and technical difficulties. There are many opinions and different approaches to this topic. One of the common exercises is to hold some fingers and move others, as exemplified in *Technical Studies* by Josef Pischna, and *Essential Finger Exercises* by Erno Dohnanyi. Many pedagogues criticize these exercises, claiming that they contradict natural finger movement and lead to the more tension and even injury. However, other pedagogues, including Mikimoto believe they are beneficial. If students perform them properly, moving each finger without excess tension, they can effectively improve their finger movements and speed.

Kochevitsky's approach to finger independence closely parallels that of Mikimoto. Kochevitsky asserts that lack of finger independence is related to the neural system in the brain and muscles. He explains that when students move an individual finger, they have the tendency to move other fingers and to tighten the wrist because "when excitation, as a result of some stimulation, arrives at certain cells in the brain, it is not defined to these cells but tends to spread (irradiate), involving other cells that are not

directly related to this simulation”.<sup>95</sup> He states that often the upper arms or bigger muscles will have stronger excitation and overshadow the sensations from the smaller muscles responsible for finger work. Nevertheless, he claims that with concentration and practice, students can consciously control this irradiation tendency to confine motion to the individual, desired muscle. Kochevitsky points out that the danger of the old arm–weight schools was that they concentrated too much on arm movements with passive finger movement. In this situation, the fingers will never achieve independence or be adequately trained. He writes that “the more the upper parts of the arm are involved in execution of a composite movement, the more attention should be directed toward the polishing of finger proprioceptive sensations....”.<sup>96</sup> Kochevitsky notes that the first step towards finger independence is to try to isolate the fingers from the detrimental influence of the upper parts of the arm. Even though finger movement is a very complicated function and unthinkable without the participation of these upper muscles, each finger should be able to press a key and produce a tone without causing muscle tension in nonparticipating fingers.<sup>97</sup> Kochevitsky again recommends high finger actions in the exercises to increase the sensation of finger independence.

Matthay also included finger independence exercises in his book so that students could distinguish and direct each finger individually. He states that a clear sense of finger independence enables the pianist to accurately time the beginning and end of each finger movement required in any passages.<sup>98</sup> Otherwise, fingers show “sloppiness” and lose clarity in passage work. In order to achieve finger independence, he recommends

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<sup>95</sup> Kochevitsky, *The Art of Piano Playing: A Scientific Approach*. p. 26

<sup>96</sup> Ibid.26

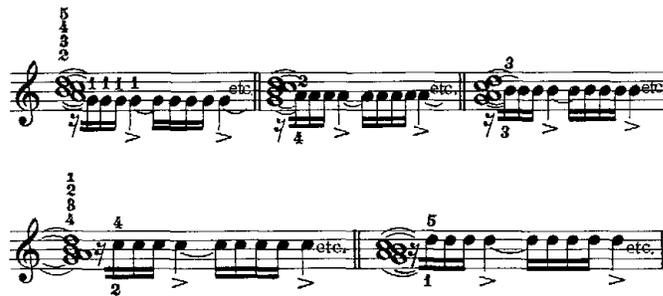
<sup>97</sup> Ibid.38

<sup>98</sup> Matthay, *Relaxation Studies in the Muscular Discriminations Required for Touch, Agility and Expression in Pianoforte Playing*. p. 100

playing the short pattern exercises below, which are similar to Pischna and Dohnanyi's in the manner that they require some fingers to hold down keys while other fingers play.

The following music example 4–1 is one of his exercises that appears in his book *Relaxation Studies*.<sup>99</sup>

**Music example 4–1: Matthay's Finger Independence Exercises**



Source: Tobias Matthay, *Relaxation Studies in the Muscular Discriminations Required for Touch, Agility and Expression in Pianoforte Playing* (London: Bosworth, 1908), 107

It is interesting to see that Matthay, who is known as a teacher of relaxation and free movement of the hands and arms, is promoting these finger exercises which many pedagogues believe create a rigid hand position and overall tension. However, these exercises are not designed to force finger movement. Neurologically, these exercises have the effect of controlling the undesirable irradiation of the muscles' sensations. Mikimoto also teaches many isolated finger exercises to achieve finger independence, which are similar to those of Matthay, Pischna and Dohnanyi. Mikimoto, along with Kochevitsky, is more explicit in stating that the main purpose of independent finger exercises is to develop kinesthetic awareness and proprioceptive sensation in individual fingers.

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<sup>99</sup> Ibid. p. 103

## **Finger Dexterity**

Proprioceptive sensation of finger independence is very important for finger dexterity. Mikimoto states that some students can move their individual fingers reasonably fast despite excessive tension in the other fingers and wrists, yet, in many cases that they cannot move the fingers as quickly in alternations. She believes that in order to achieve fast–finger combination movements, students must master proper finger independence. On the other hand, Kochevitsky maintains that the speed of finger movement does not depend on individual finger movement, but rather in the precision of timing successive finger movements. Kochevitsky cited Oscar Raif (1847– death date unknown) who was a piano pedagogue from Berlin who did a study in 1901 that showed that non–pianists may move their fingers faster than those who are studying the piano. He concluded that “the problem of velocity lies not in the speed of any individual finger, but in dexterity of mind.”<sup>100</sup>

Kochevitsky asserts that persistence of concentration is necessary to achieve the finest precision in timing successive fast finger movements. He recommends numerous and diverse rhythmic variants in scales and exercises created out of actual pieces in order to master these timings. The consistent alternation of rhythmic patterns helps achieve the necessary flexibility of the pertinent nervous processes.<sup>101</sup> Mikimoto also recognizes that achieving finger dexterity involves more than developing the speed of individual finger movements. Once finger independence is mastered, Mikimoto, like Kochevitsky, includes exercises for combination finger movements to achieve fine precision in timing successive finger movements. However, her exercises are different from those of

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<sup>100</sup> Kochevitsky, *The Art of Piano Playing: A Scientific Approach*. p. 41

<sup>101</sup> *Ibid.* p. 41

Kochevitsky in that they do not use rhythmic patterns, but instead rely on over a hundred musical figures with different finger combinations.

### **Finger Strength**

It is widely believed that playing finger exercises by Pischna, Dohnanyi, Czerny, and many others will strengthen the fingers. In contrast, Mikimoto believes that the essence of strengthening individual fingers lies in the development of finger joints through of physical training away from the piano as well. She insists that stabilization of the finger joint is one of the most important aspects of technique. A lack of concern over the strength of finger joints can cause many problems, such as excessive tension and weak tone production. For students who have weak joints, especially children, finger joints can be trained more effectively away from the piano. Bernstein and Matthey are among the few pedagogues in addition to Mikimoto to suggest physical training for stabilization of the fingers.

Seymour Bernstein stresses the importance of finger stabilization, which he refers to as “taut fingers”. Citing the octave figures from the “Wander Fantasy” by Schubert as an example, he writes that “in strenuous passages should your fingers not assume their share of responsibility, your forearm muscles will then contract involuntarily as a compensatory action for what your fingers ought to have been doing. Keeping your fingers taut at all times will help you avoid initiating an arm cramp”.<sup>102</sup> He further explains that “taut fingers” does not imply stiff fingers, and he compares them with our legs, which always remain flexible as we bend and straighten them while walking. He suggests the following simple exercise away from the piano:

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<sup>102</sup> Bernstein, *With Your Own Two Hands: Self-Discovery Through Music*. p. 136

- 1) Hold your right hand opposite your chin with your thumb nail facing you. Keep your fingers slightly curved.
- 2) Cover the nail of each finger (including your thumb) with the corresponding finger tips of your left hand.
- 3) As your left hand fingers gently bear down, press up against them with the fingers of your right hand. First, bend each finger of your hand up and down elastically (your thumb will move from left to right), and then bend all five fingers at once in a similar fashion.
- 4) Now reverse your hands and try this exercise for your left hand.<sup>103</sup>

Matthay also emphasizes the importance of the finger joints, asserting that any combination of arm or hand movements cannot make an effect without the intervention of the fingers. One's tonal capacity is ultimately limited by the strength of the individual digits.<sup>104</sup> He suggests the following finger exercises to strengthen the finger joints in flat and bent positions:

- 1) After placing the tip of one finger on a table with the knuckles of the hand dropped in a buckling position, bring the knuckles upwards with a gentle contraction of the finger, until the knuckles are fully raised.
- 2) For a few moments support the light weight in the raised position.
- 3) From this raised position, suddenly allow the knuckles to fall into their initial (and very low) position; carefully time the relaxation of the finger.<sup>105</sup>

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<sup>103</sup> Ibid. p. 137

<sup>104</sup> Matthay, *Relaxation Studies in the Muscular Discriminations Required for Touch, Agility and Expression in Pianoforte Playing*. p. 72

<sup>105</sup> Ibid. p. 73

Though both Bernstein and Matthay realize the importance of stabilization of the finger joints, their exercises are not as extensively detailed as Mikimoto's. While Bernstein's exercises may be effective for strengthening the finger joints, they are vague as to which joints are being trained. Matthay's exercises are slightly more elaborate than those of Bernstein, but likewise he does not explain exactly which joints are being trained. Presumably, Matthay's finger exercises shown above were meant to be practiced in the flat finger position in order to train the third joint, whereas finger exercises practiced in the bent position train the first and second joints.

Gyorgy Sandor, meanwhile, believes that finger independence and strength depend upon the placement or alignment of the forearm and upper arm. He writes:

“It is most important that we regard the fingers not as isolated units but as the extension and continuation of the forearm muscles and tendons that move them... no finger exercise will ever give us true independence of the fingers unless each finger is helped by the proper placement and adjustment of the forearm and upper arm. True independence can be achieved only by cultivating interdependence with the forearm and upper arm muscles and not by maintaining a fixed hand (or wrist) position that brings the fingers into a forced, unnatural situation. In the long run these fixed positions will cause tension, fatigue, pain and acute or chronic ailments. Worst of all, they produce a poor piano sound.”<sup>106</sup>

This statement clearly points out that coordination among fingers and forearm and upper arm is crucial for supporting the weak fingers. Besides compensating for weak finger movements, this coordination and involvement of the forearm and upper arm is extremely important for good tone production. However, it is difficult to create sufficient tone with the support of the forearm and upper arm unless the fingers can hold all of the force and weight from the arm. This is frequently not the case, because finger joints are often untrained. Mikimoto realizes that a prerequisite for this coordination of fingers and

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<sup>106</sup> Sándor, *On Piano Playing: Motion, Sound and Expression*. p. 52

forearm and upper arm is independence of the fingers, especially in the beginning stage of piano study.

In this chapter, I have discussed the similarities between Kochevitsky's and Mikimoto's approaches, which both attempt find the causes of and solutions for the physical problems in piano technique revealed through the neurological systems. Even though many early—and middle—twentieth-century pedagogues realized the importance of physical and mental training and suggested exercises to achieve the awareness of the proprioception needed for piano technique, their teaching on muscle contraction and relaxation and finger independence, agility, and strength are somewhat limited. As we have seen in the previous chapter, Mikimoto emphasizes the importance of the fundamental condition of the fingers and analyzes their excessive tension and weakness. She provides far greater detail in her exercises which addresses each student's weaknesses, and thus instills an awareness of controlled contraction and relaxation.

## Chapter V

### Applications to Students

#### Mikimoto's Findings Observed Seen in Specific Students

Many of Mikimoto's observations regarding the causes of tension (arising from varying habits and finger shapes) can be easily seen in our students, and some of her exercises can even help in a short period of time; but still it generally takes many years for the full effect of the method to be realized. In this chapter, I will report my own experiences with some common problems found with beginners, and my results with Mikimoto's finger-board and dexterity exercises, as used with my students. Also, I will discuss exercises that I found to improve proprioception in the entire apparatus: finger, wrist forearm, upper arm, and shoulder.

#### Excess Finger Tension

As we can see in Figure 5-1, a nine year old student who has been studying piano for three years, has a problem with controlling the fourth and fifth fingers.

#### **Figure 5-1: Excessive Tension in Second Finger**



This creates tension in those fingers so that they straighten out, and the second finger compensates by stretching up. Furthermore, tension is not isolated in the fingers only, but extends to the whole arm and shoulders as well. To correct this habitual movement,

the teacher should consistently watch for this raised second finger, and simply remind the student not to raise it whenever it is in this incorrect position. Most importantly, the student must develop a more clear sense of finger independence and strength in the weak fourth and fifth fingers.

Figure 5–2 is a seven year old who has been playing piano for two years and shown an example of a double–jointed finger.

**Figure 5–2: Double Jointed–Finger**



Many young students have double–jointed fingers and thus experience difficulty controlling them. Their passage work is uneven and their tone is weak. Most of them improve on their own over the years; once they grow up, muscle strength increases and joints become more stable, so that they can play in the correct position and their passage work becomes even. However, if this problem is not addressed at an early stage, tension problems can develop as students compensate for their muscle weakness, just as Mikimoto’s observations indicate. To avoid excess hand tension with double–jointed students, the teacher must carefully observe and not force them to play passage work that is difficult or loud. In addition to suggesting the student play lightly in the proper position with curled fingers, it is also helpful to strength–train the joints with rubber bands or by pulling with other fingers, as discussed in Exercise 7 in Chapter III.

### **Excessive First Finger (Thumb) Tension**

Another common tension was observed in the first finger (thumb). Figure 5–3 is a ten year old who has been playing piano for four years shows the inward–shaped first finger.

**Figure 5–3: Inward–shaped Thumb**



This student has a very flexible wrist and arm movement, yet the first finger (thumb) has a certain amount of tension. This is due to the lack of strength and independence in the other fingers, especially the fourth and fifth fingers. The thumb's muscles try to compensate for the other weak fingers by tightening to control them. Once the first finger tension becomes a habit, it becomes very difficult to release that tension. In this case, in order to detect the tension, it is very helpful to hold the first finger while playing the passages. It is also very effective to develop the feeling of relaxation in the first finger; simply stop in the middle of a scale or other passage and feel the thumb relax.

The problems discussed above typically affect young children, partly because of a lack of proprioceptive sensation. The best way to address these issues is through consistent use of the finger–board and the tapping finger exercises. The author found many positive results from using Mikimoto's finger–boards and also devised other exercises for these students, as discussed in Chapter III.

## **Results of Mikimoto's Exercises**

### **Finger-board Exercises**

The finger board was used in ten students aged seven to thirteen, for a period of six months to a year. The students were asked to practice the exercises a minimum of once a day, seven days a week. The exercise regimen consisted of four sets of each finger in individual movement, then a combination movement using fourth and fifth fingers, then third and fourth fingers, which was followed by three-finger combinations with third, fourth and fifth fingers. It was challenging to undertake this sort of experiment because actual practice time varied greatly among students. Almost everyone showed some improvement due to the exercises, even those who practiced the least. Five of the ten students showed great improvement in their finger movement (including agility and in double note playing), gaining much more control and tonal clarity.

The author discovered that students can retain tightness in the wrist even while improving finger motion with the finger-board. To remedy this problem, the author adjusted the exercise and had the students gently move the finger-board during the exercises, so that the wrist was in constant motion while the fingers were exercising. As a result, students gained better finger movement at the piano as well as a more flexible wrist. Their proprioceptive sensation was increased by this added movement in the exercise, which also made it easier for them to incorporate a circular wrist motion generally in their playing.

Just as Mikimoto observed a decline of students' technique during adolescence, the author also found some awkwardness and unevenness in exercises and performance during this period. Adolescent students' bones and tendons grow at a much faster pace

than at any other age. In many cases, the bones grow faster than the tendons and muscles, which cause some loss of proprioceptive sensation previously developed, as evidenced by awkwardness and uneven passage work. Often students will try to control the problems by tightening up their muscles. Most noticeably, this problem manifests itself in an overly tight hand and wrist. A consistent regimen of stretching and finger exercises, including use of the finger-board, will alleviate tension and improve coordination for many students.

### **Dexterity Exercises**

Another significant result found by the author concerned Mikimoto's dexterity exercises (exercises 17–19 on pages 104), used for about three months with seven students between the ages of seven and thirteen, who were instructed to play each figure ten times using the metronome and increasing up the tempo each day. Although there was some uncertainty in practice habits (some students practiced other exercises), overall the greatest benefit was found with the eleven to thirteen year olds, who increased their finger work speed just as Mikimoto has suggested. However, younger students did have difficulty playing at a fast speed, often tightening, their hands and wrists. A likely cause is their lack of proprioceptive sensation in individual fingers. Even though the key resistance is very small, they cannot properly distinguish or isolate the different muscles when they hold one finger down and move the other fingers. The combination of maintaining speed and holding one finger down greatly confused them physically, and even created extra tension. The author discovered that in many cases, students can execute the same exercise more easily on the flat surface of a table.

## **Wrist, Arm, and Shoulder Exercises**

Mikimoto's method gives us many insights on how students play and how to observe them. As we have seen previously, lack of finger independence is one of the recurring problems students face. She also addresses the involvement of other body parts, especially the wrist, elbow, and shoulder, and asserts that developing proprioceptive sensation in each of these greatly improves students' technical skills. Likewise, the author found that the following exercises, based on the principles of Mikimoto's method, were very effective with his own students:

### **Exercise 1: Developing Proprioceptive Sensation in Lifting Arm**

Have a person hold the student's arm, which should be completely relaxed. Let go of the arm slowly enough so that the student can experience the feeling of gradual muscle contraction or engagement while maintaining the arm in position. At the same time, check the elbow for flexibility to ensure it is not tightly held.

### **Exercise 2: Developing Proprioceptive Sensation in Elbow Movement**

Relax the elbow and the hand – be sure it is completely relaxed. Then straighten it with a twitch-like motion from the triceps muscle.

### **Exercise 3: Developing Proprioceptive Sensation in Wrist Movement**

The student should hold his or her forearm, letting the hand dangle with a relaxed wrist, then twitch up the wrist and relax.

Many students focus exclusively on finger movement. However, consistent practice of these arm exercises, as well as the teacher's reminders to involve the whole arm, help students release tension.

The following examples show the positive results of the above exercises in developing the flexible use of the whole arm. The first student is six years old; as we can

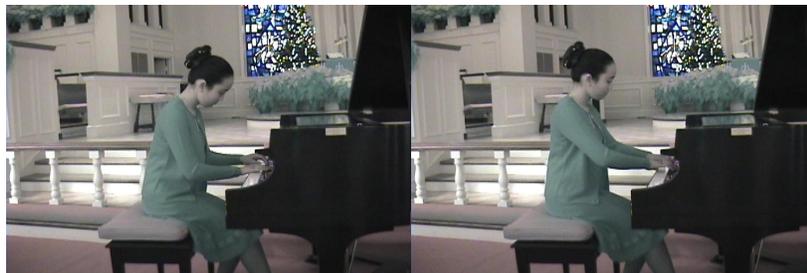
see, he has a very flexible elbow and shoulder joints which help to move hands between white and black keys as shown in Figure 5–4. He also developed better dynamic control.

**Figure 5–4: Flexible Elbow and Shoulder**



The second student is thirteen years old; she uses arm movement in a rather exaggerated manner, but it still helps her tone production and finger dexterity as shown Figure 5–5.

**Figure 5–5: Arm Movement**



The exaggeration of movement is a natural way to learn a new motion because it helps cultivate the proprioceptive sensation, and is preferable to a motion that is too small, which can become more rigid and fixed. As students progress, the motion will become more natural and efficient.

Piano playing is not naturally learned; in this respect, it is somewhat similar to ballet or gymnastics. Students need special long-term training from a young age, beginning before the physical changes of adolescence occur so they can achieve maximum development. For most students, simply playing pieces will not be enough to develop a virtuosic technique. Exercises are needed to achieve a high level of playing, yet the mindless repetition of exercises will not necessarily be effective if they do not

consciously address specific physical/technical problems. Thus, maintaining constant awareness of each goal of the exercise is essential.

Each student faces a different set of problems. Some struggle with playing rapid and even scales and arpeggios, while others are challenged by repeated notes and chords. Still others have problems with tone production and achieving a rich, deep sound. Teachers use their own personal experiences to counsel the students. The most common suggestion and solution is repetition (“practice until one gets it right”). However, this suggestion may overlook students’ fundamental physical differences and weaknesses and lack of understanding. Since teachers’ experiences are limited to themselves and it may be difficult for them to remember what kind of physical problems they had when they were younger, they may not understand that each student has a different kind of body structure.

Mikimoto’s approach inherently takes these individual physical variations into account. Her method shows us that many technical problems are improved by physical training that can develop an awareness of proprioceptive sensation in fingers, wrist, forearm, upper arm, and shoulder. Strengthening the weak finger joints and learning how to employ controlled tension are good examples of this fundamental training. Although repetition is necessary in any activity that involves motor skills, if the students do not know exactly what is causing the problem, these repetitions become a waste of time and solidify bad habits. From observing my students and practicing Mikimoto’s exercises with them, it became clear to me that constant awareness of the purpose of each exercise is crucial.

## Chapter VI

### Role of Piano Technique in Injury Prevention and Rehabilitation

Like some other piano pedagogues, Mikimoto collaborates with a medical doctor. This collaboration helps to deepen the understanding of the motor skills needed for piano playing and also promotes an awareness of piano-related injuries, including muscular pain syndromes, tendonitis, tendon entrapments, nerve entrapments, and focal dystonias.

Pianists' injuries have been debated since at least the development of the piano's frame into its current state. The heavier action of the keys and the stronger frame required pianists to play with greater strength and power than previously. Most injuries occur at the advanced level of playing, and overuse and misuse of the muscles are a common cause. For example, a sudden increase in practice time spent on demanding technical passages (often due to upcoming examinations and recitals) can create discomfort or injury. In addition, extended periods of bad technical habits make pianists more vulnerable to injuries. Dr. Robert D. Leffert, who specializes in musicians' injuries, states in his article, *Physicians' Views of Physical Problems*:

“We have found that many aspiring artists, as well as already established artists, subject themselves to really punishing routines. Some of these routines seem not to be grounded in logic but are performed because someone suggested them or because they believed it was beneficial...there has been a great deal written about pianistic technique but little to correlate it to the anatomy of people.”<sup>107</sup>

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<sup>107</sup> Dr. Fred H. Hochberg, Dr. Robert D. Leffert, Robert J. Silverman, "Physicians' Views of Physical Problems." *Piano Quarterly* (1983, vol. 31) p. 42

## **Two Types of Common Injuries**

Leffert lists two types of common injuries, one involving pain and the other same sort of neurological disorder.<sup>108</sup> Pain can be caused by inflammatory tendonitis or inflammation of the coverings of joints brought on through overuse, or by some unusual technical problem having to do with the instrument. When the tendons move and rub against each other for a long period of time, inflammation can result, often causing swelling and pain.

This type of common injury involving pain in tendons and joints has been widely reported in many articles. A sudden increase in practice time because of recitals or examinations, combined with over-practicing a new technical difficulty such as octaves and chords, places physical stress on the pianist. One cause of this sort was reported by Dr. Yoshiaki Kitayama on the Asahi newspaper web site,<sup>109</sup> involving a patient who had been playing Czerny, Bach, and Mozart for many years but very little from post-classical repertory. When she started with this new repertory, more specifically the Grieg Concerto, which requires more open-handed positions and fuller sonorities, she was unable to execute octave passages well. While practicing them over and over, she sustained an injury, caused by the imbalance in use of different muscles. Dr. Kitayama indicates that based on biomechanics of muscle movement the larger muscles provide more power while the smaller muscles control speed. In this case, the patient did not coordinate properly between those types of muscles and used only small muscles to perform all of the work.

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<sup>108</sup> Ibid. p. 43

<sup>109</sup> Akiyoshi Kitayama, *Pianists' Fingers*, (<http://mytown.asahi.com/ishikawa>, 2006)

Mikimoto discusses this kind of injury with Dr. Naotaka Sakai, a medical doctor who has published articles regularly in the journal *Medical Problems of Performing Artists*. Dr. Sakai stated that 70% of patients incurred a piano-related injury due to the use of the open-hand position when playing. Tendonitis very frequently appears on the first joint of the thumb, caused by this open-hand position. At first it was thought that only small hands were prone to this condition, but tendonitis can occur in any size hand. Excess tension is the main problem, since many students over-contract muscles when they play octaves or chords repeatedly.

Mikimoto believes that many injuries are caused by overuse of the muscles, especially the extensor muscles. Dr. Sakai concurs and states that all of the extensor muscles are concentrated in and around the elbow (in the epicondyle). Overuse of the extensor muscles creates a lot of tension and fatigue in the ligaments and causes inflammation at the epicondyle. Mikimoto observed that students tend to overuse the extensor muscles when they lift the finger in order to strike the key. According to Mikimoto, the speed of the descending finger movement is more important than the tightening extensor muscles when depressing the key.

The second type of injury described by Dr. Leffert can be categorized as a neurological disorder. It occurs when the muscles do not have sufficient rest and lactic acid accumulates and becomes hardened, causing muscles to shorten and lose their flexibility. This causes a loss of control over muscle movement. Continued overuse leads to impediments in motor skills, such as curling fingers and decreased agility. Since these effects are not painful, some pianists attribute loss of control to lack of practice. This is a misunderstanding that leads to more practice, making the situation worse.

Leon Fleisher and Gary Grafman are two well-known pianists who both suffered from a neurological disorder in their hands. In both cases, their problems progressed over a long period of time. Leon Fleisher started complaining about his right forearm around 1963 or 1964. In the case of Gary Grafman, he started compensating for a weak fourth and fifth finger by playing octaves with his first and third finger instead, and over time made it a habit. This habit further weakened his fourth and fifth fingers and even altered his hand position, eventually leading to injury.

These injuries described above can be treated in various ways. Many are treated with anti-inflammation medicines such as Tylenol and aspirin, which are widely used for inflamed tendons, muscles, and joints. In recent years, Leon Fleisher recovered from his injury and returned to the concert stage after his hand condition was diagnosed as focal dystonia and he received a series of *botulinum toxin* (also known as botox) injections from 2004 to 2005. Unfortunately, there are many more pianists struggling to recover than those who have succeeded.

It is possible that many injuries are rooted in the long period of foundational technical training. Even though it is very difficult to see which habits were formed in this training period, it seems quite possible that many earlier weaknesses of the fingers and other body parts contribute to bad habits and unwanted compensation and tension. Many current piano pedagogues are concerned about piano-related injuries and therefore incorporate preventive measures into their methods. While most of them emphasize coordination in order to avoid excessive tension, a focus on coordination alone might exacerbate the weakness.

The example of the student who played the Grieg Concerto shows that if we do not exercise our technique in a well-rounded manner, using all the possible movement combinations, then the weak technical spots never get strengthened and can even cause injury. Obviously, it is important to use good coordination in piano playing, which helps avoid placing stress on just one part of the mechanism. However, focusing solely on coordination might not solve the problems, and Mikimoto and others believe that overall strength in each part of the hand and arm is crucial for injury prevention. An understanding of the body functions combined with moderately repetitive practice for strengthening each part of our bodies is the most effective preventive measure in piano technique.

### **Treatments and Rehabilitations for Injury: A Personal Account**

#### **Background of Problem**

The author himself experienced an injury which seemed to have a neurological basis. The first symptoms were noticed in 1996, evidenced by discomfort in the third finger of the right hand. During a performance of Beethoven's third Concerto, in the cadenza of the first movement (following the extended arpeggio passages), the third finger of the right hand played a note, but the other fingers suddenly locked up and could not be controlled. The second incident occurred in measures 280–287 of Chopin's third Scherzo when the third finger again caused dysfunction in the other fingers of the same hand. Once the third finger played a note, the fourth and fifth fingers lost control, so that the tone was affected and the passagework became very uneven. Both figures in the Beethoven and Chopin were combination scale/arpeggio passages in descending motion

with thumb-under-the-palm involved. This symptom occurred more frequently with an increase in practice time in preparation for a performance. The author first assumed that the problem was due to lack of practice, but it became more severe and began to affect simple tasks like holding a pencil, which itself become very difficult. Eventually, the need for professional help was unavoidable.

### **Rehabilitation Centers**

In 2001, after a visit to the NRH/Suburban Regional Rehab,<sup>110</sup> which is well-known for its work with athletes and accident victims, a diagnosis was provided. Apparently, the thumb was held more tightly than needed which caused inflammation of the thumb tendons and muscles in the forearm, pinching the nerve to the third finger. The prescribed rehabilitation was electrical massage on the forearms and strength training of the supporting muscles such as the shoulder, back, biceps, and triceps. However, after ten weeks of rehabilitation, the only improvement was with holding the pencil; piano playing was not as it used to be. With sufficient rest, the third finger would regain its control of motion, but when practice intensified, there was a loss of control the next day. After consultation with the staff of the NRH/Suburban Regional Rehab, the author was sent to a different center, the Body Dynamics Rehabilitation Service.<sup>111</sup> However, the treatment there was identical to the previous one. Forearm electrical massage and stretching and strength exercises for the surrounding muscles were prescribed. Therapists also suggested wearing a splint to hold the thumb for complete rest. Again, this helped

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<sup>110</sup> NRH/Suburban Regional Rehab, 6410 Rockledge Drive, Suite 600 Bethesda , Maryland 20817

<sup>111</sup> Body Dynamics Inc., 5130 Wilson Boulevard, Suite B-1, Arlington, Virginia 22205

the author regain some flexibility in the third finger, but the same problem recurred with an increase in practice time.

### **Rolfing**

Then the author tried Rolfing after a friend recommended it, because Fleisher had reported some partial relief from this treatment. Rolfing, more properly known as Structural Integration, is a type of deep tissue massage that lengthens the connective tissues and muscles, and repositions them back into a natural alignment. Rolfing loosens the fascia, a thin membrane that encases each muscle, which tightens around the muscle and can restrict motion over time. This tightening is a slow progression brought about by the long-term effect of gravity. Rolfing allows the body to regain its natural shape. This treatment also enables the muscles and connective tissues to move in a more natural manner. After a total of twelve treatments, the author found a degree of tension release, which helped with mobility of finger motion temporarily, but when the practice sessions became more intense, the same problem resurfaced.

### **Alexander Technique**

These recurrences of the same physical problem were similar to the experiences of Matthias Alexander (1869–1955), the founder of the Alexander Technique. Alexander was an actor, who started having problems with his throat and vocal cords at the peak of his career. While he was reciting, he would become increasingly hoarse. His doctors and teachers recommended a treatment of rest and inhalations, but his condition kept

recurring.<sup>112</sup> After almost ten years of self-observation and experimentation, he found that the main problem was his misuse of body movement, and incorrect body posture. He believed that correct balance and use of the head, neck, and torso could help many functions of body movement including vocalizing as well as instrumental playing. Alexander called this relation between the head, neck, and torso “Primary Control.” He stated that most of us misuse our bodies; over a long period of time, this misuse creates many problems. By understanding and developing our Primary Control, we can use the body more efficiently.

In his process of learning, Alexander also realized the importance of mental training. When we face a problem, many of us search for a short-cut cure or answer. For example, one trombonist had a back problem and was told to swim in order to train his back. However, Alexander believed that if the trombonist’s back problem was caused by his bad habits, swimming might not cure the root of the problem. Alexander called this short-cut solution without concern for the process “end-gaining”. Once bad habits are created, they are very difficult to break. Alexander maintained that we must reeducate or retrain our kinesthetic awareness using the principle of Primary Control. This re-education involves breaking bad habits, and becoming aware of all the intermediate steps that are involved in achieving any purpose. He termed this process of steps “means-whereby”.<sup>113</sup> These principles of “end-gaining” and “means-whereby” are more mental than physical training. These mental training principles always co-exist with the physical training of the Alexander Technique, and help develop a keener sense of our body movement and proper proprioception.

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<sup>112</sup> Pedro de Alcantara, *Indirect Procedures: A Musician's Guide to the Alexander Technique* (Oxford and New York: Clarendon Press, 1997). p. 10

<sup>113</sup> *Ibid.*20

The author found the Alexander Technique to be a very valuable approach to correcting bad habits of body movement that seem to lead to problems with piano technique. The author took Alexander Technique lessons for a year, once a week. In 2004 he joined a teacher–training program at the Alexander Technique Center of Washington for two semesters, where each semester consisted of training sessions five days per week over period of fourteen weeks.

There are many varieties of exercises, among them the most basic exercise, which is to sit down in a chair and then stand up. Although this appears to be a very simple exercise, it is very difficult to execute properly. The student sits down on the chair and allows the instructor’s hand to guide him/her back to a standing position. The instructor’s hands are placed on the front and back of the neck, or sometimes on the back, shoulder or chest. At first, it is very difficult to cede control of the body and follow the lead of the instructor’s hand; as a result, many parts of the body become tense. For some students it may take a whole semester for their whole body to become more keenly aware of the instructor’s subtle guiding hands and to move more freely without excessive tension.

Another useful exercise for correcting excessive tension is the exercise called the hands–on–the–back–of–the–chair. A student sits down facing the back of another chair placed in front. Then the instructor corrects the student’s sitting posture and guides his/her hand movements, moving each hand in turn to the back of the chair. This exercise is repeated a number of times with various degrees of arm movement and can help students become aware of their arm position in actual playing. After two years of lessons, the author concluded that both exercises are very effective in developing better

proprioception and improving body movement in general. Unfortunately, they did not completely solve the specific problem with finger control that the author experienced.

It is a central tenet of Alexander Technique that misuse of the body causes bad habits which need to be corrected through re-education of fundamental body movement rather than through quick solutions. Rehabilitation exercises at the NRH/Suburban Regional Rehab and the Body Dynamics Rehabilitation Service unfortunately represent these quick solutions. They are designed to correct accident injuries and restore certain body movements. However, for piano playing, hand and finger movements are much more subtle. Even if an injured hand recovers enough to hold a pencil, which was not possible in the initial stage of the author's injury, this does not indicate full recovery. If the clients' problems are rooted in their misuse of the body and a long period of bad habits, the rehabilitation provides only temporary release and does not solve the underlying problems. This general philosophy of the Alexander Technique, which focuses on fundamental body movements, is certainly shared by Mikimoto's method. However, the author believes that Mikimoto's exercises not only offer an increased awareness, but also facilitate the practical movement of the fingers, and thus correct the problem in the long term or avoid it altogether.

### **Preventive Measures for Piano Injury**

Once pianists injure themselves, they will experience a very frustrating effort to find recovery. Some are fortunate if their injuries can be treated with medicine, as described before. Unfortunately, some will never recover. Thus, injury prevention is an important issue in this extremely demanding field. Pianists cannot avoid long periods of

practice while preparing for a performance. There are several preventive measures that pianist can employ in their practice. It is true that for most pianists, many years of training naturally help to make their fingers, hands, arms, and other parts of the body strong and more injury-resistant. However, all tendons and muscles need sufficient rest for recovery. Most pedagogues believe that pianists should plan their practice schedules more carefully. Many doctors recommended a rest interval of five minutes for every twenty minutes of practice.

Dr. Brenda G. Wristen, in her dissertation “Overuse Injuries and Piano Technique: A Biomechanical Approach,” suggested several practice tips, such as 1) avoiding a sudden increase in the amount and intensity of practice, and 2) warming up muscles to their optimal functional temperature and cooling them down after practice to prevent muscle soreness and cramping.<sup>114</sup> She also quoted from Dr. William B. Meinke’s article titled “The Work of Piano Virtuosity: Ergonomic Analysis” published in the journal *Medical Problems of Performing Artists* in 1995, which presents four laws of motion for avoiding injury that apply to pianists. These four laws are:

1. Use of momentum to assist work;
2. Use of smooth curvilinear rather than straight, jerky motions;
3. Use of the best-suited sets of muscles to accomplish work;
4. Avoidance of wrist positions that deviate from neutral.<sup>115</sup>

The author finds these four laws to be excellent recommendations and absolutely essential. However, they only show that the solution lies in coordinated motions; unless

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<sup>114</sup> Brenda G. Wristen, "Overuse Injuries and Piano Technique: A Biomechanical Approach" (dissertation, Texas Tech University, 1998). p. 223

<sup>115</sup> William B. Meinke, "The Work of Piano Virtuosity: An Ergonomic Analysis," *Medical Problems of Performing Artists* 10 (June 1995): p. 54

students develop a kinesthetic awareness and sufficient strength in all body parts these laws will be very difficult to apply to piano playing.

Other alternate ideas for preventing injury are found in Dr. Richard Norris' exercise video called "Therapeutic Exercises for the Musicians."<sup>116</sup> Dr. Richard Norris is a physical medicine and rehabilitation physician and author of *The Musician's Survival Manual: A Guide to Preventing and Treating Injuries in Instrumentalists*.<sup>117</sup> He states that early physical exercise habits may likely continue in professional life, and thus contribute towards injury prevention in the future. He demonstrates warm-up, stretch, strength, and some cardio exercises in his video. For the warm up exercise, he uses tai-chi movement with deep breathing. Then he shows how to stretch all the body parts used by musicians including, the neck, shoulder, torso, back, hip and leg. For the strength exercises, he uses a therapeutic exercise band (thin rubber cloth band) and demonstrates shoulder and upper limb exercises. He points out that each musician has his or her own particular problems. But he believes that common problems of musicians lie in their playing positions. In order for musicians to sustain certain positions, muscles must have strength and endurance; for example, the shoulder and arm muscles must be strong enough to hold the violin. For pianists, he points out that they should pay attention to their sitting position. Because torso weight lies behind the point of the sitting bone, pianists tend to slouch. This position creates a greater burden on the shoulder and arm; and in the long term it may cause some problems. In order to sit properly, he suggests strengthening the abdominal, back and hip flexor muscles.

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<sup>116</sup> Richard Norris, "Therapeutic Exercises for Musicians," (the "Playing Less Hurt" conference, MNLPS, MN: 1990), videotape.

<sup>117</sup> Richard Norris, *The Musician's Survival Manual: A Guide to Preventing and Treating Injuries in Instrumentalists* ([S.l.]: International Conference of Symphony and Opera Musicians, 1993).

These ideas and exercises are excellent aids that we can implement in our practice. Unfortunately, in most cases, once pianists have injured themselves, there is no definite remedy for the injuries. Many musicians with physical problems try various treatments and exercises. Exercises that work for some people might not work for others, and it is possible that a combination of exercises and treatments is the best course of action for some musicians. Mikimoto's exercises and the Alexander Technique certainly helped the author discover the inadequacies in his body strength and movements (e.g. with respect to excessive tension) and to become more aware of balanced body movement. At the same time, he recognizes that bad habits involving excessive tension while playing are difficult to correct. As an injury prevention measure, he believes that before these bad habits accumulate it is crucial to check students for their specific weaknesses and eliminate them early, so that they properly execute natural types of coordination movements and thus prevent injury.

## **Chapter VII**

### **Conclusion**

The modern style of teaching builds on the ideas of many predecessors. An emphasis on mechanical finger training flourished in the early nineteenth century, with Czerny as the most prominent figure in this movement. The development of the instrument physically demanded more strength from pianists in order to produce louder sounds and faster finger movements. Since the middle of the nineteenth century, when Deppe suggested the involvement of the arms in coordination with the fingers, there have been many debates about different styles of piano technique that are not finger-oriented. In the twentieth century, many pedagogues (such as Matthay, Ortmann, and Kochevitsky) added many great contributions to the theory of piano technique.

Even though Mikimoto's method is based on her own experience and research on both professional pianists and piano students, it also reflects and grows out of this great lineage of piano methods. Her emphasis on finger training is somewhat similar to that of Czerny and others' approaches from the early nineteenth century, with regard to the amount of exercises that promote speed and strength; the difference is that her approach also incorporates physiological and neurological principles in order to develop motor skills. This concern shows clear affinity with the approaches of Kochevitsky and Ortmann. Mikimoto's distinctive approach is especially illustrated in her detailed and practical exercises. Mikimoto's exercises stabilize the finger joints, increase flexibility and speed of finger movement, and develop the sense of relaxation and fixation. These exercises help students increase awareness of body movements. This awareness can aid

students to develop their technique more effectively and also easily find solutions for technical problems (caused by uneven development of fingers and other parts of the body). Weakness of the finger joints is a good example, which is commonly thought to be confined to beginners. Few students and teachers realize that this weakness affects later development and causes the bad habit of excessive tension in the hand, wrist and arm. Developing finger strength and the proper sensation of finger independence and proper arm and wrist movement is essential to piano technique. Mikimoto's method not only supports comprehensive development of these basic skills and sensations but also helps the specific weaknesses of individual students.

The author also believes that Mikimoto's exercises, along with Alexander technique, can help with rehabilitation and injury prevention. There are many treatments for injuries and alternative approaches to injury prevention. Unfortunately, most institutions of rehabilitation do not offer specific programs for pianists. Their treatments are limited and most often give only temporary relief. For pianists who are injured, it is first important to find the causes of injury, then undergo step-by-step training (rehabilitation) for effective recovery. Mikimoto's exercises and Alexander technique offer some alternative options that can help patients develop awareness of the body, and also improve the pianist's capability for specific movements in rehabilitation. As a preventive measure, coordination is most frequently cited. Yet we must understand that coordination is possible only when each part of the body is properly developed. Mikimoto's exercises most certainly develop individual muscles to make this coordination possible, and prevent injury because they improve the proprioceptive awareness.

Discussion of piano methods tends to be somewhat imprecise in terms of any academic or scientific basis, as many methods are based on experience and success with students. Ortmann's writings constitute one of the few scientifically based approaches to piano technique. Publications like *Medical Problems of Performing Artists* also contain many scientific and medical studies about injuries which contribute greatly to general knowledge. Pedagogues can incorporate some of these findings with respect to injury prevention into their own teaching. Unfortunately, most of these studies are after-the-fact, and they are not totally related to the actual development of piano technique.

Also one of the reasons for imprecision in the discussion of piano methods is their empirical nature. Piano methods, or in this some cases the pedagogues themselves, are judged by their results with students. Sometimes playing advanced repertoire becomes an overly important goal, which leads to ignoring the importance of students' physical development, and thus may create many problems later.

Despite the fact that there is still a gap between empirically based piano methods and those with a more scientific basis, maintaining a dialogue between the two is crucial in order to bring new insights to teaching and learning and to create a healthy environment for students' development. Among the current piano methods, Mikimoto's seems to combine successfully both scientific knowledge and practical training. On a purely empirical basis, she has achieved excellent results with actual students, both her own and others, and has demonstrated that her approach also has benefits in terms of injury prevention and rehabilitation. We can hope that in the future, Mikimoto's method becomes more widely known and applied so that its utility can be evaluated in a broader context.

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