BUILDING AN EFFECTIVE PIANO TECHNIQUE WHILE AVOIDING INJURY: A COMPARISON OF THE EXERCISES IN ALFRED CORTOT’S RATIONAL PRINCIPLES OF PIANOFORTE TECHNIQUE AND CARL TAUSIG’S DAILY STUDIES FOR THE PIANOFORTE

Lae Hyung Woo, B.M., M.M.

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APPROVED:
Pamela Mia Paul, Major Professor
Bradley Beckman, Committee Member
Gustavo Romero, Committee Member
Benjamin Brand, Director of Graduate Studies in the College of Music
John Richmond, Dean of the College of Music
Victor Prybutok, Vice Provost of the Toulouse Graduate School
It is the teacher's responsibility to guide students in building an effective and injury-free piano technique. Improper technique, poor training and bad posture at the instrument all may cause problems such as lack of muscle control, weakness, or tension in the hands. Many teachers are interested in finding information about specific exercises dealing with finger strengthening, stretching, and warm-up strategies, as well as guidelines for safe practicing. It is therefore important for both teachers and students to understand how to build a technique from the earliest years of instruction. Carl Tausig (1841-1871) and Alfred Cortot (1877-1962) both contributed to the development of piano technique by writing books that include a significant number of exercises and excerpts. Their books incorporate detailed instructions on how to play each exercise effectively and without fatigue. Subsequently, Heinrich Ehrlich (1822-1899) collected and systematically arranged Tausig's notes, complementing them with detailed information on how to play Tausig's exercises without causing injury. This dissertation compares and contrasts the exercises found in Alfred Cortot's book, *Rational Principles of Pianoforte Technique*, and Carl Tausig's book, *Daily Studies for the Pianoforte*. The latter is based on the practical guidebook, *How to Practise on the Piano: Reflections and Suggestions*, written by Heinrich Ehrlich. Included in this study are references to the performing arts medical literature dealing with pianists' injuries. By comparing two different historical piano methods and considering their effectiveness in light of modern medical performance research, this dissertation aims to help...
teachers to determine which methods might be better for students to build a solid piano technique without injuring themselves.
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A sound technique is the foundation upon which all music making is based. Without it, pianists are not able to play advanced repertoire, and they risk injuries later in their playing career. It is therefore important for both teachers and students to understand how to build the right technique from the earliest years of instruction. Technique, in the broadest sense, is the application of movements to create sounds in accordance with specific musical texts written by the composer.\(^1\) Technique itself is not artistry, but a physical or motor skill. Pianists need to learn to properly apply technique, not only to interpret the music they perform, but also to be free of piano-related injuries that are often induced by immoderate tension.

According to Redmond and Tiernan, 93% of undergraduate piano students experience playing-related injuries. The study also shows that 68% of teachers spend a considerable amount of time teaching injury-prevention principles during their lessons; this includes proper warm-ups, technical exercises, and choosing repertoire that is appropriate for the student’s level.\(^2\) However, how often do teachers really know what kind of specific exercises are needed for students in order to build an effective piano technique? Do teachers always have enough information about how to teach a specific exercise, either as a warm-up to prevent injury or as a means of building technique? If students seek advice for


technical problems or for piano-related injuries, are there any exercises that will answer both their questions as well as their teachers’?

It is the teacher’s responsibility to guide students in building an effective piano technique that does not result in physical distress. Improper technique, poor training, and bad posture at the instrument may all cause issues such as lack of muscle control, weakness, or tension in the hands. Many teachers would be interested in finding information about specific exercises dealing with finger strengthening, stretching, and warm-up strategies, as well as guidelines for safe practicing.

Serious piano students have always followed a regimen of technical exercises, starting in their early years of study. These can run the gamut, starting with Czerny or Clementi but also including later regimens of Tausig, Brahms, Leschetitzky, Cortot and sometimes even exercises devised by their professors. Carl Tausig (1841–1871) and Alfred Cortot (1877–1962) both contributed to the development of piano technique by writing books that include a significant number of exercises and excerpts. Their books incorporate detailed instructions on how to play each exercise effectively and without fatigue.

Subsequently, Heinrich Ehrlich (1822–1899) collected and systematically arranged Tausig’s notes, complementing them with detailed information on how to play Tausig’s exercises without causing injury. The exercises of Tausig remain popular and are widely used by teachers in Korea. The exercises of the great French pianist Alfred Cortot, while less popular with teachers of young students, are known, respected, and used by more advanced students and their teachers worldwide. Moreover, Cortot and Tausig’s methods provide not only exercises but also their own comments to help teachers and students make
the most of these exercises. For this reason, Cortot and Tausig’s methods are more valuable than other exercises such as those by Hanon, Czerny, and Clementi.

This document will compare and contrast the exercises and practical guides found in Alfred Cortot’s book *Rational Principles of Pianoforte Technique* and Carl Tausig’s book *Daily Studies for the Pianoforte*. The latter is based on the practical guidebook *How to Practise on the Piano: Reflections and Suggestions* by Heinrich Ehrlich. In this study, the two different historical piano methods will be compared and their effectiveness considered in light of modern research, with particular attention to determining whether correct practice of these exercises can in fact decrease the possibility of piano-related injuries.
CHAPTER 2
ALFRED CORTOT AND CARL TAUSING:
MUSICAL LIFE, TEACHING METHODS, AND PIANO EXERCISES

Alfred Cortot was one of the most renowned French pianists and pedagogues of the twentieth century. He achieved international fame through his poetic interpretations, recordings, and concerts as a member of the Cortot–Casals–Thibaud Trio. Cortot’s performing career began in 1907 and was distinguished by an extensive repertoire including Baroque music such as Purcell, Bach, Vivaldi, Händel to the repertoire of his contemporaries, Rachmaninoff, Stravinsky, Faure, Frank and Ravel. Cortot achieved an international reputation through concerts given in the United States and Europe, in the years following World War I 1918 to 1924. According to an article in the New York Times in 1962, “M. Cortot made few American appearances. He first came to the United States as soloist with the Paris Conservatory Orchestra in 1918, and he returned to play with the Philadelphia Orchestra and other ensembles in 1920.” One of the reviews of his performance with the Philharmonic Orchestra in New York reports that “when he came out to play Schumann’s concerto in A minor, and when he had finished, his hearers loudly proclaimed their approval in a five-minute ovation. In light and heavy playing he was

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4 Ibid., 176.
equally effective and the contrasts were effective."\(^6\) The repertoire of Cortot’s last recital in the United States in 1927 was: “Concerto da camera” of Vivaldi—a work long credited to Wilhelm Friedmann Bach—with certain careful editing of Cortot’s own; a selection of twelve Chopin Etudes, taken from both sets, the Chopin Sonata in B flat minor, and the first book of the Debussy Preludes.\(^7\) According to Olin Downes, “It is not a common thing for any pianist, great or small, to play Chopin with so much sentiment, color and avoidance of mannerisms, and hold fast the attention of his audience as Mr. Cortot did on this occasion.”\(^8\) Cortot was able to reach a wide audience through a substantial number of recordings of the standard repertoire. He made outstanding recordings of the Schumann Concerto (1926) as well as Chopin’s Preludes (1926), Ballades (1930), Waltzes (1934), and Fantasy in F minor (1934).\(^9\) Charles Timbrell complimented Cortot’s technical prowess, as exhibited in his recordings of Chopin’s Etudes (1933/34), Preludes, and B-minor Sonata (1933):

… musically, his variety of touch and unique combination of eloquence and elegance have often been compared with [i.e., to] Chopin’s reported style of playing…. From these fervent, poetic and always spontaneous-sounding interpretations there is much that today’s pianists can learn.\(^10\)

Cortot’s style of interpretation stemmed from his early musical education. He first had lessons with his sisters, who had studied at the Geneva Conservatoire. Cortot remembered that they always focused on sound production, tone quality, and the search to be


\(^8\) Ibid., 24.

\(^9\) Taylor, 175.

imaginative, creative, and expressive even when performing the simplest melody and basic rhythm. Cortot’s sisters encouraged him to search for a meaningful sound, rather than concentrate on theoretical music education. Cortot stated:

My whole career and the course of my later study were surely influenced by that first encounter with the secret meaning of sounds. No doubt my predilection for what has sometimes not too charitably been termed [my] “expressionisme,” 11 which I’ve tried to make the lynchpin of my interpretations, stems from there. 12

Despite the fact that Cortot had both a highly acclaimed musicality and technique, he was never satisfied with his hands or his pianistic development. His arduous efforts to develop technique stem from his years at the Paris Conservatoire. Cortot studied with Émile Decombes (1829–1912), Louis Diémer (1843–1919), and Édouard Risler (1873–1929), beginning in 1887. In general, there was a growing tendency among students in the Conservatoire to become virtuosos who could win competitions and perform a sophisticated repertoire. In order to gain recognition from professors, Cortot had to play with a machine-like technique rather than express his musicality. Unfortunately, he was not a prodigy who had an easy command of the piano. In spite of his eagerness to become a better pianist, he did not receive the necessary help from Decombes or Diémer to overcome the technical problems that he had. Decombes wanted his students to strictly follow the instructions given during the lesson, and he focused on the attainment of flexible and powerful fingers. However, his suggestions to develop technique did not interest Cortot:

I hardly need say that there was no question of approaching the piano from the standpoint of poetic imagination that had enriched my early study with my

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11 Expressionisme: It is not clear whether Cortot is alluding to critics who found his style hyperexpressive by French standards, or those who took exception to his “symbolist” leanings (i.e., his tendency to find a specific image or poetic meaning in music).
12 Taylor, 19.
sisters. Now is was a matter of mastering the many technical difficulties through daily confrontation with the treacherous imbroglios of [Clementi’s] Gradus ad Parnassum, which is appealing only when it is caricaturized by Debussy… at the beginning of the Children’s Corner Suite.13

Diémer was a prodigy and famous pianist. However, his teaching method was superficial, and insufficient for Cortot. Alfredo Casella, a student of Diémer, remarked that:

When a piece did not go well, he never knew how to explain the cause, but told the student only to study it again and to practice many exercises, especially scales. From three years in his class, I do not remember ever having heard from him one of those observations which solve a problem for the pupil and disclose a new horizon to him. His technical instruction was thus negative. He was no more interesting in matters of interpretation, where his remarks were colorless and banal.14

Rislcr, in contrast, was a professor who did inspire Cortot. He was more interested in highlighting various and rich tone colors than playing like a machine.15 Notwithstanding this positive experience, Cortot set himself to the task of further developing his technique in order to focus on a more sensible and musical approach to his interpretations. Cortot practiced endless hours in order to accomplish his pianistic goals from both the artistic and the technical viewpoint:

Risler and Rubinstein provided Cortot with performance goals far loftier than virtuoso fingerwork and pianistic polish, but neither could have explained to him the exact ways and means of achieving those goals. Cortot had to figure those out for himself, by experimentation, and it is likely that he did not happen onto the technical procedures best suited to his physical equipment overnight.16

Cortot tried to singlehandedly solve most of his technical difficulties. Roger Nicholas states that:

13 Ibid., 61–62.
14 Ibid., 80.
15 Ibid., 71.
16 Ibid., 97.
Cortot never had an easy command of the keyboard. He used to complain his hands were clumsy, and his technique was the result of a solid four hours’ practice every morning, at least until 1939. He therefore became interested in the mechanics and psychology of how the hands learn and soon came to the conclusion that every difficult passage can be reduced to one or two basic problems and that practicing the passage itself is counterproductive as well as wasteful of valuable time. His book *Les principes rationnels de la technique pianistique* and his éditions de travail of Chopin follow this method.\(^{17}\)

Cortot’s interest in piano technique led him to publish the book *Rational Principles of Pianoforte Technique* in 1928. He organized his material into five chapters: 1) Equality, independence and mobility of fingers; 2) Passing under of the thumb (scales, arpeggios); 3) Double notes and polyphonic playing; 4) Extensions; and 5) Wrist technique and execution of chords. Not only did Cortot use these exercises himself, he also used them to teach his students.

Cortot began teaching at the Paris Conservatoire in 1917, and helped Auguste Mangeot to establish the École Normale de Musique two years later.\(^{18}\) He would train many future renowned pianists, including Yvonne Lebure, Clara Haskil, Magda Tagliaferro, and Dinu Lipatti.\(^{19}\) Cortot emphasized musical interpretation through emotion and a profound use of the imagination that could transfer composers’ ideas to listeners through the personality of the performer. According to Manshadt, “at the foundation of Cortot’s ideas on instrumental technique was the concept that technical means will influence musical result; the nature of the physical gesture used in playing will influence the feeling

of the player.”

Cortot defined the essential elements of piano study in the foreword of *Rational Principles of Pianoforte Technique*:

Two factors form the basis of any instrumental study—one psychological factor from which arise taste, imagination, reasoning, the feeling for shading and tone: in a word, style—one physiological factor, that is, dexterity of the hands and fingers, absolute submission of the muscles and nerves to the material exigencies of execution.

Cortot primarily focused on teaching artistic values and musicianship. But when his students encountered technical issues, he wanted them to find their own method to overcome difficulties. However, he did highlight strict and precise practical guidelines for his students. Cortot did not favor tedious repetitions of exercises played with a rigid wrist and arm. He followed these ideas when he wrote the exercises in *Rational Principle of Pianoforte Technique*. In addition, the repertoire list at the end of the book includes suggested examples of exercises.

Carl Tausig was a piano virtuoso who had a great technique and strong fingers. Tausig began studies with his father, who was also a pianist. Tausig rose to fame at an early age, after taking lessons with Liszt. Tausig’s impeccable technique and his wide-ranging performance style enchanted not only Liszt but also Brahms and Wagner. According to Von Lenz on Lahee’s book, *Famous Pianists of Today and Yesterday*, “Tausig’s left hand was a second right. He never appeared to notice difficulties. Anton Rubinstein called him

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22 Manshardt and Amundrud, 2.
23 Schonberg, 256–262.
‘the infallible’; Liszt spoke of his fingers as ‘brazen.’” Brahms praised Tausig’s infinite potential. Clara Schumann wrote in a letter, “He is really a remarkable little fellow, and a very exceptional pianist, who, incidentally, as far as it is possible for a man to do, is constantly changing for the better.” Wagner also complimented Tausig on his outstanding performances and allowed him to arrange some of his own works. According to Harold Schonberg, Eugen d’Albert, one of the supreme students in Liszt’s class, described Tausig’s extraordinary talents: “Liszt’s musical conceptions were grander, but Tausig had a more wonderful, more accurate technique coupled with a good deal of poetry.”

As evidenced from the aforementioned information, Tausig and Cortot’s technique were at the opposite sides of the spectrum. Tausig pursued perfection in his pianism and found mistakes unacceptable. He always intended to play with complete accuracy and no wrong notes. Amy Fay, an American pianist who studied with Tausig, stated “Tausig strikes every note with rigid exactness, and perhaps his very perfection makes him at times a little cold.” Tausig made his first appearance to audience in 1858 with the noted conductor, Hans Von Bülow in Berlin and gave concerts in Vienna and Germany. According to Lahee, “His repertoire was varied and extensive, and he could play by heart any representative piece by any composer, from Scarlatti to Liszt.”

25 Schonberg, 261.
26 Ibid., 260.
27 Ibid., 261.
28 Ibid., 274.
29 Lahee, 171.
30 Ibid., 172.
in Hamburg, Denmark, Berlin and Sweden starting in 1865. Tausig settled in Berlin in 1866, where he established a music school and gave a series of concerts dedicated to the music of Chopin. Tausig was widely acclaimed for his Chopin interpretations. Von Lenz states that “Tausig’s playing was flawlessly moulded[sic]. How he would have charmed Chopin, whose perfect ease and grace in overcoming the greatest difficulties he possessed, together with far superior strength and power.” As “the living impersonation of Chopin,” Tausig made a profound impression on Liszt with his performance of the A flat Polonaise by Chopin. Schonberg writes that when Tausig first met Liszt at the age of fourteen, Liszt was initially not interested in listening to the young prodigy but after hearing the beginning of the polonaise, Liszt was astonished by Tausig’s marvelous technique and his mature musicality of interpretation of Chopin.

Tausig’s natural talents caused him on occasion to be less than understanding of the technical struggles faced by his students. However, Tausig employed a systematic method to develop piano technique that was not only for his own use, but also for his students:

First we had to go through Cramer, then through the Gradus ad Parnassum, then Moscheles, then Chopin, Henselt, Liszt and Rubinstein…. Tausig was for Gradus, you know, and practiced it himself every day. He used to transpose the studies in different keys, and play just the same in the left hand as in the right, and enhance their difficulties in every way…. Gradus is not only good for finger technique—it trains the arm and wrist also, and gives a much more

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33 Schonberg, 257.
34 Ibid., 257.
35 Ibid., 257.
powerful execution.36

The following quote also sheds light on how Tausig built his own technique and taught his students:

Tausig focused on the technical development of his students, so that in performance, they would have no physical obstacles to prevent them from achieving his high musical ideals. He favored Clementi’s *Gradus ad Parnassum*, and published his own version of it around 1850: his edition contained twenty-nine exercises (selected from one hundred) that were more etude-like in character and less musical in content.37

Tausig’s exercises, *Daily Studies for the Pianoforte*, consist of three books. The first two books contain exercises dealing with the rudiments of technique, such as scales, trills, chords, and wrist exercises, as well as studies for building independence of fingers, stretching, and strengthening. The third book is composed of preludes—short pieces that encapsulate all the exercises in the first two books. For health reasons, Tausig was unable to finish writing the last book. Heinrich Ehrlich, Tausig’s friend and a pianist himself, completed the task.

Cortot and Tausig provided numerous exercises that contain important principles. These include warm-up exercises and studies for finger independence, stretching, strengthening, and wrist relaxation. All are followed by careful illustrations provided by the authors. These exercises are not only suitable for students to improve their piano technique, but were also used by Cortot and Tausig themselves to build their own technique.

36 Judith Pfeiffer, “Amy Fay and Her Teachers in Germany” (DMA diss., University of Memphis, 2008), 15-16.
37 Ibid., 15.
CHAPTER 3

RISK FACTORS AND PRINCIPLES FOR AVOIDING PIANO-RELATED INJURY

Bad habits related to technique, training, and posture may cause physical damage, as well as encourage loss of muscle control, weakness, or tightening of the hands. Therefore, it is important for teachers to endeavor to teach students the appropriate technique for avoiding piano-related injury. According to an article by Nicholas Quarrier, most music teachers who were surveyed in New York were aware of the risk factors but had little or no knowledge of how to manage and prevent pain. Quarrier states that the teachers did understand some injury-prevention principles such as relaxation, stretching, and proper posture, but lacked information on injury management. This study points to the need to promote safe practicing as well as specific warm-up exercises including finger strengthening, stretching and relaxation to improve students’ technique safely.

A number of articles list risk factors and types of injuries reported in surveys that targeted piano students. Margaret Redmond and Anne M. Tiernan (2001), Heidi Blackie et al. (1999), and Joan Revak (1989) all cite risk factors and types of injury, as well as offer suggestions for preventing over-use injuries. Redmond and Tiernan catalogue the symptoms of playing-related disorders among pianists, such as inflammation of the tendons,

39 Ibid., 107.
40 Ibid., 108–110.
41 Margaret Redmond and Anne Tiernan, 32–38.
muscles, and nerves, which may cause muscle cramps and pains. Their article posits that inappropriate habits can contribute to physical discomfort:

Habits that may predispose individual musicians to injury include tension, bad posture or body mechanics, prolonged practice sessions, lack of practice breaks, poor technique, playing multiple instruments, sudden increase in practice time, difficult repertoire, typing, and caffeine consumption.44

Furthermore, this article states that piano instructors need to be aware of exercise principles which can be imparted to their students. “The majority of the participants ... would like to know more information on the prevention of playing-related injuries such as relaxation, specific stretching or flexibility exercises and guidelines for safe practicing.”45

Blackie et al. took a survey of piano students at Washington State University. The study investigated risk factors and type of injuries among the respondents. According to Blackie et al, Bejjani et al define “Overuse syndrome” as a “painful condition brought about by long, hard use of a limb that is excessive for the individual affected, and stresses the tissues beyond their anatomic and physiological limits.”46 Overuse syndrome is regarded as a piano-related injury that may be developed by “Prolonged repetitive motions, increased playing time, and compromised positioning due to fatigue increase the risk of overuse syndrome.”47 Most of the students surveyed were unaware of strategies to prevent piano-related injuries. According to the survey, “Ninety-three percent of the participants reported a total of 27 playing-related injuries, with ten sustaining more than one injury.

44 Redmond and Tiernan, 32.
47 Ibid., 141.
Hands and wrists were the most frequently injured areas (66% of the total), followed by back injuries. Of those participants injured, 21% reported that their pain or discomfort restricted practice and participation in activities other than piano.\textsuperscript{48} The study states that half of the pianists reported seeking treatment when they had physical discomfort. “Of the 15 (93%) participants reporting injuries, one (7%) sought medical care, while seven (46%) went to their instructors for suggestions regarding injury resolution.”\textsuperscript{49} The results of much of the extant research illustrate the need for teaching injury-prevention techniques that may be practiced in daily exercises:

\begin{quote}
Participants were asked about their knowledge and use of several injury prevention education techniques. Application of proper body mechanics and posture in practice was the most frequently cited education principle received by the respondents, followed by avoiding or lightening practice when fatigued, strengthening, and conditioning.\textsuperscript{50}
\end{quote}

Knowledge of these techniques could protect pianists from physical injuries and therefore make their careers less vulnerable to serious physical problems.

Revak identified pianists’ complaints of pain in the hand, forearm, and wrist through a questionnaire survey of music schools in Philadelphia.\textsuperscript{51} Students were asked to identify the most uncomfortable part of their body. “In the right hand, the long, ring and little fingers were involved most often. In the left hand, the ring finger was affected most often.”\textsuperscript{52} Students revealed that distress in their hand or arm may have resulted from intense practice, ineffective technique, or an irregular practice schedule such as abrupt

\begin{quote}
\textsuperscript{48} Blackie, Stone, and Tiernan, 143.
\textsuperscript{49} Ibid., 144.
\textsuperscript{50} Ibid., 145.
\textsuperscript{51} Revak, 151.
\textsuperscript{52} Ibid., 151.
\end{quote}
changes of duration of practice time due to preparation for recitals and juries as well as after the long holidays. This article also cites articles in American medical journals that discuss the risk factors of upper-extremity injuries in pianists. Stanish (1984) observes that pianists have experienced overuse syndrome from extrinsic causes such as “improper skill technique, improper training, lack of preconditioning, and overexertion.” An interesting assertion by Polnauer and Marks (1967) is that musicians who focus on repetitive exercises, continuing to work despite fatigue or muscle cramps, degenerate faster than musicians who concentrate on sound quality. Hochberg and Leffert examined the hand positions that make pianists vulnerable to injury. One of the factors of physical disorders in the hands may be certain habits in playing. The article deduces that when the right hand plays on the upper part of the keyboard with a bigger sound, a deviation of the ulnar on the right hand occurs which makes it vulnerable to overuse syndrome.

Grieco, Occhioni, and Colombini conducted a general survey of piano students at the Milan Conservatory to determine the incidence, location, and frequency of playing disorders. The study examined the movements of muscle groups of the hand and wrist when using specific piano techniques and repertoire, in order to discover which anatomical parts of the hands are involved in piano technique. The report shows that flexion and extension of fingers are exhibited in playing scales, arpeggios, and repeated notes.

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53 Ibid., 153.
Movement of the arms is seen in octaves, octave scales, and tremolo.\textsuperscript{57} Grieco et al. offer some constructive suggestions for building technique while avoiding potential injury:

\textbf{… suggestions regarding relaxation and stretching exercises for the muscle groups most involved during practice and exercises to strengthen the supporting muscle groups. It is important not only to explain how the exercises should be performed but also how to organize them during the day.}\textsuperscript{58}

A study by Kristen Burkholder and Alice G. Brandfonbrener\textsuperscript{59} found that overuse syndrome was prevalent among junior-high, high-school, and university students because of poor technique, “hypermobility of joints involved in fine repetitive motions”\textsuperscript{60} and increased practice time with excessive tension.\textsuperscript{61} The authors maintain that teaching principles for prevention such as “technique correction, relaxation and body awareness training”\textsuperscript{62} are crucial for high-school and younger students to enable them to lead a successful musical career.

\textsuperscript{58} Ibid., 712.
\textsuperscript{60} Ibid., 121.
\textsuperscript{61} Ibid., 121.
\textsuperscript{62} Ibid., 122.
CHAPTER 4
PRELIMINARY EXERCISES

The field of performing arts medicine is relatively new, and as set forth in Chapter 3, we can see that pianists – both students and professionals – are prone to repetitive stress injuries. Awareness of this situation is what has motivated this author to research exercise regimes with specific instructions not only for improving piano technique but also for considering physical comfort for each exercise. Unlike other exercises by Hanon, Czerny and Clementi, both Cortot and Tausig/Ehrlich’s methods offer detailed practical guides for each exercise in terms of how and what to practice with teacher’s guidance. Cortot and Tausig/Ehrlich’s directions will be discussed in the following chapters. Each method’s purpose and value will be investigated with the aim of determining, if possible, which regime might be the best for developing a piano technique without risk of injury.

As a prelude to his exercises, Cortot provides an effective practice plan in a preparatory chapter entitled “Plan for the Study of the Exercises.” Ehrlich also includes preliminary exercises in his book How to Practise on the Piano for building strength and finger independence. The practice of both of these series of gymnastic exercises is a prerequisite for students wishing to learn Cortot and Tausig’s studies.

4.1 Schedule and Plan for Daily Preliminary Exercises

In his practice plan, Cortot emphasizes the need for a specific schedule in order to complete a successful study of his preliminary exercises, “Daily Keyboard Gymnastics,” as
well as the exercises in each chapter. Cortot also suggests methods of applying each exercise, with rhythmic variations, modulations, and harmonic changes for building various techniques efficiently. In addition, he considers students’ different physical conditions in order to enable them to relax. According to Cortot, “Physical effort, if not followed by complete muscular relaxation, is prejudicial to any form of training.”

_Rational Principles of Pianoforte Technique_ comprises five chapters, preceded by the “Daily Keyboard Gymnastics.” Each of the five chapters has three series of exercises, and Cortot also provides a one-hour practice plan for every day. For example, he suggests spending fifteen minutes on exercises from “Daily Keyboard Gymnastics” and forty-five-minutes on exercises from one of the chapters. Moreover, Cortot proposes a six-month plan for going through his book, dividing the work into five cycles. Each cycle last thirty-six days, one cycle per chapter. In order to complete one cycle in thirty-six days, students must play each of the three series twelve times. Students modulate through twelve keys per series, and repeat the same transposing routine for three series in order to complete a chapter. The exercises can be successfully completed by students with all conformations of hand. Successful completion of these exercises will improve their piano technique and give them confidence about most technical challenges.

Cortot also offers methods that can be adapted to every exercise. He wants students to avoid static positions. Besides transposing the exercise through all twenty-four keys, Cortot asks students to practice by systematically changing the rhythm, beginning fingering,

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63 Cortot, 3.
64 Ibid., 2.
65 Ibid.
and key. He provides a so-called “Transferable Table” at the end of the book that shows how the system works.

Table 4.1: Cortot, “Transferable Table” from *Rational Principles*, pp. 105–106

![Transferable Table Image]

A variety of fingering patterns is used “to avoid accustoming the fingers to the repetition of formulae invariably presented in the same sequence.”

In addition, constantly changing the fingering patterns can be beneficial for students to avoid overuse injury due to the repetition of a static position. Ranelli et al. determined overuse syndromes among musicians by ages, gender, and instrument type. According to their study, one of the

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66 Cortot, 2.
67 Sonia Ranelli, Leon Straker, and Anne Smith, “Playing-related Musculoskeletal Problems in Children
factors of overuse syndrome was repeating a stationary position or practice session, as can be seen in both adult pianists and the growth phase by “Sustained awkward postures and the repetitive and forceful movements” that can be developed “during periods of growth.”\textsuperscript{68} Moreover, “It may be that the cumulative repetitions and prolonged postures of more extensive adult playing times and less physical variation are the reason adults have more problems with piano/keyboards than did the children in our study.”\textsuperscript{69} Cortot’s method underlines “accustoming the hand to all the positions,”\textsuperscript{70} leading students to adjust to all possible technical difficulties they can meet without disorders.\textsuperscript{71}

Finally, Cortot stresses relaxation of unnecessary tension on the hand and arm by resting for ten minutes after practicing the exercises and before moving on to repertoire study.\textsuperscript{72} He also considers students’ physical condition, such as size of fingers. Cortot creates different fingering numbers and notes in accordance with the length of the fingers:

A summary classification of the different types of hand sufficiently explicit, however, to avoid being equivocal—hands with long fingers or hands with short fingers—will serve as a point of departure for the particular direction of the pupils’ studies. Adopting a method of work, specialized in this way, should permit of a fairly rapid amendment of certain faults, which, at first sight might seem impossible to overcome, even by means of the most stubborn work.\textsuperscript{73}

At this point, Cortot underlines that there should be “no physical obstacle ... in pianistic

\begin{footnotesize}
\begin{enumerate}[\textsuperscript{68}]  \item Ibid., 137.  \item Ibid., 134.  \item Cortot, 3.  \item Ibid., 3.  \item Ibid., 2.  \item Ibid., 3.\end{enumerate}
\end{footnotesize}
execution”\textsuperscript{74} while practicing his exercises. Medical sources that have investigated the relationship between hand size and piano-related problems show that pianists with small hands have a tendency to have more injuries than pianists with large hands due to wrist joint extension thumb abduction. According to a report by Lai et al. “… pianists with smaller hand spans needed to spread their fingers to an excessive degree, which often exceeded their self-perceived maximal static hand span.”\textsuperscript{75} In this case, exercise method for pianists with small hands will be required in order to avoid abduction of thumb and weak fingers while playing the piano.

Cortot advises that the teacher should pay attention to whether a student complains about discomfort and should listen to students’ feedback about the exercises. Blank music paper is included at the end of each chapter, so that students have the opportunity to their own examples. At the end of the book, Cortot adds a “Repertory” chapter in order to show how students can apply his method to actual repertoire. The repertoire list goes from Frescobaldi to Franck. Cortot categorizes each piece by degree of difficulty and marks the parts of the five chapters that are recommended by him as appropriate for the piece.

\textsuperscript{74} Ibid., 3.

Table 4.2: Cortot, “Repertory” from Rational Principles, pp. 97–98

Cortot’s method is carefully written to consider students’ physical condition and includes a detailed practice schedule, as well as application to repertoire. By completing these exercises and maintaining them in some fashion as a part of daily practice, a pianist can be reasonably certain of building and maintaining their technique in a safe manner.

Ehrlich offer gymnastic exercises to be used daily before the pianist moves on to Tausig’s exercises. The aim of gymnastic exercises is to focus on each muscle of the fingers, hands, and body in order to achieve “perfect equilibrium” and co-ordination of strength. If the student is tired, the exercises should be played at a slow tempo.

77 Ibid., 2–3.
gymnastic exercise include the rudiments of piano technique such as scales, broken chords, arpeggios, and octaves. He suggests an ideal time frame for practicing both gymnastic exercises and the *Daily Studies for the Piano-Forte by Carl Tausig*. Ehrlich points out that both his gymnastic exercises and Tausig’s method should not be played for more than five to eight minutes per day at first. Later, students can play for ten to fifteen minutes, three times a day—in order to prevent pain in hands and fingers. Ehrlich also includes a gradual timeframe to guide students as they play the gymnastic exercises:

> Everyone who wishes to follow the method here laid down, should for 8 or 10 days practice very slowly the preceding separate finger-exercises, scales, broken chords and octaves, in the proper order, at first not longer than from 2 to 5 minutes at most, four or five times daily…. After 8 or 10 days these exercises may be practised longer, or—which is much more profitable—oftener, say 6 to 8 times daily, always from 4 to 6 minutes at a time.

After two weeks of warming up with the preliminary exercises, students can move on to the “Tausig–Ehrlich Daily Studies.” Tausig’s method also incorporates frequent resting. If the exercises are played without breaks, the hands will become too fatigued. According to Ehrlich, “the longest practice should last 10, 15 or 20 minutes; it can, however, be taken up—according to the player’s usage and strength—three, four, or even five times a day.”

Medical sources that stress the importance of daily warm-up exercises within a specified time frame support Cortot and Tausig/Ehrlich’s ideas. The article by Blackie et al. reports that muscle pain, tenderness, and weakness may develop due to a sudden increase in

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78 Ibid., 3.
79 Ibid., 21.
80 Ibid., 22.
81 Ibid., 22.
practice time. But:

... frequent breaks, and appropriate warm-up techniques have been documented as effective in the remediation of overuse syndrome. In addition, some of these (warming up, taking breaks, and modifying playing behavior, including posture) have been noted to enhance muscle responsiveness, improve the quality of practice, and decrease the risk of overuse injury.

Revak writes about the importance of a steady practice routine. Several students experience hand and arm discomfort when they change to an immoderate number of hours of practicing after a semester, during vacation breaks, or before recitals. A study by Brenda Wristen states that “The single most important recommendation to prevent injury is to avoid sudden increase in the amount or intensity of practice.” In addition, warm up exercises and taking rests often during the practice sessions would protect students from “soreness and cramping.”

Cortot and Tausig/Ehrlich both believe that daily warm-up exercises are essential for students to build their piano technique without physical discomfort. Cortot and Tausig/Ehrlich emphasize taking short breaks intermittently to prevent piano-related disorders. Teachers should pay attention to Cortot and Tausig/Ehrlich’s approach to their preliminary exercises when there is any possibility of having piano-related injury.

The next chapter compares the two authors’ methods dealing with posture of body and positions of hands while playing their exercises, as well as medical articles about posture and related risk of injury.

82 Blackie, et al., 145.
83 Ibid., 141.
84 Revak, 153.
86 Ibid., 56.
4.2 Posture of Body and the Hands

One principle to which more attention should be paid is the posture of body and hands while practicing exercises. Cortot provides some preparatory work, *Daily Keyboard Gymnastics*, to try to protect pianists’ hands and fingers from the possibility of piano-related injury. The primary aim for the preliminary exercises is to relax the pianist’s muscular apparatus, such as fingers, hands, wrists and forearms. In contrast, the goal of Ehrlich’s gymnastic exercise is to build independence and strength in the fingers. This is a prerequisite for students who are studying the “Tausig-Ehrlich Daily Studies.” The two authors share a similar idea for hand posture. However certain recommendations for arm posture and finger technique may be controversial.

In order to maximize results from Cortot’s method, it is essential to follow his suggestions for arm and body position meticulously. First, Cortot suggests adjusting the height of the piano bench to match the student’s physique. He states that the keyboard of a grand piano is generally 28½ inches from the floor. He believes that the typical height of the bench is about 18 inches, although of course it needs to be adjusted for the size of the body, especially the length of the arm. Cortot also discusses a suitable posture for the body:

The arm should be bent in a natural curve in such a way as to avoid those troublesome angles which paralyse the normal play of the muscles of the forearm and of the hand.

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87 Cortot, 6.
88 Ibid., 7.
As a general rule the wrist should be held less high than the hand: the naturally curved position of the index-finger on the key will fix that of the other fingers, which, as far as their unequal length will permit, without injurious contraction, should strike the respective keys on the same level and at the same point. Exaggerated articulation and disastrous stiffness will thus be avoided.\(^{89}\)

According to Cortot’s student, Magda Tagliaferro, on the Taylor’s dissertation, Cortot mentions about the importance of considering each pianist’s physical condition while practicing. “One day it dawned on me that I didn’t have enough technique, and I started working furiously all by myself. I developed my technique on my own. In the final analysis, I think that every pianist must to some extent devise his own personal technique, with his own hand and physique.”\(^{90}\) The idea of considering individual body size and suitable posture is supported by an article, “Epidemiology of Medical Problems of Performing Artists,” by Brandfonbrener. The article proposes a desirable posture that is determined by the students’ physique. Since the only static condition is the height of keyboard, the posture of the arms will be an important factor to consider:

Individuals with “nonstandard” body proportions (e.g., shorter or longer relative lengths of upper versus lower arm segments) must be considered. The ideal (i.e., physiologically and mechanically) is for the lower arms and wrists to be level with or slightly above the keyboard, while at such a distance that the hands are neither crowded into the keys nor so far away that the arms must be extended at the elbows to reach the keyboard.\(^{91}\)

An appropriate posture needs to follow the coordination of the arms, shoulders, hands, and

\(^{89}\) Ibid., 7.
\(^{90}\) Taylor, 397.
wrist's in order to prevent muscle distress. According to Brandfonbrener, “The upper arms should hang naturally and relaxed from the shoulders, slightly anterior to the trunk, with the elbows partially fixed. For most pianists this allows for optimal integrated functioning of hands, wrists, arms, shoulders, and back.”

She also writes of physicians: “we generally recommend that the wrist be maintained as closely as possible to a neutral position – in a relatively straight line with the forearm, neither bent toward the thumb (radially) nor toward the small finger (ulnarly).”

In general, Cortot emphasizes physical comfort and avoiding awkwardness as much as possible while playing his exercises. It is important that teachers not permit their students to raise their fingers with excessive tension.

In contrast, Tausig/Ehrlich makes reference to a suitable hand and body position in order to build solid and independent fingers to play the exercises as Tausig/Ehrlich intended. The important matters for practicing Tausig/Ehrlich’s method are the posture of the upper arm and the position of the fingers. One of the chief ideas is holding the upper arm close to the body. This leads to “control of the position of the elbow and forearm.”

Ehrlich contends that the upper arm should stay in a stable position against the body in order to sustain the exact position of the fingers and hand without “an uneven raising and lowering of the wrist.” According to Ehrlich, the “upper arms are to be moved toward the body so as to closely press it with the elbows; the elbows, however, must lie, not beside but

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92 Ibid., 39.  
93 Ibid., 39.  
94 Cortot, 7.  
95 Ehrlich, 4.  
96 Ibid., 4.
before the body, the forearm remaining extended in front of the body, and planted on the ribs. Ehrlich mentions a number of wrong positions that should be avoided by students:

The incorrect position of the fingers, now too straight and again too much bent, causing them to touch the keys either with the middle joint, or with the nails; the turning the elbow outward, by which the position of the hand is changed every instant; the drawing the forearm forward and back, whereby the wrist is prevented from being quiet and from ever attaining to even and regular motion; the pushing with the upper arm, which places the hand either too far back on the keyboard or too far forward; — all these are drawbacks which everyone would like to be able to remove.

Ehrlich believes that the fingers will be arranged appropriately by the correct movement of the upper arm and elbow moving sideways, not back and forward tight to the body. He believes that this allows students to control the accurate position of the fingers, hand, and body. In addition, this posture allows students to focus on the motion of the fingers, hand, and wrist. Tausig/Ehrlich ask the teacher to monitor whether students are playing Tausig’s exercises properly, and to teach them to develop “in the highest degree the strength of the fingers and wrist, by concentrating power upon them.”

There is, however, a limitation of Tausig/Ehrlich’s principle of holding the upper arm. Building force on the fingers and the wrist by controlling the upper arm may produce unnecessary tension which could lead to a playing-related injury.

An article by Dr. Brenda Wristen, a piano professor at Chadron State College in Nebraska, examines both biomechanical studies and qualitative approaches in illustrating

97 Ibid., 7.
98 Ibid., 5-6.
99 Ibid., 7.
100 Ibid., 8.
101 Ibid., 7.
102 Ibid., 8.
and analyzing the execution of selected elements of piano technique. This article describes a practice strategy and includes checklists for working on techniques such as scales, arpeggios, and broken chords, focusing not only on the ideal posture of the hands, but also body posture. The fundamental mistakes that pianists should avoid are “abrupt, arresting, or jerky motions”\textsuperscript{103} or exaggerating a posture with suddenly increasing movement of the shoulders, upper arms, forearms, and wrists. The upper arms should hang naturally to adjust the direction of the forearm. However, positions of the upper arm are slightly modified by various techniques. For example, when the student plays a scale, Wristen writes that the upper arm moves steadily in the direction of the scales and leads the forearm to follow the direction of the scale.\textsuperscript{104} When the student plays a trill, the upper arm stays relaxed.\textsuperscript{105} However, if the music contains chords and octaves in flat keys, the upper arm needs to move back and forward effortlessly to reach the black keys by guiding the forearm.\textsuperscript{106} Checklists define how the elbow stays without jerkiness in order to follow the upper arm, and the fingers are curved slightly, generally not striking the key with force.\textsuperscript{107} Wristen highlights the “neutral position” of the wrist to avoid injury:

As much as possible, extreme flexion or extension at the wrist should be avoided since these motions increase the work of the extensors and flexors of the fingers and wrist, and may eventually contribute to the development of carpal tunnel syndrome. Dropping the wrists below the key level should also be avoided; wrist motions should be made gently and smoothly due to the demonstrated relation of sudden accelerations of wrist motion and injury.\textsuperscript{108}

\textsuperscript{103} Wristen, 62.
\textsuperscript{104} Ibid., 58.
\textsuperscript{105} Ibid., 59.
\textsuperscript{106} Ibid., 59–60.
\textsuperscript{107} Ibid., 58–61.
\textsuperscript{108} Ibid., 62.
Tausig/Ehrlich’s method may help the pianist to concentrate on their fingers during certain exercises. However, practicing repetitively with a controlled position of the upper arm could create tension. If teachers do not supervise their students carefully such tension may lead to carpal tunnel syndrome. Wristen states that “Repetitive motions of high force, at both the wrist and forearm, have been associated with nerve entrapments in both location; this correlation is so strong that it has been found to substantially increase the risk of carpal tunnel syndrome more than any other factor.”\textsuperscript{109}

The other important topic for Tausig/Ehrlich is the posture of the fingers. Ehrlich insists that focus on the “fleshy finger-tips”\textsuperscript{110} is crucial for building the strength of the hand muscles. Ehrlich recommends to “First, lay the fingers of both hands \textit{flat} on the keys $c e g a c$, yet so that the round, fleshy part of the finger tips, but by no means the \textit{nail}, touches the keys. The \textit{thumb}, of course, does not lie perfectly \textit{flat} on its key, but is turned edgeways.”\textsuperscript{111} When the upper arm is moving sideways by pressing the elbows close to the torso, the fingers stay firmly on the keys with the “fleshy tip” in a slightly bent position.\textsuperscript{112} Playing with the fleshy finger-tip can produce a powerful stroke on the keyboard if the fingers are raised high during the exercise. Ehrlich, however, warns teachers to look out for students’ complaints about stiffness or pain from raising the fingers. Therefore, he recommends playing in a slow tempo, taking intermittent short breaks during practice sessions.\textsuperscript{113}

\textsuperscript{109} Ibid., 56.
\textsuperscript{110} Ehrlich, 8.
\textsuperscript{111} Ibid., 6.
\textsuperscript{112} Ibid., 7.
\textsuperscript{113} Ibid., 21.
Both methods advocate playing with a curved finger position. However, it may be difficult for teachers to figure out which method is better for safe practicing. Ehrlich mentions that “Each finger should be raised as high as possible, and then fall on the key with full force with the cushion of the third joint. The wrist must be held motionless, almost rigid, upper arm and elbow close to the body.”\textsuperscript{114} In contrast, Cortot writes, “it will be well to avoid extension exercises practiced with a motionless hand, during which the fingers are cramped on the key-board in an abnormal position.”\textsuperscript{115}

Proper posture at the keyboard is essential. Since students have different body structures, it can be difficult for teachers to rely on either Cortot or Tausig/Ehrlich exclusively without understanding the physical movements involved in piano playing.

A number of articles examine the “finger tendon tensions and joint reaction forces for finger positions used in playing the piano.”\textsuperscript{116} The goal of these articles is to define specific finger position that can minimize strain on the tendons and tension in the fingers, hands, and arms. It would be advisable for teachers to advocate for a healthy posture at the keyboard, based on the Cortot’s and Tausig/Ehrlich’s methods. The analyzed results in medical articles show how specific postures can affect joint tensions of the fingers, leading to understanding the relationship between joint force and finger position. According to a study, “Finger Joint Force Minimization in Pianists Using Optimization Techniques,” “finger position variables affecting tendon and joint forces during piano performance


\textsuperscript{115} Cortot, 60.

include the fingertip/key contact angle, flexion angles of the distal interphalangeal (DIP), proximal interphalangeal (PIP) and the metacarpophalangeal (MP) joints, and the fingertip force on the key.\textsuperscript{117} The angle of key contact can be completed by the fingertip with the movement of the three joints of the fingers, DIP, PIP, and MP. Moreover, the arms and wrists contribute to constructing different key-contact areas by changing the height or direction toward the body or keyboard.

Figure 4.1: Finger joints and phalangeal segments: DIP, PIP, and MP\textsuperscript{118}

![Figure 4.1](image)

\textbf{Figure 4.1}. Skeletal anatomy of finger showing joints and phalangeal segments. MP = metacarpophalangeal joint, PIP = proximal interphalangeal joint, DIP = distal interphalangeal joint.

The variables of joint force relevant to finger position discussed in medical articles were analyzed by electronic equipment such as an electronic piano, video data system, computer model, cameras, and recorder. The Yamaha CLP-300\textsuperscript{119} has “touch-sensitive”\textsuperscript{120} systems for evaluating key weight and velocity of fingertip forces when striking the keyboard with different dynamics and tempos. Videocameras and data computer models can record and calculate the key force, hand posture, and key contact angles of each subject.

\textsuperscript{117} Ibid., 1403.
\textsuperscript{119} Ibid., 103
\textsuperscript{120} Ibid.
Participants play certain repertoire and specific piano techniques such as octaves, arpeggios, trills, legato, and staccato with a variety of dynamic ranges from the softest sound which can be produced with minimal motion to the loudest sound, all produced in different tempos. Throughout the different studies, a number of hand postures and key-contact angles are used, from flat finger angles to upright/vertical angles, depending on the type of technique and strength of the joint forces from the magnitude of key strikes during piano performance.

The first study by Harding et al. examines the tendon force posture of the fingers during trill technique, concentrating on the finger motion “while the hand and forearm remain relatively motionless.” Pianists were asked to play trills at moderate tempo, then finish with the fastest tempo possible for them. The article “Minimization of Finger Joint Forces and Tendon Tensions in Pianists” (1989) suggests desirable finger positions to avoid unnecessary tension in the hands, achieved by examining finger tendon and joint tensions during playing “numerous times with various intensities” and “utilizing both legato and staccato key strikes to calibrate the piano.”

Studies have established that the posture of the hands is determined by the angle of key contact of DIP, PIP, and MP regulation and the movement of the wrists and arms.

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124 Ibid.
126 Ibid.
Harding et al. state that “during piano playing, the sum of the three joint flexion angles and tip contact angle were constrained by the wrist position”\textsuperscript{127} In addition, posture of the wrists and forearms were defined by the angles of the various tendons and muscles that are associated with the DIP, PIP, and MP joints. This posture is correlated with sitting position, “since piano bench height is typically adjusted to position the elbow slightly above the level of the keyboard.”\textsuperscript{128} This result supports Cortot’s idea of adjusting the position of the bench in relation to the individual size of the students.\textsuperscript{129}

It is important to understand that finger joints are associated with other muscles and tendons of the hands and body. If one posture may be helpful to reduce the joint stress on one particular tendon, it does not necessarily follow that other joint forces can be minimized by playing with the same posture. The study by Harding et al. illustrates several postures that minimize stresses on tensions and others that have negative results. “A worst case condition was considered by assuming a straight finger pivoting at the MP joint with the key force at the fingertip.”\textsuperscript{130} In order to reduce tendon force on the MP joint, “a high MP/low PIP flexion angle” is necessary.\textsuperscript{131} Figure 4.2 compares positions that produce different tensions on the MP joint. According to the article “Minimization of Finger Joint Forces and Tendon Tensions in Pianists,” “Position 1 and 2 have contact and DIP flexion angles of $5^\circ$. However, the PIP and MP flexion angles for Position 1 are $30^\circ$ and $5^\circ$, whereas those for Position 2 are $5^\circ$ and $85^\circ$. Position 2 is the minimum MP joint

\textsuperscript{128} Ibid., 1405.
\textsuperscript{129} Cortot, 7.
\textsuperscript{131} Harding, et al., “Minimization of Finger Joint Forces,” 105.
force position.”

Figure 4.2. MP Joint

DIP joint force can be decreased by reducing the contact angle with a larger DIP flexion angle. Figure 4.3 demonstrates the different tensions that can result from two different finger positions. The result of experiments by Harding et al. defines that Position 1 is composed of 70° of contact angle, 5° of DIP flexion angle and PIP flexion angle, and 40° of MP flexion angle. Position 2 stays the same angle as Position 1. However, the contact angle is reduced to 5°, while DIP flexion angle and PIP flexion angle increase to 35° and 20°, respectively.

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132 Ibid., 106.
133 Figure 4.2 from ibid., 106.
135 Ibid., 106.
136 Ibid., 106.
Figure 4.3. DIP Joint Force\textsuperscript{137}

According to the results of Harding et al., “As a result of increased flexion angles at the DIP and PIP joints and a decreased key contact angle, more than 50\% reduction in DIP joint force was achieved by a change from Position 1 to Position 2.”\textsuperscript{138} Another posture of fingers that may diminish finger tendon force is created by a sharper fingertip position. If the fingertip contact angle is decreasing but the DIP, PIP, and MP flexion angles remain the same, the Flexor Digitorum Profundus (FDP) tendon tension, force can be reduced.\textsuperscript{139}

\textsuperscript{137} Figure 4.3 from ibid., 106.
\textsuperscript{138} Ibid., 105.
\textsuperscript{139} Ibid., 105.
This position illustrates how students can reduce tension on the fingers by using their fingertips. This result supports Tausig/Ehrlich’s “fleshy finger-tip” method and may produce sound with less stress on FDP tendon tension. However, it requires extreme care. If students attempt to build finger strength by employing a full strike in this position, stress level on the joints will be raised. In addition, an upright finger position may create a problem with other parts of the body. Harding et al. state that “to accomplish this decrease in key contact angle during piano playing without changing joint flexion angles would require either an increase in wrist flexion or elevation of the shoulder and elbow, neither of which may be desirable.” Since “a joint with a small contact area is subjected to higher
contact stress than a joint with a larger contact area,”143 this may hinder a natural and effective touch on the keyboard. The article, “An Investigation of Finger Joint and Tendon Forces in Experienced Pianists,” studied joint forces and finger position during piano performance. Each participant was asked to play a certain section from Mendelssohn’s *Song without Words*, Op. 19, no. 2.144 The study calculated data for joint and tendon forces of ten selected notes in this piece. In general, “a more curved finger position, with an almost perpendicular contact between the key and distal phalanx, results in the lowest DIP and FDP force coefficients; this observation agrees with Harding’s finger-force minimization results”145 Another article, “Comparison of Three Piano Techniques as an Implementation of a Proposed Experimental Design,” examined three different positions: “method A, flat hand and extended fingers; method B, arched hand with rounded fingers and slightly flexed wrist; and method C, quasi-right angle flexion at the knuckles and slightly ulnarly deviated wrist.”146 While subject played Bach’s Prelude no. 6 in D minor from the Well-Tempered Clavier I.147

143 Wolf, et al., 95.
144 Ibid., 85.
145 Ibid., 94–95.
146 Bajjani, et al., 109.
147 Ibid.
Three different hand postures were investigated as the pianists performed three tasks selected from the repertoire: “task 1, features a jump of 1 and 1/5 octaves; task 2, requires a repetitive pattern of the thumb and index finger; task 3, begins with one held note and ends with double held notes.”

In this study, position A is the most effortless posture, followed by positions B and C:

148 Figure 4.5 from ibid., 110.
149 Ibid., 109.
Middle finger DIP and MCP(MP) range of flexion-extension was significantly less for method A in all tasks, and significantly more for method C. MCP range of abduction–adduction was significantly less for method A in all tasks, and comparable for B and C. Method C showed significantly more ulnar and less radial deviation of the wrist than A and B in all tasks.150

In addition, the study examined the finger joints and rotation of the wrist in each method:

MCP abduction and adduction are free when the finger is straight, but rotation is extremely limited. As the finger joints flex is an arched fashion, as in method B, rotation becomes more possible and abduction-adduction less…As the MCP joint approaches full flexion, as in method C, its stability relies entirely on the collateral ligaments, thus a laterally deviating force cannot be easily dissipated without straining the various structures.151

Method A can be found in the article by Harding et al.: “an extended joint in combination with a large key contact angle produces maximal PIP joint force.”152 This position is similar to Vladimir Horowitz’s position, which can be seen in many of his performances.153 However, it may have been used by Horowitz only because he “traveled with his own customized piano with lighter keys that reduces the overall finger forces.”154 The study by Bejjani et al. maintains that “professional pianists can efficiently and rapidly alternate between different techniques and yet accurately abide by their specific postural requirements.”155

To sum up the results from the studies above, “In general, use of a more curved

150 Ibid., 111–112.
151 Ibid., 112.
153 Ibid.
154 Ibid.
finger position, with a large metacarpophalangeal joint flexion angle, reduces flexor tendon tensions and thus resultant forces in the finger joints. In addition, the medical literature agrees that playing a large MP with a fingertip can reduce tendon tension at the joints:

In conclusion, finger key strike positions that minimize the fingertip force moments at the joints, especially the MP joint. This force reduction is achieved by using a generally curved finger key strike position with a relatively large MP flexion angle. A generally curved finger position promotes neutral wrist position and thus minimizes potential nerve compression syndromes.

This finding validates the finger positions described in the regimes of both Cortot and Tausig/Ehrlich. However, one can raise issues with Tausig/Ehrlich’s method because the excessive tension needed to produce a powerful sound by striking the keys with full force can be harmful to students’ pianistic health. Even though the student is playing with a fleshy tip created by a large MP, a small contact angle of the keyboard with the little digit of the fingers may cause piano-related injury. Therefore, teachers should consider the general curved posture of the hands and arms while seeking to develop the strength of the fingers gradually.

4.3 Gymnastic Exercises

In their preparatory exercises, Cortot and Tausig/Ehrlich have similar ideas about creating finger independence and building strength in the fingers, hands, and wrists. However, each method has different approaches to practicing gymnastic exercises. Cortot

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offers *Daily Keyboard Gymnastics* as a warm-up exercise for “a quarter of an hour”\(^{158}\) daily, in order to make the hands, fingers, and wrists’ flexible for playing the piano. The goal of these exercises is “the reasoned loosening of all the pianist’s muscular apparatus, that is to say, fingers, hand, wrist and even forearm.”\(^{159}\) Cortot composed these exercises with the intention of improving the independence of the fingers, with lateral and pliable movement of wrists and elasticity of forearms and elbows. He gives detailed instructions along with the exercises in which he stresses the importance of physical comfort.

Tausig/Ehrlich asks students to have frequent rests while playing the exercises in order to avoid bodily distress. Tausig/Ehrlich also stresses moderation for the body, particularly in the upper arms, in order to be able to create the necessary force in the fingers:

> The chief point is, that the upper and forearm get accustomed to their position, and that the keys be boldly struck by the fleshy finger-tip...keep the upper arm, if not exactly against, yet as near to the body as possible. The development of strength necessarily resulting from this, re-acts most beneficially on the independence of the fingers.\(^{160}\)

Different ideas about pliability and intensity are found in the exercises of the two methods. Cortot’s exercises can be divided into two sections: building the individual strength of the finger muscles, and developing flexibility in the fingers, wrists, forearms, and elbows. He cares about avoiding physical distress while developing power in the fingers. For the exercise shown in Example 1, Cortot provides the following directions:

> Place the fingers on the keys marked with semi-breves, without pressing them down. Then, leaving the other fingers in silent contact with the keys, resting

\(^{158}\) Cortot, 4.

\(^{159}\) Ibid., 2

\(^{160}\) Ehrlich, 21.
lightly on their surface, lower each finger affected by the execution of the semi-quavers, counting four on each crotchet: 1, to strike the note; 2, to press the finger down as far as the key will go (without cramping or stiffening the other fingers); 3, to let the key rise with the finger; 4, to cease the pressure.161

Example 4.1: Cortot, *Daily Keyboard Gymnastics* from *Rational Principles*, Exercise No 1, p. 4

Exercises No 2 and No 3 use the same music as Exercise No 1. In addition to these exercises, Cortot gives an example of transposition, so that students can practice this exercise every day with different hand formations.162

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161 Cortot, 5.
162 Ibid., 5
Example 4.2: Cortot, *Daily Keyboard Gymnastics from Rational Principles*, Transposition, p. 5

The effect of practicing the diverse topography of the keyboard and the figuration of the hands can be beneficial for students to overcome technical difficulties that they may experience because of the numerous possible postures of the body and hands. According to Cortot’s practical guide for Exercise No 1, students must avoid “cramping or stiffening the other fingers” while pressing the key. However, there are some exercises that may increase the possibility of feeling tightness or jerkiness while stretching or raising the fingers. For example, the directions for Exercise No 2 state:

1. To strike the note; 2, to slide the finger in action below the level of the motionless fingers, relinquishing the key and stretching it downwards as far as possible, perpendicularly, in front of the key-board; 3, to bring the finger back to the level of the keys; 4, to lift the finger vertically, as high as possible.

This exercise is for enhancing the strength of the fingers. Cortot mentions extending the fingers below the level of the keyboard and raising the fingers as high as possible. The same ideas can be found in Exercise No 3. The goal of Exercise No 3 is giving elasticity to the fingers by horizontal movements. A significant guideline for Exercise No 3 is:

1, to sound the note; 2, to stretch the extended finger to the left, crossing it over the other fingers and as far as possible; 3, the same movement to the right; 4, to raise it vertically above its key. Only the thumb’s movements differ from those just described, owing to its especial conformation. It should be brought to the right for the right hand, so the left for the left hand, passing under

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163 Cortot, 2–3.
164 Ibid., 5
165 Ibid., 5.
the fingers instead of over them.\textsuperscript{166}

The act of finger crossing while lifting up in a vertical direction may create tension. However, Cortot asserts that the three Exercises Nos. 1 to 3 should be “exclusively practiced \textit{piano}”\textsuperscript{167} but later can be practiced \textit{mezzo forte} and \textit{forte}.\textsuperscript{168} Teachers should instruct students to practice with the softest possible sound initially in order to avoid tension.

Cortot emphasizes relaxation of the wrists by providing horizontal and lateral movements of the wrists, forearms, and elbows. Exercise No 4 is for loosening rigid wrists.

Example 4.3: Cortot, \textit{Daily Keyboard Gymnastics} from \textit{Rational Principles}, Exercise No 4, p. 5

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{exercise4.png}
\end{figure}

In order to practice this exercise effectively, Cortot suggests to “Strike each chord neatly, taking care to attack all the notes simultaneously, then subject the wrist to a combined flexuous and rotary movement.”\textsuperscript{169}

The wrists move in circular motions, but the fingers should maintain a secure posture

\textsuperscript{166} Ibid., 5.
\textsuperscript{167} Ibid., 5.
\textsuperscript{168} Ibid., 5.
\textsuperscript{169} Ibid., 5.
on the keyboard.\textsuperscript{170} Cortot emphasizes the importance of loosening the wrists while practicing his exercise in order to prevent pain.

The following exercise is for establishing a solid finger touch while maintaining relaxed wrists.

Example 4.4: Cortot, \textit{Daily Keyboard Gymnastics} from \textit{Rational Principles}, Exercise No 7, p. 6

Cortot’s comment for this exercise is to:

Press down all the fingers, taking care that all the notes are struck simultaneously, then, with the exception of one finger which remains in contact with its key, lower the hand as far as possible below the level of the keyboard, keeping the free fingers folded back towards the palm of the hand. Use each of the five fingers in succession to hold the single note on each chord formation, and repeat the movement four times after each change of finger.\textsuperscript{171}

Instead of striking full force on the keyboard, Cortot recommends wrists movement in order to feel the weight on each finger. However, teachers should be aware that if students press their fingers too vigorously on the keys they may end up with upper body pain. Cortot stresses that “Contact with the keys will naturally be established by the largest possible surface of the small phalanx.”\textsuperscript{172} He emphasizes the importance of avoiding an exaggerated

\begin{footnotesize}
\begin{enumerate}
\item Ibid.
\item Ibid., 6.
\item Ibid., 7.
\end{enumerate}
\end{footnotesize}
posture of hands or stiffness.\textsuperscript{173}

Tausig/Ehrlich focus on developing finger independence and strength by means of powerful finger strokes from a somewhat rigid hand position. They state that in the exercise shown in Example 4.5, students should be sure to strike the keys with the fleshy tip and must sustain the key until they play the next note.\textsuperscript{174}

Example 4.5: Tausig/Ehrlich, \textit{gymnastic exercise} for independence and strength from \textit{How to Practise}, p. 9

\begin{center}
\begin{music}
\musicentry{C:\tgTupletMine\cues\scores\N\music}{
\G2 \F2 \G \A \G \F2 \E \D \C \B \A \G \F2 \E \D \C \B \A \G \F2 \E \D \C \B \A \G \F2 \E \D \C \B \A \G \F2}
\end{music}
\end{center}

The effect of this gymnastic exercise is best accomplished through a proper position of the body, namely the upper arm close to the body, the elbows firmly sustained in front of the body, and playing in a very slow tempo, striking the keys with fully raised fingers.\textsuperscript{175}

Tausig/Ehrlich also provide a tenuto scale exercise to further develop finger strength.

\begin{footnotes}
\footnotetext{173} Ibid.
\footnotetext{174} Ehrlich, 9.
\footnotetext{175} Ibid., 21.
\end{footnotes}
Example 4.6: Tausig/Ehrlich, *gymnastic exercise* for scales from *How to Practise*, p. 10

Tausig/Ehrlich suggest that this exercise can help not only to increase the power of the fingers, but also to enhance legato technique. In order to have the best result from practicing this exercise, the fingers should “be raised as high as possible while the other remains down, and must fall quite forcibly with its flesh tip on the key.”  

The most important part of this exercise is sustaining the hand in a curved position, keeping the wrists even without raising them. Tausig/Ehrlich believe that when student plays Example 4.6, a legato can be achieved without shifting the position of the hand, especially when the thumb is passing under the third and fourth fingers of the right hand to play the next upper note. This intense exercise should be performed in a very slow tempo, trying to project a full sound. This approach will later result in more comfort and ease when playing in a faster tempo, with a secure and accurate touch, holding the elbows and upper arm close to the

176 Ibid., 11.
177 Ibid., 11.
178 Ibid., 11.
Another example of Tausig/Ehrlich’s *gymnastic exercise* is the wrist exercise. Unlike Cortot, Tausig/Ehrlich stress playing with firm wrists, elbows, and upper arms when playing wrist exercises.

**Example 4.7:** Tausig/Ehrlich, *gymnastic exercise* for the wrist from *How to Practise*, p. 15

\[
\begin{align*}
\text{Example} & \\
\text{Exercise} & \\
\text{Description} & \\
\end{align*}
\]

This exercise can be played with the hands together in a slow tempo. According to Ehrlich, “the wrist must be raised each time as high as possible, the elbow close to the body, and in front; the fingers, including the thumb, must fall with the fleshy tip on the keys.”\(^{180}\) The most important thing about practicing this exercise is “perfectly uniform raising and lowering of the wrists, together with a uniform strength of stroke.”\(^{181}\) The idea of holding the upper arm and elbow next to the body with quiet wrists can be misunderstood by students, resulting in tightness and overly strict control of the body. This method differs from Cortot’s idea, which emphasizes relaxation and suppleness of the wrists, forearms, and elbows. Tausig/Ehrlich’s exercise may have a positive effect on developing the power of the fingers, but some medical points of view assert that striking the key with full force is somewhat risky, especially with weak fingers such as the fourth and fifth.

Misunderstanding this exercise or doing it without adequate supervision can cause pain or

\(^{179}\) Ibid., 12–15.
\(^{180}\) Ibid., 16.
\(^{181}\) Ibid., 16–17.
tension.\textsuperscript{182}

Alford and Szanto explore the medical, pedagogical, and performer’s points of view to define risk factors and present conditions and treatments for piano-related injury in their article, “Orpheus Wounded: The Experience of Pain in the Professional Worlds of the Piano.”\textsuperscript{183} The article points out the possible problems of practicing exercises similar to those of Cortot and Tausig/Ehrlich.

In this exercise, intended to strengthen the fingers, the pianist holds down one or more notes with the fingers of one hand, and plays other notes with other fingers of the same hand. By thus isolating the fingers from each other and from the hand, that exercise, when repeated constantly, produces extreme tension and strain in the hand.\textsuperscript{184}

The article reports “neurophysiological theories” to support the danger of holding tension in the fingers. According to their study, “such painful stretches, while endured by the body for perhaps a long time, ultimately cause a rebellion of the body in the form of pain or stiffness that inhibit playing.”\textsuperscript{185} Repetition of pressing the key with excessive tension may result in the deformation of structure of the hands. Bard et al. made observations of the radiology of pianists’ hands to evaluate the shape of the phalangeal joints and digits.\textsuperscript{186} Their evaluation demonstrates modifications of the joints of the fingers in three categories:

1) alignment adaptation consisting of axial radial rotation of the digits, particularly the fifth but also the third and fourth, 2) degenerative changes at the distal interphalangeal DIP and metacarpophalangeal MCP joints, and 3) mechanical remodeling manifested as periostal thickening and flattening of the

\begin{itemize}
\item \textsuperscript{182} Revak, 150.
\item \textsuperscript{184} Ibid., 16.
\item \textsuperscript{185} Ibid., 16.
\end{itemize}
phalangeal tufts associated with sclerosis.\textsuperscript{187}

Misalignment of joints can harm pianists’ hands, particularly those with small fingers. Possible changes of structure of the hands can appear as radial rotation of the bones, narrowed joints space, and flattening and thickening of the phalangeal tufts in the joints of the third, fourth, and fifth fingers.\textsuperscript{188}

The study shows that some exercises may cause deterioration of the hands. According to Bard et al., “some of the most difficult exercises that pianists perform are designed to increase the power of abduction of the fingers in flexion and extension.”\textsuperscript{189}

For example, the exercises for increasing the power of the fingers by stretching the muscles and playing full force on the keyboard may produce an “abnormal concentration of stress points in the last digits of pianists’ hands leading to a degenerative osteoarthritis related to repetitive wear and tear.”\textsuperscript{190} Sakai et al. studied the injury mechanism related to overuse syndrome. The study involved several cases of pianists who experienced piano-related injury. One such case was a high-school student who suffered injury in the right fifth finger while doing repetitive key-striking exercises. According to the study, the “patient had pain in the radial collateral ligament of the fifth PIP joint, which occurred while striking the piano key with the little finger abducted. This pain was thought to be due to a repeated valgus stress and joint laxity of the fifth PIP joint.”\textsuperscript{191} Harding et al. state that “pianists incur more injuries of the fourth and fifth fingers because these fingers are required to

\textsuperscript{187} Ibid., 154.
\textsuperscript{188} Ibid., 155–56.
\textsuperscript{189} Ibid., 156.
\textsuperscript{190} Ibid., 157.
produce the same acoustic intensity as the larger digits, but have the smallest joint contact areas and thus the highest joint stresses.”\textsuperscript{192} According to a medical report by Poore, “pianists have special difficulty in educating the ring-fingers, which have less power of independent movement than the other fingers. This is partly due to the absence of special extensor muscles, such as are provided for the index and little fingers.”\textsuperscript{193} Poore also suggests that the shoulders, elbows, and wrists should be well-balanced by following the movement of the hands and fingers—which goes against the stationary motion recommended in Tausig/Ehrlich’s method.\textsuperscript{194}

Cortot and Tausig/Ehrlich both offer tenuto exercises for the independence and strength of the fingers. Cortot advocates loosening wrists, forearms, and motion of the elbows to create relaxation. His method further advocates playing with the largest unit of the fingertips to avoid tightness in the body. In contrast, Tausig/Ehrlich advocates control in the fingers by holding the upper arms, forearms, and wrists in order to focus on strict finger motion, raising the fingers as much as possible and pressing the key with solid force. Even though Tausig/Ehrlich pays attention to stiffness and advocates taking frequent rests during practice sessions, it is important to be aware of the peril of inappropriate strain on the student’s body.

Based on the surveys and experiments, it is important for both teachers and students who are working on the Tausig/Ehrlich exercises to be particularly alert to the risks involved if these exercises are not done properly or are not supervised carefully.

\textsuperscript{192} Harding, et al., “Minimization of Finger Joint Forces,” 108.
\textsuperscript{194} Ibid., 441–42.
Students who do not have solid fingers should be careful not to practice finger independence exercises with excessive force. Teachers should supervise students as they are first learning these exercises and counsel them to begin in a moderate tempo and with moderate intensity until their finger strength gradually builds up.
Cortot and Tausig/Ehrlich arranged their books by classifying exercises into several chapters according to the purpose of the technique. Cortot’s book is divided into five chapters:

1. Equality, independence and mobility of fingers.
2. Passing under of the thumb (scales and arpeggios).
3. Double notes and polyphonic playing.
4. Extensions.
5. Wrist technique, execution of chords.\textsuperscript{195}

Tausig/Ehrlich also wrote two “books” (chapters) of exercises and one book comprised of preludes that includes technical elements from the first two books. The exercises of the first two books are categorized by type of technique:

**Book I**
I. With the position of the hand unchanged.
II. Exercises formed from scales.
III. Exercises formed from broken intervals in ascending or descending motion.

**Book II**
I. Special exercises in passing the fingers over and under.
II. Turns with chords.
III. Exercises formed from broken chords.
IV. Trill studies.
V. Exercises in double notes.
VI. Wrist exercises.
VII. Stretches and skips.

**Book III.**
Preludes 1–19.\textsuperscript{196}

\textsuperscript{195} Cortot, 8.
\textsuperscript{196} Tausig, 3–75.
The two authors have the same ideas about building technique, such as scales, stretching for chords, and wrist movement. To sum up each method, the exercises could be considered in two categories: finger exercises and wrist exercises. The exercises for scales, independence of the fingers, mobility, and trill motion fall into the category of finger exercises. Chords, leaps, and octaves fall into the category of wrist exercises. However, some exercises such as double intervals and broken chords combine both skill sets as they involve both the individuality, flexibility, and stretching of the fingers as well as wrist relaxation. The exercises that follow will be compared with medical articles, providing information about injury due to overuse, in order that teachers can better understand the different methods and design of exercises and the way in which they should be practiced to help students prevent injury.
CHAPTER 6

FINGER EXERCISES

6.1 Independence and Strengthening Exercises

Cortot and Tausig/Ehrlich both have valuable suggestions for the strength of the fingertips. Important parts of both methods are devoted to tenuto finger exercises. Chapter I in Cortot’s book is titled *Equality, Independence and Mobility of the Fingers*. He focuses on achieving independence for each finger, as well as evenness; he does this through various positions of the hand, emphasizing having curved fingers in order for the keys to be struck at the same level. Tausig/Ehrlich also provide numerous tenuto exercises for improving the muscles of the fingers in order to create a powerful touch by controlling the body through such means as how the arm should be held. However, whether the tenuto exercises are safe to practice without developing some sort of injury remains unclear. A number of medical articles demonstrate the possibility of piano-related injury resulting from practicing tied notes. Alford et al. state that tenuto exercises may cause intense pressure and stress on the fingers when students consistently try to separate the muscles of each finger. Harding et al. assert that holding the notes after the key goes to the key bed would not be recommended for most students, since it results in excessive joint and tendon tightness and would not contribute to the sound or tone quality. Sakai et al. quote Tobias

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197 Cortot, 9.
198 Alford and Szanto, 16.
Matthay contradicting the idea of tenuto practice. Matthay states that striking the notes and holding the key down has no relation to producing a better sound, since the motion of raising the fingers before playing the key requires a greater amount of effort prior to the hammer reaching the strings, and both holding and playing the key powerfully require excessive energy. All told, it is important that teachers pay attention to Cortot and Tausig/Ehrlich’s practical guides and design of tenuto exercises carefully in order to avoid students’ distress. Cortot cares about students’ comfort while practicing held notes exercises, therefore he emphasizes relaxation and suppleness. In contrast, Tausig/Ehrlich focus on developing the endurance of each finger to project a solid sound during the tenuto exercises.

Different hand shapes and playing in a variety of keys are important aspects of Cortot’s method. He believed that practicing in a different key every day with varying tone, tempo and dynamics was valuable for students in order for them to be able to play any repertoire they faced. Therefore, he avoided practicing monotonously and playing lengthy repetitions of the same passage. Example 6.1 shows consistent changes in various positions for tenuto exercises.

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Example 6.1: Cortot, Exercise for four fingers with one finger held from *Rational Principles*, Exercise No 2a-b, p. 11

The exercises are designed to hold down the thumb and second finger. Cortot composed five different drills for “one note held”, from holding down the thumb to holding down the fifth finger. Each exercise has various figurations of the consistently changing sixteenth notes. According to Cortot, “The use of the held finger reduces any participation of the hand to a minimum in tone production, and while loosening the active fingers, favours their individual attack.”\(^{202}\) He suggests playing the sixteenth notes interchangeably in legato and staccato as well as using the “Transferable table” at the end of his book to play with different formations to have the best effect.\(^{203}\) This exercise can be used to build independence and intensity of the fingers in playing single melodies. However, when students face more than one note, such as double-note technique in the repertoire, more

\(^{202}\) Cortot, 11.
\(^{203}\) Ibid., 12.
complicated exercises are needed to build the necessary finger control. Since tenuto exercises may create tension on the active fingers while playing free notes as well as tied fingers while pressing the key down, teachers should introduce these exercises slowly and gradually. Cortot provides preparative work for students to reduce stress on the fingers and to allow the pianist to become accustomed to tenuto exercises, especially for double notes, in stages. He maintained that the double notes should be played by the “perfectly simultaneous attack of the fingers executing the various successions of intervals.”\footnote{Ibid., 37.}

Example 6.2 is an example of an exercise for practicing synchronized touch of the chords by extending intervals.
Example 6.2. Cortot, Tenuto exercise for double notes from *Rational Principles*, Exercise No 1a-d, p. 38

Cortot provides a teaching guide for Example 6.2:

Place the fingers on the keys without pressing them down—then play each interval in succession, taking care not to alter the position of the silent fingers. On the fourth beat of each bar let the finger or fingers brought into action on the first beat, regain contact with their keys. These fingers will once more become silent at the next bar, the finger or fingers which continue in action, remaining suspended above their keys and in readiness to strike them.205

Practicing Example 6.2 helps students to build independence of the fingers and simultaneously to focus on tone projection. This exercise is more helpful than Tausig/Ehrlich’s tenuto exercises, which do not offer preparatory work for rendering the

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205 Cortot, 38.
fingers ready for double-note exercises. In addition, Cortot encourages students to practice the different figurations by modifying the rhythms as given in the “Transferable Table.” Once students have had enough experience practicing tenuto exercises by working on Example 6.2, teachers can lead students on to more complicated exercises, such as that shown in Example 6.3.

Example 6.3: Cortot, Tenuto exercise for double notes from *Rational Principles*, Exercise No 2, p. 39

Cortot highlights relaxation and loosening of the hands by having students play with different patterns and fingering of free notes in order to avoid tightness.\(^{206}\) He does not focus on the same intervals, but rather, composes different intervals of chords in one exercise, so that students can practice several double notes in one session while adjusting the muscles of the fingers. He maintained that a relaxed repositioning of the hand is necessary in order for students to avoid overuse injury due to repetition in a static position. The idea of playing repetitive patterns with similar hand shapes, as exemplified by Cortot, is supported by Wristen’s article, which deals with injury prevention. “Static finger or hand positions will likely lead to undue tension and inefficient motion; therefore, a variety of positions should be employed. It has been suggested that increased carpal tunnel pressure (CTP) plays a role in the development of carpal tunnel syndrome, and possibly in finger

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\(^{206}\) Ibid., 37.
flexor tenosynovitis as well."\textsuperscript{207} This is powerful medical evidence that Cortot’s admonition about renewing hand position was ahead of its time and extremely valuable advice. Cortot’s effort to avoid undesirable tension by varying patterns or using different fingering is supported by Hoppmann and Patrone’s article. The article shows the importance of evading repetition with a static position of the fingers in a long session. According to Hoppmann and Patrone, “When evaluating technique, it is important to consider both dynamic and static loads on the musculoskeletal system. Static load is continuous muscle contraction and stress across a joint and its supporting structures.”\textsuperscript{208} Static loading may be harmful to pianists’ muscles “such as the shoulder and hand for considerable periods of time. This results in static loading to these muscles and joints which can lead to problems.”\textsuperscript{209} In addition the article refers to the risk of creating tension on the fingers by excessive repetition.

Dynamic load refers to the stress to joints and supporting structures resulting from movement, especially high-frequency, forceful movements. Musicians’ movements are not typically of great force, but high-frequency, repetitive movements are the rule while performing. Dynamic load can be reduced by more efficient movements and reducing unnecessary muscle tension.\textsuperscript{210}

In contrast, Tausig/Ehrlich’s exercises are more focused on developing strength in each finger. He believed that if students quickly understand the pattern in each exercise, they can focus on specific finger movements and achieve the goal set by each study.

\begin{footnotesize}
\begin{enumerate}
\item \textsuperscript{207} Wristen, 56.
\item \textsuperscript{209} Ibid., 77.
\item \textsuperscript{210} Ibid., 77-8.
\end{enumerate}
\end{footnotesize}
Example 6.4 consists completely of repetition of the same pattern. According to Tausig/Ehrlich, “the finger which has the quarter-note should be raised, not at the 4th sixteenth note, but after it.”\textsuperscript{211} It is difficult at first to fully press down on the held notes while completing each group of sixteenth notes. Therefore, Tausig/Ehrlich suggest playing in a slow tempo. However, each finger should be played “with heavy stroke on each tone.”\textsuperscript{212} Moreover, every note should be played “distinctly”\textsuperscript{213} in order to be heard. Even though the patterns of the Tausig/Ehrlich exercises are stationary, they provide transpositions similar to those of Cortot, so students can have the opportunity to play with a different fingering depending on the key. Ehrlich states that Tausig considered transposition to be one of the primary elements of his method, and suggests starting with the most

\textsuperscript{211} Tausig, 9.
\textsuperscript{212} Ibid., 9.
\textsuperscript{213} Ibid., 9.
demanding keys every day. This signifies that Tausig wanted students to have command of most of the demanding techniques without difficulty. Giulio Draghi discusses Tausig’s style of pianism and transposition method. “Tausig was one of the first pedagogues to advocate the transposition of the same section in different keys in order to make it more difficult, and once mastered, much easier when [going] back to the original key.”

Ehrlich recommends practicing exercises in four different keys every day, since changing keys for every exercise would be challenging; thus he begins with C major instead of the most difficult key. However, the Tausig/Ehrlich’s exercises are composed using the same pattern and direction, so something more than transposition would be required in order to lessen the tension resulting from a static position. Additional variations could include such things as alternating dynamics, playing in either legato or staccato, and changing rhythms.

Before moving on to their double-note tenuto exercises, Tausig/Ehrlich recommend preceding them with exercises from Clementi’s *Gradus ad Parnassum* and Czerny’s passages of thirds. Ehrlich recommends practicing both Clementi and Czerny’s double-note exercises for strengthening the fingers, but Tausig/Ehrlich’s exercises are more feasible for all but the most students than are the exercises of Clementi and Czerny. This is one of the differences between Tausig/Ehrlich and Cortot, who composes preparatory warm-up in stages for students when they face the more intense tenuto exercises, including those for

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214 Ehrlich, 32.
217 Ehrlich, 32.
218 Ibid., 47.
double notes.

Examples 6.5 and 6.6 are double-note exercises from Tausig/Ehrlich’s method for practicing independence of the fingers.

Example 6.5: Tausig/Ehrlich, Tenuto exercise for double notes from *Daily Studies* Book II, No. 23, p. 47

Tausig/Ehrlich state that Example 6.5 should be played “with a powerful stroke”\(^{219}\) and the tenuto notes must be held until the very last end the sixteenth note. Students can extend the trill motion to make the exercise more challenging. Once students build up an intensity of fingers by holding down their fifth finger, the following exercise offers regulation of the fingers while holding down the thumb. The repetition of the same pattern can be seen in Example 6.6.

\(^{219}\) Tausig, 47.
Example 6.6: Tausig/Ehrlich, Tenuto exercise for double notes from *Daily Studies* Book II, No. 24, p. 48

Tausig/Ehrlich describe this exercise as one that requires the pianist to create legato as much as possible on every two third-chords of a series of sixteenth-note chords. According to Tausig/Ehrlich, “The player must endeavor to bring over the 3rd and 5th fingers to the keys in such manner that they may glide rather than jump.”220 The main goal of this exercise is to build strength of the fingers when the arm remains in a fixed position with a strong touch.221

Tenuto exercises from both authors provide different ideas about relaxation and steadfastness. As to whether either method can help students’ technique without creating physical disorders, teachers today have access to medical reports that discuss in detail the development of piano-related injuries and it is recommended that they consult these often. One of the notable medical articles, by Parlitz et al., supports the importance of relaxation for preventing pianists from experiencing bodily distress.222 In this study, various levels of

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220 Tausig, 48.
221 Ibid.
tenuto exercises were played by two groups of pianists: amateurs and professionals. The study analyzed the dynamic force measurements of participants’ touch, pulse, and duration on the key while playing the tenuto exercises in order to determine “characteristic differences in force-economy due to instrumental expertise.” To measure the dynamic force system, a special sensed-foil that could record key pressure while pianists were touching the keys was connected to the piano and collected information from professionals (who had been practicing daily for more than 15 years) and amateurs. The shape of the tenuto exercises was similar to those of Cortot and Tausig/Ehrlich, such as holding the thumb and index finger together, and adding the middle and fourth fingers. Parlitz et al.’s study proves that once the hammer strikes the string, every attempt to change after the initial attack is fruitless. The study shows that relaxing after the key is down is the most important way to avoid excessive tension on the fingers; and if students expend too much energy in holding both active and inactive fingers, that would cause cramping:

the expert player relaxes his playing fingers immediately after each touch; the amateur remains much longer in a state of tension. Moreover, the forces of the expert’s non-playing fingers remain below the resolution of our measurement tool (< 2 N), while the amateur shows an enormous expenditure of forces in the first and second finger.

This finding supports Cortot’s relaxation method for his exercises. Parlitz et al. also demonstrate the reason of having tension in the fingers while practicing tenuto exercises. According to the study, “due to the counterproductive attempt to compensate for the

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223 Ibid., 1063.
224 Ibid., 1063–64.
225 Ibid., 1065.
226 Ibid., 1066.
difficulty by stabilization of the hand with the ‘tied fingers.’ Additionally, an increasing
general tenseness might be caused by the higher coordinate demands."\textsuperscript{227} One of the other
interesting results from this study is that most of the amateur pianists did not recognize how
much tension and force they were using in their fingers.\textsuperscript{228} Based on this article, teachers
should be particularly vigilant when their students are practicing either Cortot or
Tausig/Ehrlich’s tenuto exercises.

Cortot devises diverse manners for practicing his exercises, such as a “different key
each day, contrasting the degrees of rapidity and the dynamics, [and] the fingers playing
alternately legato and staccato.”\textsuperscript{229} In addition to physical health, practicing in different
manners should increase the effect of learning. According to Kageyama one should, “rather
than practicing a passage in only one specific, rigid, and unvarying way, practice a wider
range of possibilities that you might incorporate on stage—different nuances of shaping,
articulation, pacing, dynamics, tempo, color etc.”\textsuperscript{230} Cortot suggests to build evenness of
the fingers by avoiding motionless tension and patterns. Cortot offers exercises for building
steadiness and freedom of the fingers. This is done by focusing on controlling tension and
relaxation between the fingers by practicing repetition of the notes. Example 6.7 could be
extended by adding a number of the same notes for developing evenness of tone projection
by regulation of the fingers, a prerequisite for trill exercises.

\textsuperscript{227} Ibid., 1067.
\textsuperscript{228} Ibid., 1067.
\textsuperscript{229} Cortot, 14.
Example 6.7: Cortot, Evenness and independence of the fingers from *Rational Principles*, p. 15

Cortot considers tension on the fingers undesirable while repeating notes. According to him, “the fingers not in action are absolutely relaxed, all the effort being centered on the finger in action.”\(^{231}\) He provides several configurations with different fingerings in order to develop the individual strength and independence of all fingers.

Example 6.8: Cortot, Evenness and independence of the fingers from *Rational Principles*, Exercise No 6\(^{a-d}\), p. 19.

\(^{231}\) Cortot, 15.
While practicing with different fingerings, students should listen to the sound quality and adjust the strength they use for certain fingers which may have less muscle strength. One of the features of Cortot’s method is that he designs his exercises in levels of difficulty, going “step by step.” After building the suppleness of the fingers, students can go on to play more intense exercises such as trill exercises. Once students have become accustomed to the idea of relaxation through Example 6.7, they then have a foundation for Example 6.9, which deals with attaining a better understanding of trill motion by keeping the fingers light.

Example 6.9: Cortot, Developed exercise for building evenness and independence from Rational Principles, Exercise No 7a, p. 19

Example 6.9 cannot be played with stiff or tight fingers. This exercise works on relaxation of the hands by shaking the fingers.

As a next step, Cortot gives trill exercises for every finger. One of the prominent characteristics of Cortot’s method is that he writes all the possibilities of different formations in his exercises, either by giving different fingerings or by varying the design of the exercises.
Cortot argues that tenuto exercises for independence of the fingers must be played without lengthening the practice session. By playing a variety of his finger exercises, students can develop their technique with less discomfort.

In contrast, Tausig/Ehrlich emphasize the strong touch of each finger in order to build their independence, as in Example 6.11.

Example 6.11 has a similar design to that of Cortot’s exercise shown in Example 6.7. There is repetition of two notes with the same fingering. Cortot makes changes by adding notes to
the two-note grouping, whereas Tausig/Ehrlich adds accidentals to require the pianist to adjust the fingers to different keys. However, Tausig/Ehrlich’s method differs strikingly from Cortot’s method. According to Tausig/Ehrlich, Example 6.11 should be played several times while “each finger should be raised as high as possible, and then fall on the key with full force, and with the fleshy tip. The wrist must be held motionless, almost rigid, upper arm and elbow close to the body.”233 Whereas Cortot underscores releasing undesirable tension in the hands and fingers, Tausig/Ehrlich propose a firm posture of the hands and a secure touch of the fingers.

Another example that has a comparable design to Cortot is shown in Example 6.12. This exercise requires the same note to be played with different fingerings.


Both Examples 6.12 and 6.8 deal with evenness and solid touch of the fingers. However, Tausig/Ehrlich require strict positions and ways to build finger strength while playing this exercise. According to the authors, “The 4th, 3d, and 2d fingers should, being kept perfectly rigid and half-bent, glide one after the other, thus holding the key as firmly as possible; let the fingers fall powerfully on the fleshy tip; keep the arms perfectly quiet.”234 Unlike Cortot, Tausig/Ehrlich have a trill exercise, without preparatory steps, for holding

233 Tausig, 5.
234 Ibid., 7.
notes in order to build independence of the fingers.

Example 6.13: Tausig/Ehrlich, Trill exercise with tenuto notes from *Daily Studies*, Book II, No. 18, p. 44

![Example 6.13: Tausig/Ehrlich, Trill exercise with tenuto notes from *Daily Studies*, Book II, No. 18, p. 44](image)

Tausig/Ehrlich suggest repeating this exercise a total of twenty to thirty times; subsequently, when students move to the next position, the hand and wrist should maintain the same shape. The practice time and tempo chosen for this exercise depends on the strength of the student’s fingers.\(^{235}\) When a student first attempts this exercise, Tausig/Ehrlich recommend playing slowly, but with a powerful tone.\(^{236}\)

Both the problem of striking the notes with the fourth and the fifth fingers and the posture of the body and the hands are described earlier in Chapter 4. The medical standpoint, especially from Wolf et al., is that the fingers which have smaller digits and joints, especially the fourth and the fifth fingers, are exposed to greater contact pressure than those fingers that have a wide fingertip area.\(^{237}\) Therefore, striking the key with the weak fingers without help from the wrist and with the arms held motionless may create pain.

Some articles argue that one of the reasons for the method of forcing the fingers

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\(^{235}\) Tausig, 44.

\(^{236}\) Ibid., 47.

\(^{237}\) Wolf, et al., 95.
stems from the history of the piano and its performance. According to Harman, “around the turn of the nineteenth century, many teachers still advocated what had become known as the ‘finger school’ of playing, emphasizing use of the fingers only and extensive technical practice.”

Lee mentions the necessity of different types of finger technique being developed in accordance with the development of the piano itself: wrist and body movement are needed to overcome the deeper tension, weight, and action of the piano mechanism. Sakai maintains that piano-related injury among pianists already appeared in medical reports in the nineteenth century, coinciding with changes to the modern piano. Sakai also asserts that some exercises would impact certain fingers; for example, the fourth and fifth fingers may be “hyperabducted in order to strike the keys with each fingertip” and this could be a factor of physical pain. In addition, Sakai underscores that great tension on the fingers, especially on the thumb and the fingers with small fingertips, will give rise to wrist pain and other serious pains, such as de Quervain’s syndrome which has been linked to the technique of striking the keys, since the fingers and wrist absorb the strong impact of the key response. Striking the keys with excessive extension of the fingers affects tightness on the fourth and fifth PIP joints; thus teachers should oversee inappropriate postures of the fingers while their students are playing Cortot and

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241 Ibid., 180.
242 Ibid.
243 Ibid.
Tausig/Ehrlich’s exercises.

Sakai discusses movement of the fingers in general. He advises that pianists extend the joint of MCP for preparation, and bend the MCP joint when pressing the key down, all the while shaping every finger into an arch posture.244 This advice means that teachers should pay particular attention to their students if they are using Tausig/Ehrlich’s method. The Tausig/Ehrlich’s exercises that are discussed in this chapter are designed for accentuating each finger stroke while regulating the upper arm and maintain quiet wrists. This technique may create a risk of piano-related injury due to tension in the hands and fingers.

Even though both authors make use of transposition as a means of varying their exercises, Tausig/Ehrlich keep their free notes moving always in the same direction so that the notes remain with a static finger and hand posture. In contrast, Cortot’s exercises stress relaxation and reduction of tension as much as possible by devising varying patterns and directions from the free notes. In addition, Cortot advises that exercises should not be repeated for long periods of time during a practice session. His preparation exercises can be beneficial for students as warm ups before moving on to the actual exercises. This gives them the opportunity to prepare their fingers and hands for more developed tenuto exercises.

6.2 Stretching Exercises

Stretching is one of the most important techniques for developing piano technique. Cortot maintains that the development of the keyboard instruments from the harpsichord to the pianoforte during the eighteenth century and the new repertoire containing wider chords,

244 Ibid.
leaps, and intervals required pianists to develop the technique of extension between the fingers.\textsuperscript{245} When students have to stretch between the fingers to play intervals that require deviation from a comfortable position, physical discomfort in the hands may lead to pain, especially for students who have small hands.

The article “Hand Pain Related to Keyboard Techniques in Pianists” (1992) by Sakai reports clinical documents related to studying the medical claims of patients who experienced overuse injury.\textsuperscript{246} The study was conducted by taking a survey among the patients in order to determine pain in their hands and forearms in relation to certain piano techniques including “wide extended passage.”\textsuperscript{247} One of the cases concerned a student who was having trouble with the wrist from repeating the extension technique.\textsuperscript{248} Stretching the fingers excessively may create a lot of stiffness in the hands due to “both ulnar tilting of the wrist joint and abduction of the extended thumb.”\textsuperscript{249} This study illustrates the peril of stretching exercises that have not been well thought out, especially for small-handed students. Sakai advocates for special consideration for small-handed pianists. His article makes a case for preventing overuse injuries that stem from wide positions of the hands. Education in this area is critical in order for pianists to avoid pain.

Both Cortot and Tausing/Ehrlich consider the limitation of the physique of students, such as the size of the fingers and the hand span. The two authors offer similar exercises written with two different fingerings according to the hand size. Cortot believes that

\textsuperscript{245} Cortot, 60.
\textsuperscript{246} Sakai, “Hand Pain Related to Keyboard Techniques in Pianists,”63–65.
\textsuperscript{247} Ibid., 63.
\textsuperscript{248} Ibid., 63.
\textsuperscript{249} Ibid., 64.
teachers should consider the size and shape of their students’ hands and guide them differently accordingly. Tausig/Ehrlich also provide extension exercises with fingerings adjusted to take into consideration different hand sizes. Cortot presents varying versions of the same exercise, as shown in Ex. 6.14.

Example 6.14: Cortot, Stretching exercises for different hand size from *Rational Principles*, Exercise No 3, pp. 64-65

Cortot also provides practical suggestions to accompany his stretching exercises. “On the whole, it will be well to avoid extension exercises practiced with a motionless hand, during which the fingers are cramped on the key-board in an abnormal position. They are nearly always fatal to muscular suppleness and often provoke serious accidents.” Cortot asks students to relax their finger muscles through lateral movements of the hands on the keys; he also states that the wrist should be placed somewhat higher than normal.

Tausig/Ehrlich also provides exercises for different hand sizes but with double notes. Double-note exercises are recommended for students who already have a certain

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250 Cortot, 60.
251 Ibid., 60.
252 Ibid., 65.
degree of skill and may want to develop additional stretching techniques. However, teachers should be alert for students reporting pain and fatigue when practicing.\textsuperscript{253}

Example 6.15: Tausig/Ehrlich, Stretching exercise from \textit{Daily Studies}, Book II, No. 28 (for small hands), p. 50

Exercises 6.14 to 6.16 are meant to develop the stretch between the second and third fingers. Tausig/Ehrlich advise students to play with bent fingers and always to be careful to avoid physical discomfort while executing the exercises.\textsuperscript{254} The authors explain that the technique of holding the adjacent fingers may be difficult for small-handed students, but practical guides are given in Example 6.15, recommending to “only let the player practise it

\textsuperscript{253} Tausig, 50.

\textsuperscript{254} Ibid., 50.
with moderation and leisurely, carefully avoiding all excessive fatigue.” Example 6.16 includes both stretching exercises and also double-note exercises on chromatic scales for students who have large hands with enough strength and endurance. For maximum benefit from Example 6.16, students have to play with “the greatest distinctness combined with a perfect legato” and “without risk of incurring excessive fatigue.” Although there are some students who have enough ability to practice Tausig/Ehrlich’s stretching exercises, teachers need to supervise carefully in order that the students do not experience cramping. Repetition of such strenuous exercises may be one of the risk factors of overuse injury especially with students who have less endurance.

Nora Shields and Sara Dockrell conducted a survey of piano students at music schools in Ireland to investigate the relationship between the incidence of physical pain and certain piano techniques. The study reports that students who were practicing the piano literature that include techniques of octaves, fast tempo, and producing a bigger sound experienced tightness, pain, and soreness in their wrists, fingers, and upper body. According to Shields et al., “Seventy-three percent of the respondents reported that they experienced pain when playing at least one of these techniques or another that they specified.” This study cites Brandfonbrener’s article in connection with possible factors of physical discomfort, such as “a rapid change in the quantity and quality of playing

255 Ibid.
256 Ibid.
257 Ibid., 258 Ibid.
260 Ibid., 157.
261 Ibid., 159.
without gradual conditioning.”262 According to Brandfonbrener, the reason for “warming up is that warm muscles contract more effectively than cold muscles, and that active muscles are warmer than inactive ones.”263 This supports Cortot’s method of warming up exercises to prepare the extension exercises followed by gradual steps.

Cortot recommends teachers guide their students carefully watching that they not play to exhaustion in inappropriate positions such as with stationary hands and wrists or with exaggerated articulations.264 According to Cortot, “the width of stretch between the fingers should therefore only be practiced progressively, without condemning the player to the useless torture of holding down the keys, and with a care for the constant suppleness of hand and wrist.”265 Example 6.17 offers a moderate exercise for stretching between the fingers.

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263 Brandfonbrener, “Epidemiology” 66.
264 Cortot, 60–61.
265 Ibid., 61.
Example 6.17: Cortot, Progressive stretching of the fingers from *Rational Principles*, Exercise No 1ª, p. 61

Fingerings for this exercise are marked with arrows that show the range of notes that students can reach. For example, students can practice stretching between the fourth and fifth fingers on the right hand by following the direction at the top of Example 6.17. The arrow between the fourth and fifth fingers shows that these fingers can be played from C to Ab. This exercise progresses from the smallest interval to the largest so that students can become accustomed to stretching gradually. Cortot gives a practical guide for playing extension technique without distress:

> In cases of difficulty in the execution of the widest extension, accompany the movement of the fingers with a lateral rocking of the hand. Which will facilitate the attack on each note. As far as is possible, avoid letting the attack fall on the side of the keys.²⁶⁶

In addition, Cortot argues that playing an extension with legato is desirable, but holding

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²⁶⁶ Ibid., 61.
notes must be excluded.\textsuperscript{267} He gives tenuto exercises in the later parts of the extension chapter, with double-note exercises and exercises for substitutions of the fingers between the third, fourth, and fifth fingers. However, the double-note exercises are only for students who have long fingers, and the exercises for substitutions of the weak fingers are written in two versions which take into consideration the size of the hands. Cortot stresses that teachers need to check their students to see whether they are playing legato without having undesirable tension in their hands.\textsuperscript{268}

Example 6.18: Cortot, Legato method for stretching exercise from \textit{Rational Principles}, Exercise No 1\textsuperscript{b}, p. 61

Cortot emphasizes relaxing the fingers while playing more developed extensions. Example 6.19 offers various intervals for both short fingers and long fingers.

\textsuperscript{267} Ibid., 61.
\textsuperscript{268} Ibid., 65.
Example 6.19: Cortot, Between 3rd and 4th long fingers from *Rational Principles*, Exercise No 2\textsuperscript{a}, p. 63

Example 6.20: Cortot, Between 3rd and 4th short fingers from *Rational Principles*, Exercise No 2\textsuperscript{b}, p. 64

Example 6.19 and 6.20 show two versions of the exercises with different intervals in accordance with the length of the fingers but with the same fingerings. What is unique about these exercises is that Cortot adds extra notes except for the targeted fingers, which are the third and fourth fingers in Example 6.19. According to Cortot, “the execution of notes extraneous to the strictly extensional formulae has the salutary effect of relaxing the muscles of the fingers which have been momentarily subjected to the effort of a stretch.”\textsuperscript{269}

Cortot underscores relaxation through wrist motion to help the fingers to stretch out. He also prefers the exercise to be practiced legato rather than tenuto.

In contrast, Tausig/Ehrlich suggest practicing stretching exercises with held notes in a firm position to foster individual strength of the fingers. Example 6.21 is for stretching

\textsuperscript{269} Cortot, 62.
exercises that emphasize individual finger attack.

Example 6.21: Ehrlich, Stretching exercise with tenuto from *Daily Studies*, Book I, No. 24, P. 12

This exercise was composed by Ehrlich. According to Ehrlich, “Tausig was primarily induced to confide to him a share in the work, and afterwards its entire elaboration, is very difficult, and many a stretch is impracticable for small hands if the half-note be held strictly.”^270^ The suggestion that the students project a “perfectly even execution of the thirty-second notes, which must be played loud and very *legato*”^271^ may be challenging. Unlike Cortot, Tausig/Ehrlich stress striking the keys firmly and this hinders the necessary release of tension in the hand. Example 6.22 represents one of the stretching exercises with controlled posture of the body.

^270^ Ehrlich, 34-35.

^271^ Ibid., 35.

Tausig/Ehrlich change the fingerings and notes in many ways, but the basic hand position of this exercise is questionable:

The elbows must lie close, so that in passing the fingers over or under the hand may retain its position unchanged. Even though the body should follow the motions of the fingers, the arms must remain firm in position.\(^{272}\)

A medical article by Eaton and Nolan\(^{273}\) investigated the risk factors of hand pain in pianists and its treatment. One of the examples which calls into question Tausig/Ehrlich’s method, is sustaining a fixed position of the hands while practicing the stretching exercises by the fingers, as in Example 6.22. The article observes that physical discomfort of the fingers and wrists are caused by repetition of the finger passing motion. According to the report, “the patient reports pain associated with thumb motion, localized on the radial side of the wrist…. Pianists often report severe pain with ‘thumb-under’ motions, where the

\(^{272}\) Tausig, 24.

thumb is flexed beneath the fingers to strike a key in sequence after the little finger.”  

Passing under the notes with the thumb may be harmful to certain tendons of the fingers—The abductor pollicis longus and extensor pollicis brevis.  

These tendons are connected to the thumb, wrist, and forearm, and allow the flexing movement of the thumb and the wrist. This motion may cause the “first dorsal compartment” of deQuervain’s disease.  

The report argues that the technique of crossing the thumb under the fingers may be one of the risk factors of deQuervain’s disorder; but when students are playing Example 6.22 with a static position of the hands while using the full force of the fingers without any relaxation, they are very likely to experience hand pain. Unlike Tausig/Ehrlich, Cortot suggests playing warm-ups from the smallest intervals to the largest intervals. In addition, he focuses on legato instead of holding notes, and suggests using the wrist help the fingers to stretch without tension.

Another difference between the two methods is exercises for practicing between the weak fingers, especially for the third, fourth, and fifth fingers. These adjacent fingers need to play carefully because of their smaller digits.

A medical article by Leijnse proposes how the muscles and flexors of the individual fingers are related to each other while playing the piano by the calculated forces for each position of the fingers and their force assumption while extending the fingers. The study defines muscle connection of the fingers by stretching motion. According to the study, when the

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274 Ibid., 216.  
275 Ibid., 216.  
276 Ibid., 216.  
277 Ibid., 216.  
fingers are stretching, two parts of muscle forces can be determined: “(a) forces required to execute the same movement with unconnected tendons, and (b) forces required to stretch the connection.”279 The study argues the importance of guiding students to be injury-free. The extension movement can impact other fingers that are not in connection with the activated fingers in stretching motion.280 In addition, fingers that are loading to expand need muscle of other fingers in order to counterbalance the coactivation forces, so the proper postures of the hands, wrist, and upper body are required to compensate for the force on the muscles of the straightening fingers.281 The study proves that when unloaded fingers move slightly, the fingers can stay relaxed; but when the stretching movement increases, the resting fingers tend to cramp by “the coactively pulled tendons and their antagonists.”282 Therefore, there would be motion for balancing tension between the fingers: “with large coactivations, motor forces in unloaded as well as loaded fingers can be much greater than in the unconnected system.”283 The results of this study show the possibility of overuse injury while practicing stretching exercises:

Even in single finger movements, motor forces must be controlled simultaneously in all connected fingers…. Even in unloaded finger movements muscles can be stressed to their maximum capacity by the stretching of intertendinous connections.284 Therefore, students have to relax their fingers as much as they can after loading a greater amount of extension or even during stretching the fingers. In addition, if the compensation

279 Ibid., 660.
280 Ibid., 660.
281 Ibid., 660.
282 Ibid., 661.
283 Ibid., 661.
284 Ibid., 663.
is not done, the excessive tension increases inflexibility in the arms and shoulders. The conclusion is that teachers should provide moderate exercises at the beginning of the stretching exercises, so that students can become used to relaxing their hands while stretching.

Cortot provides exercises with the smallest motions between the weak fingers; later, he offers exercises that have a variety of changes for promoting the strength and agility of the fingers. In addition, as in the other extension exercises, Cortot takes into consideration students who have different lengths of fingers, as in Example 6.23.

Example 6.23: Cortot, Extension between the weak fingers from *Rational Principles*, Exercise No 2, pp. 68–69

Example 6.23 increases intervals by repetition of the same notes, but changing the fingerings. This allows students to feel how their muscles depend on the location of the fingers and creates a natural movement of the wrists followed by the placement of the fingers.

Cortot developed exercises for the neighboring fingers with diverse rhythms.

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285 Ibid., 666.
Example 6.24: Cortot, Extension between adjoining fingers from *Rational Principles*,
Exercise No 3, p. 69

**EXERCISE No 3.** (extensions between adjacent fingers in chromatic motion.)

(long-fingered hands)

A.  

\[ \text{Musical notation} \]

(short-fingered hands)

B.  

\[ \text{Musical notation} \]

Rhythmic changes shown in Example 6.24, particularly in shorter note values, give an opportunity to relax the tension between the fingers, because they require agility and speed in moving to the next note. This encourages students to play with lightness and elasticity of the hands, and this lightness leads to performing the stretching exercises without static hand position or stiffness. In addition, Cortot gives an exercise for the widest intervals of the fingers.
Example 6.25: Cortot, Extension between the fingers in the thumb and the fifth from *Rational Principles*, Exercise No 4, p. 69

Example 6.25 above also can be practiced at various dynamic levels. The idea of practicing the same exercise in a variety of ways is supported by an article about staying injury-free by Wristen. According to her, “repetitive motion has been suggested as one of the factors that directly contribute to injuries, the pianist should attempt to use a variety of motions. Practice segments should be varied so that the pianist is not practicing the same physical motion (or by extension, the same musical passage) repeatedly.”

In contrast, Tausig/Ehrlich maintain a similar shape of the exercises with a strong stroke on each note between the adjacent fingers.

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286 Wristen, 62.
Example 6.26: Tausig/Ehrlich, Extension exercise from *Daily Studies*, Book I, No. 33, p. 28

The design in Example 6.26 is formed by extending the thumb and fifth finger. In order to have the best effect from this exercise, students should play legato with a loud tone between the thumb and fifth fingers.\(^{287}\) Ehrlich also provides a reversed exercise for extending between the thumb, fourth, and fifth fingers by playing in the opposite direction from Example 6.26. This suggests fingerings for the right hand above the notes and for the left hand below the notes.

Example 6.27: Ehrlich, A reversed exercise example of Example 6.26 from *How to Practise*, p. 37

Tausig/Ehrlich offer stretching exercises between the third, fourth, and fifth fingers which involve holding the thumb.

Example 6.28: Tausig/Ehrlich, Extension exercises from *Daily Studies*, Book I, No. 35, p. 28

\(^{287}\) Ehrlich, 37.
Example 6.28 promotes strength between the weak fingers. This exercise should be played with a motionless hand and “the right and the left hand hold firmly the notes struck by the thumb and followed by the skip of a seventh, with a view to perfect legato.”

Tausig/Ehrlich’s method is to foster the fingers’ strength while stretching between the fingers rather than practicing suppleness between the adjacent fingers as in Cortot’s method. However, the idea of striking every note “‘pounding’ on the thumb, using a static hand position with continual extension of the hand/fingers,” may risk injury.

Poore concluded that the greatest risk of incurring piano-related injury is “prolonged strain upon the muscles.” The most important technique for pianists to avoid cramping is to play with a motion between intervals:

The very essence of piano-playing, as of all musical performances, is rhythm, and rhythm in movement means that in the muscles producing the movement, periods of contraction alternate with periods of relaxation with regular intervals, and therefore break-down from fatigue is scarcely more liable to occur than in the heart itself, the untiring prototype of rhythmic movement.

Cortot also emphasizes that relaxing the hands and wrists can be considered the best method for stretching to larger intervals. However, Tausig/Ehrlich underline sustaining a firm posture of the hands and the body in order to achieve the strong sound quality needed for training each finger. The problem of maintaining this posture is written about in Poore’s

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288 Tausig, 28.
289 Wristen, 62.
290 Poore., 442.
291 Ibid.
report, which proposes that practicing with a fixed position of the hands may give rise to muscle cramping. According to Poore, “in this method of holding the hand there is considerable strain thrown upon the extensors of the wrist and the extensors of the near phalanges.” Holding the hand might allow the fingers to stay in the fingertip position accurately, so that the fingers can address the keyboard with a precise touch. However, it may not be an effective method for stretching exercises because of the feature of the extension motion. In order to reach many wide intervals, pianists need to spread their fingers out. For those with smaller hands, Tausig/Ehrlich’s requirement of keeping the hands motionless could lead to pain in the wrists and the hands.

There are a number of cases of piano-related injuries stemming from a fixed hand position, but the basic idea is as follows: many pianists complain about stiffening of the hands due to a posture that requires tension in the wrist and fingers. When patients try to keep their hands rigid, they feel pain, tremors, and tension in the muscles of the arm through “the involvement of the extensor muscles or the musclo-spiral nerve.” In addition, if students play the stretching exercises while holding the elbow and wrist taut, the nerves of the fingers can be stressed by tension that hinders the movement of the hands. Teachers need to be aware of the vulnerability of hands held immobile while stretching. Sakai argues that static wrist joints held motionless can be a risk factor along with “abduction of the thumb and little finger.”

In order to prevent injury from over-practicing the wider extension exercises,

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292 Ibid., 442.
293 Ibid.
294 Sakai, 65.
teachers should instruct students to remove tension in the thumb, fourth, and fifth fingers as much as possible, which will help to avoid stressing the tendons and muscles of the weak fingers.\textsuperscript{295} A practical guide for extension techniques such as arpeggios and broken chords by Wristen shows how the wrist, upper arm, forearm, and elbow movements need to be well balanced to help the hands and fingers. For example, the technique for broken chords is given in detail in order to explain how the motion of the body works to help the fingers to extend.

Wristen describes how the upper arm should modify a direction according to the locations of the black keys and suggests a direction for the forearm.\textsuperscript{296} The elbow should remain relaxed and the wrist should have horizontal alternating movements.\textsuperscript{297} When the thumb is used, the wrist moves outward to the fifth finger or the adjacent fingers. This is complemented by a hand motion that is generated by a smooth circular wrist movement.\textsuperscript{298} In conclusion, extension of the fingers may be followed by the risk of overuse injury when they are stretched to the extreme by playing held notes without relaxation. The same is true for hands held in a static position while requiring the fingers play at full force and volume. It is critical that students are taught effective methods of relaxing both the arms and wrists in order to practice stretching exercises effectively.

\textsuperscript{295} Ibid., 65.
\textsuperscript{296} Wristen, 59.
\textsuperscript{297} Ibid.
\textsuperscript{298} Ibid.
It is critical that pianists be aware of the importance of the role of the thumb as an important factor in avoiding injury of the wrist such as De Quervain syndrome or carpal tunnel syndrome.

Lederman studied the factors involved in piano-related injury by reviewing musicians who sought medical advice. This study illustrates that flawed technique with strong tension in the fingers specifically in the thumb tends to compress the nerves of the fingers or entrap the median nerve of the fingers, leading pianists to have chronic disease in their hands and wrists that can hinder their musical career. Lederman sees the chronic compression neuropathy of the hand as resulting from giving persistent and extreme tension to the nerve fibers of the fingers. The nerves of the fingers are interconnecting and affect the periphery of other fingers; so if all or any of the interconnected nervous system of the fingers is damaged, “injury to the axon causes degeneration of that portion of the fiber distal to the site of injury and sometimes proximally as far as the nerve cell.” The deterioration of the nervous system of the fingers gets in the way of healing or the rehabilitation of the injured finger tendon. Loss of the nerve fiber may bring about chronic

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300 Ibid., 185–190.
301 Ibid., 185.
302 Ibid.
disorders such as ‘weakness or sensory loss’ with ‘numbness, tingling, burning, or ‘pins and needles.’’ These symptoms are generally defined as carpal tunnel syndrome, which generally occurs in the wrist. The study reports patients who have had pain in their wrists and problems of the flexor of the thumb caused by carpal tunnel syndrome:

The carpal tunnel is formed by the arcade of wrist bones dorsally and laterally, with a firm ligament, the flexor retinaculum, forming the roof ventrally. The median nerve, which passes through the carpal tunnel, is subject to entrapment by the surrounding flexor tendons (particularly in the presence of an inflammation) and by the overlying ligament, especially when it is swollen or thickened.

Carpal tunnel syndrome has a strong relationship to specific finger movement, such as repetition that produces a bigger sound with full strikes. According to Lederman, “clinically, in performing artists and others, the typical features include pain and paresthesia, usually limited to the thumb, index and middle fingers, and the radial half of the ring finger, although many patients cannot differentiate and describe tingling in all of the fingers.”

In addition, entrapment of the median nerve worsens the pain of the fingers including the thumb. In addition, carpal tunnel syndrome, “tennis elbow,” and “deQuervain’s tenosynovitis” are possible conditions that pianists may develop from serious misuse or overuse of the wrist with “flexion and extension.”

Most of the technical aspects related to the wrist in Cortot and Tausig/Ehrlich include octaves, chords, broken chords, and crossing under the notes. These techniques

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303 Ibid.
304 Ibid.
305 Ibid., 188.
306 Ibid., 189.
307 Ibid., 190.
308 Hoppmann, et al., 83.
309 Ibid.
310 Ibid.
require wide stretching of the hands and the thumb, so teachers should be aware of the proper movement of the thumb, since extensive thumb motion impacts the deviation of the wrist which tends to bring overuse injury.\textsuperscript{311} Mobility of the thumb is considered to be a crucial element of piano technique not only from a physical point of view but also in accordance with the development of the piano literature. Cortot insists on the importance of the thumb by describing the history of performance style related to fingering. The major difference is between the technique of the harpsichord and that of the pianoforte.\textsuperscript{312} During the seventeenth century, use of the thumb was considered undesirable, because of the limited keyboard range and the style of the music, which could generally be played with four fingers.\textsuperscript{313} Musicians in the time of Purcell and Couperin would cross the second and the third fingers instead of passing under the thumb.\textsuperscript{314} As keyboard instruments developed, the keys became wider.\textsuperscript{315} The use of the thumb can already be seen in Johann Sebastian Bach’s preludes and fugues and of course in numerous works of piano literature since that time.\textsuperscript{316} Cortot observes that Clementi provided a practical guide to using the thumb while playing the scales in \textit{Gradus ad Parnassum}, thus making it possible now for all fingers and the thumb to play every key on the keyboard.\textsuperscript{317}

Cortot maintains that the interactive motion of the thumb and wrist is the most effective way to enhance piano technique. He provides exercises for the mobility of the thumb with a variety of chord formations and fingerings and wrist movements divided into

\footnotesize
\begin{enumerate}
\item \textsuperscript{311} Ibid.
\item \textsuperscript{312} Cortot, 23.
\item \textsuperscript{313} Hoppmann, et al., 83.
\item \textsuperscript{314} Cortot, 23.
\item \textsuperscript{315} Ibid.
\item \textsuperscript{316} Ibid.
\item \textsuperscript{317} Ibid.
\end{enumerate}
vertical, horizontal, and mixed motion. These are all excellent preparation for students to become conscious of the muscles in the thumb. Every exercise for the wrist comes with levels of difficulty and with careful practice guides. Cortot suggests practicing the lateral motion of the thumb with held notes. Examples 7.1 allow students to feel the muscle movement of the thumb by sustaining the held note.

Even though tenuto exercise is mentioned as one of the risk factors in an earlier chapter, Cortot does not make any comments about how playing the tenuto notes can lead students to tension or soreness. However, holding notes with a stable hand gives more opportunity to experience the mobility of the thumb than without holding notes.

Example 7.1: Cortot, Movement of the thumb from *Rational Principles*, Exercise No 1b, p. 24

In addition, Cortot provides warm-up exercises for preparing to pass under the notes in scales and arpeggios. Moreover, he offers ideal postures of the fingers for playing scales and arpeggios by writing both “mute” notes for the non-active fingers and actual notes for the active fingers.
Example 7.2: Cortot, Preparatory work for scales from *Rational Principles*, p. 25

Example 7.3: Cortot, Preparatory work for arpeggios from *Rational Principles*, Exercise No 6, p. 27

Example 7.3 needs the wrist to be somewhat more bent than for scales. The curved wrist can help the fingers extend toward the next notes for better preparation.\(^{318}\)

After practicing the warm-up exercises, students can go on to more complicated exercises. Cortot gives exercises for scales in both hands with detailed instructions.

\(^{318}\) Cortot, 27.
Example 7.4: Cortot, Mobility of the thumb in Scale from *Rational Principles*, Exercise No 1a, p. 26

Cortot posits that the best effect of Example 7.4 stems from playing with a “rapid lateral displacement of the hand.” Considering the motion of the hands required for this exercise, Cortot recommends reducing unnecessary tension in the hand:

Slide the thumb very close to the key-board, approaching the note it will have to strike, as soon as possible. Reduce all participation of the hand in this movement, to a minimum, which will be facilitated by a slight flexion of the wrist.

One of Cortot’s representative methods is a relaxation technique that can be practiced by doing the exercises in different configurations. As in the preceding exercises, he underscores that excessive tension must be avoided in the hands. In addition, he gives a number of fingerings that may apply to the physical conditions of most students.

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319 Cortot, 26.
320 Ibid.
Cortot maintains that the goal of playing with different fingerings is to prevent tension in
the thumb from repetitive motion.\textsuperscript{321} There is some risk of cramping because of stretching
to wider intervals, so relaxing the hands should be considered fundamental.\textsuperscript{322} In addition,
Cortot provides many examples of passing the thumb under notes in various figures that
can also be seen in piano literature. Mastering these exercises should help students to have
the confidence to play repertoire with which they may previously have been uncomfortable.

Tausig/Ehrlich have similar ideas to Cortot’s method and provide diverse examples
of exercises for students to train the mobility of the thumb, although the goal of their
exercises is different from Cortot’s.

\footnotesize{\textsuperscript{321} Ibid., 30.}  
\footnotesize{\textsuperscript{322} Ibid.}
Example 7.6: Tausig/Ehrlich, Mobility of the thumb for scale from *Daily Studies*, Book I, No. 25, p. 14

Example 7.7: Tausig/Ehrlich, Mobility of the thumb for broken chords from *Daily Studies*, Book I, No. 26, p. 21

The main purpose of Example 7.6 is to build finger strength by holding notes and creating a distinct touch. According to Tausig/Ehrlich, “when the thumb passes under or is passed over, the key previously struck is to be held by the respective finger.”\(^{323}\) Holding down the fingers in an exercise creates more stress on the fingers than not holding them. This tends to develop tension in the muscles of the hand which is a risk factor for piano-related injury such as deQuervain’s tenosynovitis. According to Hoppmann and Patrone, “in pianists, a clue to the diagnosis is a history of pain with ‘cross–over’ movements of the thumb under the fifth finger to play the next note.”\(^{324}\) Playing silently legato with the second and fourth fingers is the most important instruction for Example 7.7.\(^{325}\) but there is no comment about the wrist motion.

Cortot asserts that considerable wrist movement is necessary in order to produce a

\(^{323}\) Tausig, 14.
\(^{324}\) Hoppmann et al., 83–84.
\(^{325}\) Tausig, 21.
clear and even tone quality which is the most crucial element for playing chords.\textsuperscript{326}

Controlling the accentuated sound may be executed by unconstrained wrist motion without rigidity. Cortot suggests several exercises for double notes with different articulations between voices.\textsuperscript{327}

Example 7.8: Cortot, Various patterns of chords with different articulations from *Rational Principles*, Exercise No 4, p. 57

According to Cortot, the example above can be played with “the upper part legato and the lower part staccato and sometimes vice versa.”\textsuperscript{328}

The exercises by Tausig/Ehrlich offer a different articulation from Cortot, and they have a slightly different idea about how to practice.

Example 7.9: Tausig/Ehrlich, Chord exercise with a different articulation from *Daily Studies*, Book II, No. 20, p. 46

Tausig/Ehrlich propose playing legato in the lower voice, but the fingers should stay on the

\begin{footnotesize}
\begin{enumerate}
\item[326] Cortot, 37.
\item[327] Ibid., 54.
\item[328] Ibid.
\end{enumerate}
\end{footnotesize}
key as long as possible until the next notes are played. 329

Different articulation helps to release finger tension. Relaxing the thumb can help to relax the wrist. According to Cortot, “from a mechanical point of view, the conferring of mobility on the hand and fingers, presupposes the accompaniment of a parallel mobility of the wrist.” 330 Furthermore, a different conformation of the exercises could provide “the different degrees of weight which its various positions can communicate to the hand and consequently to the fingers, render it the true factor in sensitive and eloquent phrasing.” 331 Cortot incorporates wrist movements and ways to loosen the wrist through the three exercises shown in Examples 7.10-11.

Example 7.10: Cortot, Movements for loosening the wrist from Rational Principles, Exercise No 1a-c, p. 88

These exercises were designed to strengthen the weaker fingers (fourth and fifth) and loosen the wrist and thumb with the purpose of more balanced and even finger work. Cortot focuses on the motions of the wrist, “since they enable the executant to distribute the

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329 Tausig, 46.
330 Cortot, 72.
331 Ibid., 72.
weight of the hand among the different fingers,”\textsuperscript{332} therefore building up strength in the adjacent fingers (third, fourth and fifth), “to lighten the action of the thumb, while preserving its suppleness and mobility; in fact, to co-ordinate, in a single supple and easy gesture, muscular efforts of a contradictory nature.”\textsuperscript{333} This would be developed in the octave exercise shown in Example 7.11:

Example 7.11: Cortot, Octave exercises from \textit{Rational Principles}, Exercise No 2\textsuperscript{b}, p. 90

Example 7.11 is based on the idea of lessening tension in the thumb.

However, the practical guide by Ehrlich differs from that of Cortot. Ehrlich suggests playing this exercise in steps.

\textsuperscript{332} Ibid., 88.
\textsuperscript{333} Ibid., 88.
Example 7.12: Ehrlich, Practical guide for wrist exercises from *How to Practise*, Exercise No. 6, p. 41

Example 7.13: Tausig, Octave exercise from *Daily Studies*, Book II, No. 6, p. 37

Cortot divides wrist exercises into several categories, by direction of the movement and type of technique such as lateral, vertical, and both ways.

For the exercises for horizontal movement of the wrist, Cortot writes glissandos and leaps to make students move their wrist sideways.
Example 7.14: Cortot, Various examples for exercise leaps from *Rational Principles*,

Exercise Nos 3 and 3\textsuperscript{d}, p. 75 and p. 76

Lateral movement of the wrist can be practiced by carrying the curved hand between the notes:

The leap with a curve is especially suited to the linking together of two distant intervals, so that during the kind of trajectory performed by the hand over the keys as it travels from one point to the other, the fingers are enabled to prepare their position for the clear enunciation of the interval at which they are aiming.\textsuperscript{334}

Cortot maintains that in order to have flexibility of the wrist, “the hand passes at about the height of the shoulder.”\textsuperscript{335}

In contrast, Tausig/Ehrlich emphasize the force of the fingers during the horizontal movement of the wrist.

\textsuperscript{334} Ibid., 75.
\textsuperscript{335} Ibid., 76.
Example 7.15: Tausig/Ehrlich, Parallel movement of the wrist from *Daily Studies*, Book II, Nos. 15 and 16, p. 41

Both exercises are intended to build strength in the fingers without involving wrist movement. According to Tausig/Ehrlich, “For the fingers only must strike, and that with full force, the hand and the wrist not being allowed to add any emphasis to the stroke. For avoiding any such emphasis, the pupil will do best to hold firmly the first two tones.”

Tausig/Ehrlich stress creating a powerful tone without the aid of the motion of hand and wrist. Moreover, holding the first two voices until the next chord is sounded more demanding especially if there is not any releasing technique of the hand.

A clinical report by Meineke and Langendorf examines the risk factors of a pianist who was in his late twenties doing his doctoral degree at a university and complained about

336 Tausig, 41.
soreness in his wrists and fingers while playing the piano. The study demonstrates the risk factors of the student by observing his performance to find specific bad habits that led him to have a wrist disorder. What is unique about this study is that the student was not diagnosed with any muscular diseases such as carpal tunnel syndrome. However, he was taught by focusing on the strengthening of his fingers with curved fingers and the involvement of the forearm while maintaining a “low wrist.” The observation stemmed from recording a video of the student practicing, including scales, arpeggios, and repertoire. The study illustrates the habits of the student which included raising his fingers in order to produce a strong individual sound and sustaining his wrist in quite a low position. According to the study, “the pianist has unconsciously moved his wrists to a position at (or often below) the key bed while still retaining most of the earlier attributes of very arched fingers and over-reliance on independent finger action.” By producing a distinctive sound while sustaining the hands down without help from the wrist and arm causes “greater stress on the flexor tendons.” These excessive motions of the fingers without relaxing the wrist by holding the notes caused tightness in the student’s hand. Teachers should teach their students to either release the tension of their fingers that are holding the notes after touching the key immediately, or observe whether students are playing the key with unnecessary strain.

Cortot provides a similar design of exercises to Example 7.15, but it contrasts

338 Ibid., 97.
339 Ibid., 98.
340 Ibid.
341 Ibid.
342 Ibid.
Tausig/Ehrlich’s method.

Example 7.16: Cortot, Rocking movement of the wrist with broken chords exercise from *Rational Principles*, Exercise No 5, p. 85

According to Cortot, “the rocking motion of the wrist”\(^\text{343}\) is the main goal of Example 7.16. Nevertheless, the fingers should have at least some firmness in order to play the notes clearly. He proposes careful consideration of physical endurance if students are already tense from practicing with tightness.\(^\text{344}\)

Both authors also have different approaches to exercises for vertical motion. Cortot prefers lighter motion of the wrist to lessen the tightness in the hands and arms.

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\(^{343}\) Cortot, 85.

\(^{344}\) Ibid.
Example 7.17: Cortot, Vertical motion of the wrist from *Rational Principles*, Exercise No 1 and 2, p. 78

Students should practice the different shape of the chords by changing their hand position as little as possible and then move on when the chords have leaps.

Cortot recommends letting the wrist “rebound to the height of the shoulder after each note.” Students can practice jumping octaves or chords slowly to allow “the hand to recover its elevated position of attack before each stroke.” Altered rhythms enable students to build their technique without tautness from consistent moving.

Tausig/Ehrlich’s exercises for harmonies focus on building the strength of the hands.

The exercises are written with the hand in a widely stretched position of wide so teachers

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345 Ibid., 78.
346 Ibid.
should be careful that the students do not press down into the keys to forcefully. This has the possibility of causing cramping of the wrists and fingers.

Example 7.18: Tausig/Ehrlich, Harmony exercises from *Daily Studies*, Book I, No. 23, p. 11

Ehrlich offers more specific practice methods for Example 7.18. First, he points out that playing this exercise with accentuation of the hand and using arm motion should be prohibited. Instead, he suggests several steps to achieve the best effect from this exercise. Example 7.19 should be practiced first by using only the fingers to accent the first note.347

Example 7.19: Ehrlich, Tutorial for Example 7.18 from *How to Practise*, p. 33

According to Ehrlich, “the palm of the hand should be perfectly quiet, and must not give emphasis to the fingers.”348 The hands should be stable and the fingers should not collapse

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347 Ehrlich, 33.
348 Ibid.

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after playing each note. The elbows should remain in front of the body.\textsuperscript{349}

Example 7.20 also requires the wrist motion according to Cortot’s idea, but Tausig/Ehrlich define this exercise as being for strengthening the fingers.

Example 7.20: Tausig/Ehrlich, Exercises with harmonies from \textit{Daily Studies}, Book II. Nos. 5 and 7, pp. 36-37

3... How may we apply all that was said concerning No. 20 of Book I; the 4th finger must attack with a rather strong accent, curved, and with the fingers the chord is to be struck with the power of the fingers only, and with a stress of the hand.

5... To be practiced with the 5th, 6th and 8th fingers of both hands sharply curved, the thumb remaining as the contrary, always perfectly extended. In this way alone can the exercise be mastered. It may be taken to any time, the distinction is so much indispensable. Only a proficient and strong player will be able to carry it through more than three or four times.

The practical guide for Example 7.20 states that the fourth finger should be attacking with more accents and a flexed and sharp fingertip.\textsuperscript{350} In addition, “the chord is to be struck with the power of the fingers only, not with a stress of the hand.”\textsuperscript{351} The most significant thing about number 7 in Example 7.20 is that one should playing with a distinct touch with curved third, fourth, and fifth fingers and thumb.\textsuperscript{352} This idea is in conflict with Cortot’s idea that loosening the thumb brings more power to the thumb and fourth and fifth fingers without developing pain in the wrist.

Medical research on the relationships between coordination, wrist movement, and piano-related pain are also valuable for understanding and properly applying Cortot and

\textsuperscript{349} Ibid.
\textsuperscript{350} Tausig, 36.
\textsuperscript{351} Ibid.
\textsuperscript{352} Ehrlich, 41.
Tausig’s exercises. Wristen describes the method by Meineke which states that “expenditure of unnecessary energy should be minimized, and use of the free force of gravity should be maximized. The wrist should be maintained in a neutral position as much as possible.” Wristen gives a guideline for octave exercises by suggesting a desirable posture for the body and hands. The upper arm should be involved in playing the octaves in order to lead the forearm and elbow to be relaxed. Octave exercises require a stretching motion of the thumb, which may impact tension in the wrist. Therefore, “the palm is not rigidly maintained, but rebounds slightly after each key stroke.” The examples of Tausig/Ehrlich imply that the upper arm, forearm, and wrist should stay in a firm position without helping the fingers. However, relying on the fingers only would create a serious problem with executing the octave exercises. The upper arm allows the forearm and the hand to travel between the black and white keys smoothly. For the best effect of practicing octave exercises without injury the hand and fingers stay free and keep the wrist in a neutral position. This will prevent students from using excessive movement of the wrist which may result in tension and fatigue. Sakai et al. studied the injury mechanism related to overuse syndromes of pianists involving hand position and range of motion of the hand and wrist joints. The article concludes that teachers must be aware of tension in these areas and prevent students from consistently repeating passages in positions that could be considered extreme.

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353 Wristen, 56.
354 Ibid., 61.
355 Ibid.
356 Ibid., 59.
357 Ibid., 59–61.
359 Ibid., 29.
Cortot and Tausig/Ehrlich both have chapters on how their exercises and
instructions apply to the repertoire. Cortot’s “Repertory” chapter shows how students can
find the best exercises from his book for that purpose. The range of the repertoire goes
from “The Harpsichord” school, including Italian, French, English and German schools,
to “The Pianoforte,” such as music by Chopin, Schumann, Liszt, and Franck. Cortot
includes music through the time period of his contemporaries and asks teachers to take into
consideration the music of Alkan, Balakirev, Grieg, Fauré, and so on. The level of
difficulty of each piece is shown by means of four abbreviations “N.D., not difficult—
R.D., rather difficult—D., difficult—V.D., very difficult.” According to Cortot, “In
cases of works containing technical peculiarities which cause them to depend on several
chapters, the degrees of difficulty are marked in the columns allotted to the chapters dealing
with those peculiarities.” For example, Cortot indicates a piece by Brahms, *Variations
on a Theme by Paganini*, as “complete technique, predominance of double notes and
wrist playing.” This piece is highly demanding technically so Cortot marks it V.D.

360 Cortot, 97.
361 Ibid.
362 Ibid., 99.
363 Ibid., 102.
364 Ibid., 97.
365 Ibid.
366 Ibid., 97.
367 Ibid., 102.
368 Ibid.
Tausig composed a number of original small preludes for Volume III. In addition to these original works, this volume also contains some more advanced exercises. Tausig’s preludes integrate elements from his technical method into small pieces which also require attention to dynamics, articulation and phrasing.

Tausig’s idea was, that after having gone through the purely mechanical exercises the pupil should take up some small and difficult pieces, in which one and the same passage should be played in different position, and with all the various shadings of tone-color, thus combining with mechanical difficulty every variety of touch and of delivery.\textsuperscript{369}

Each prelude is written for specific piano techniques, such as double chords, arpeggios, scales, crossing hands with harmonies, and octaves. Ehrlich gives practical suggestions for

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|}
\hline
Chapter & 1 & 2 & 3 & 4 & 5 \\
\hline
\hline
Variations and Fugue on a theme by Haendel (complete technique with predominance of chord playing and double notes). & d & vd & vd & d & d \\
\hline
Variations on a theme by Exanini (2 books) (complete technique, predominance of double notes and wrist playing). & vd & vd & vd & vd \\
\hline
Sonata op. 5 (technique of chords, extensions, and the wrist). & d & vd & vd & vd \\
\hline
Variation on a theme by Schumann (polyphonic technique, chords and double notes). & d & d & d & d \\
\hline
Variations on an original theme op. 21, n° 1 (technique of chords and extensions). & vd & vd & d & d \\
\hline
Capriccio op. 76, n° 2 (independence of fingers, precision in staccato). & d & d & d & d \\
\hline
Rhapsody op. 39, n° 2 (breath of play, crossed hands). & d & d & d & d \\
\hline
Intermezzo op. 117, n° 2 (expressive evenness). & d & d & d & d \\
\hline
Ballad op. 118, n° 3 (chord technique, wrist play). & d & d & d & d \\
\hline
Intermezzo op. 118, n° 6 (evenness left hand, octaves). & d & vd & d & d \\
\hline
Intermezzo op. 119, n° 3 (polyphonic playing suppleness of wrist, clear articulation). & d & vd & d & d \\
\hline
Studies from Chopin (thirads and sixths legato). & vd & d & d & d \\
\hline
Ronde from Weber (perpetuum mobile for the left hand). & vd & vd & d & d \\
\hline
Presto from Bach, 2 versions (evenness of both hands, strength and independence of fingers). & vd & vd & d & d \\
\hline
Chaconne from Bach (for the left hand alone). & vd & d & d & d \\
\hline
\end{tabular}
\caption{Cortot, Repertory example for the music of Brahms from \textit{Rational Principles}, p. 102}
\end{table}

\textsuperscript{369} Ehrlich, 56.
Tausig’s preludes, some of which focus on the strength and independence of the fingers and the controlled motion of the hands. For example, Ehrlich underscores playing with powerful fingers, especially the fourth and the fifth fingers, by accentuating the notes.

Example 8.1: Tausig, Preludes from *Daily Studies*, Book III, No. 1, p. 59

Example 8.1 was composed by Tausig. Unlike the exercises in Book I and II, this prelude has expression marks such as dynamics, pedal and tempo markings that give opportunities for students to build their technique while also considering important musical aspects, such as color of sound. The technical task for this prelude is building the strength of the fingers by accenting every chord:

Give to the 1st and 4th sixteenth in every bar a full and strong accent, yet *each time* with a different degree of power, so that the higher notes of the double-notes form a melodic phrase…. the last four measures as forcibly and brilliantly as possible.\(^{370}\)

\(^{370}\) Tausig, 59.
In chapter 4.3, Gymnastic Exercises, and chapter 5, Finger and Wrist Exercises, a number of reports and articles from a medical point of view were cited that discuss the risk of lopsided exercises that focus only on building the power of the fingers, especially the weak fingers, in the name of developing the independence, stretching, and muscle power of the fingers. Teachers should take care to mention the integrated movement of the fingers and hands instead of emphasizing only the fingers with accents because of the possibility of having immoderate tension in the third, fourth, and fifth fingers. Relaxation on a single note should be accompanied by movement of the wrist.

Example 8.2 shows another case that requires careful supervision by the teacher.

Example 8.2: Prelude by Ehrlich on Tausig’s *Daily Studies*, Book III, No. VI, p. 63

This example was written by Ehrlich for practicing broken octaves and chords. According to Ehrlich, “the chords must here by struck off with the greatest delicacy and in harp-
fashion; at the ff the 4th and the 5th fingers must strike with marked emphasis.\footnote{371}

Practicing arpeggiated chords is explained in Chapter V of Cortot’s exercises. Cortot provides an exercise for “Open chords”\footnote{372} in Chapter V. The Technique of the Wrist—The Execution of Chords.

Example 8.3: Cortot, Rolling Chords from \textit{Rational Principles}, Exercise No 4, p. 84

\begin{center}
\includegraphics[width=\textwidth]{example8_3.png}
\end{center}

Cortot suggests a gradual approach to exercise for Example 8.4 by adding progressively more notes to reach a wide stretch:

\begin{quote}
It is a movement of semi-rotation of the wrist which brings about the emission of sound. The greater the number of notes contained in a chord and the more extended its position, the more justifiable is the use of this movement.\footnote{373}
\end{quote}

Ehrlich suggests playing with a full stroke of the fourth and the fifth fingers in Exercise 8.2 to bring out the sound precisely and vigorously. Cortot has a different approach to broken octaves with respect to the involvement of wrist movement.

\footnotesize
\begin{flushright}
\textit{ Sources:}
\footnotemark[371] Tausig, 63.
\footnotemark[372] Cortot, 84.
\footnotemark[373] Ibid., 84.
\end{flushright}
Cortot states that without the help of the wrist, Example 8.4 could not be accomplished, since a stretching motion would give rise to tension in the fingers:

In extended positions, the fingers are powerless to mark the melodic contour of the moving part with the necessary agility and force. In this case the intervention of the wrist becomes necessary for [clarity] of enunciation. It is manifested by a succession of rocking movements on the part of the hand, whose amplitude varies in proportion to the width of the intervals.374

By playing with circular motion of the wrist, “each swing corresponds to a characteristic attack of the finger of fingers in action.”375

Both authors provide examples which aim at a specific repertoire to improve students’ technique, such as Chopin’s Etude, Op. 10 No. 1. According to Cortot’s Repertory chapter, this etude is for building the “strength of the fingers, [and] extensions.”376

374 Ibid., 86.
375 Ibid., 86.
376 Ibid., 100.
This etude is discussed in Cortot’s Chapter 2, 4 (very difficult) and 5 (difficult). Chapter 2, “Passing under of the Thumb—Scales—Arpeggios,” and Chapter 4, “The Technique of Extension,” are the most essential parts along with Chapter 5, “The Technique of the Wrist—The Execution of Chords.” Cortot’s Chapters 2 and 5 were discussed in chapter 5 of this dissertation in relation to stretching and wrist exercises. Cortot insists that the most important values stemming from practicing his chapter 2, 4 and 5 are supple mobility of the thumb with lateral and vertical movement of the wrist. In addition, teachers have to guide students toward safe practice habits to avoid “muscular fatigue or heavy
execution” during extension exercises. For example in Cortot’s Chapter 2, he maintains that movement of “the fingers’ should be accompanied by a sort of rolling of the hand on the key-board, the wrist being held slightly higher than when in the normal position” in order to make it relaxed to play with “a lateral rocking of the hand” with a frequent rhythmic changes so that should lead students to avoid a “motionless hand, during which the fingers are cramped on the key-board in an abnormal position.” One of the examples from this chapter is shown in Example. 8.5.

Example 8.5: Cortot, Extension exercise with various rhythmic changes from *Rational Principles*, Exercise No 1, p. 67

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377 Ibid., 60.
378 Ibid., 65.
379 Ibid., 61.
380 Ibid., 60.
Tausig composed his own exercises for practicing extensions for Prelude X, No. 4.

Example 8.6: Tausig, Extension exercises from *Daily Studies*, Book III. Prelude X, No. 4, p. 68

Ehrlich writes that since Tausig had a very small hands, he used Example 8.6 to help a small-handed pianist to stretch their fingers as much as possible.\(^{381}\) Another illustration of preparation for the repertoire is Prelude X, No. 18. Ehrlich mentions Tausig’s exceptional skill in the technique of crossing hands, as in the Finale of Chopin’s Concerto No. 1 in E minor, Op. 11.\(^{382}\) Ehrlich notes Tausig’s technique in which octaves with alternation in the fastest tempo “always sounded so distinct that each single note could be plainly heard,” and the similar features are found in Prelude X, No. 18.

\(^{381}\) Ehrlich, 59.
\(^{382}\) Ibid., 60.
Example 8.7: Tausig, Exercise for crossing hands from *Daily Studieis*, Book III. Prelude X, No. 18, pp. 74–75

Crossing hands is also addressed in Cortot’s method. He provides exercises in various shapes along with useful suggestions for practice.
Example 8.8: Cortot, Alternation technique from *Rational Principles*, Exercise No 4, pp. 79–80

Cortot focuses on the wrist movement in order to achieve vertical impulses:

Absolute regularity of execution is, in this case, based on a corresponding equality in the amplitude of the wrist movements, which cause the alternate attacks of each hand to succeed one another on one or several notes.383

Cortot begins with crossing a single note at moderate speed to the subdivided rhythmic pulses. The best way to achieve this technique is described as follows:

Throw the hands alternately on to the selected key, taking the point of departure for each attack at the height of the shoulder. As the rhythm accelerates, gradually diminish the height of the attack, whose point of departure must, however, remain absolutely symmetrical in both hands.384

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383 Cortot, 79.
384 Ibid., 79.
Most of Cortot’s exercises are followed by others that increase in difficulty. For instance, in Ex. 8.8, alternation starts in the simplest way with one note but develops to add additional notes with a complicated rhythm. This exercise would be beneficial for students to get around a “physical obstacle”\textsuperscript{385} from “the mechanical and long-repeated practice of a difficult passage.”\textsuperscript{386}

Tausig’s idea of practicing is different from Cortot’s. Tausig provides various kinds of exercises targeted at challenging elements that can be found in the repertoire.\textsuperscript{387} According to Ehrlich, “Tausig acted on the principle that the player can best master a difficult passage, not by attacking it at once, but by first taking up other exercises containing the same class of difficulty, but in all possible positions and keys.”\textsuperscript{388} By studying Tausig/Ehrlich’s method, it is clear that firmness and stability of the fingers, wrist, and body become the most important values to be obtained from practicing. Ehrlich compares piano technique to learning a soldier’s march in order to emphasize how much endurance is required to develop piano technique:

Observing how the Prussian recruits learn to march, how they must first raise the leg, with strongly bent knee, very high, and hold it some time in this position, how they then with a jerk stretch out the leg and foot perfectly stiff…. this very exercise gives the Prussian soldier steadiness and endurance in marching.\textsuperscript{389}

For developing strength in the muscles of the hand, Tausig/Ehrlich requires students to practice in a slow tempo with all the muscles of the fingers. Than they need to play in a

\textsuperscript{385} Ibid., 3.
\textsuperscript{386} Ibid., 1.
\textsuperscript{387} Ehrlich, 60.
\textsuperscript{388} Ibid., 60.
\textsuperscript{389} Ibid., 26.
faster tempo to prove that they have command of the material with sureness of touch.\textsuperscript{390} Ehrlich maintains that such a great amount of effort is necessary for students, citing “Tausig, who with slight bodily frame and small hands has done such wonderful things.”\textsuperscript{391} Unlike the method of Cortot, who does not prefer mechanical practice at length, Tausig/Ehrlich’s exercises are described as comprehensive “mechanical exercises of every kind…. a complete course of piano gymnastics.”\textsuperscript{392}

However, building piano technique without considering relaxation, loosening, and coordinating the movement of the hands, fingers, and body is controversial. Medical reports by Margaret Redmond and Anne M. Tiernan (2001),\textsuperscript{393} Heidi Blackie et al. (1999),\textsuperscript{394} Joan Revak (1989)\textsuperscript{395} and Alice G. Brandfonbrener (2002)\textsuperscript{396} point out the risk factors of piano-related injury, and one of the factors is inappropriate technical education with unprepared muscle conditions of the hands and body. Furuya et al.\textsuperscript{397} reported that “excessive muscle tension when practicing chords with fortissimo”\textsuperscript{398} and “repetitive application of dynamic key-striking force and prolonged daily practice”\textsuperscript{399} would bring serious playing-related disorders to the hands, arms, and wrists. Therefore,
“proper knowledge of injury prevention for pianists must be taught.” For example, the study shows that playing extended broken chords with legato touch instead of striking the keys produces fewer playing-related disorders.

When deciding which of these methods to use, teachers should keep in mind the individual attributes of their students in order to determine whether any of these exercises may result in dangerous physical consequences to students.

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401 Ibid., 116.
Building effective technique for piano while avoiding piano-related injury has been the purpose of writing document. Chapter 3, “Risk Factors and Principles for Avoiding Piano-related Injury” shows how important it is to educate students about injury prevention education. Blackie et al. insist on the importance of gradual injury prevention education from an early age in order to prevent the development of bad habits that may later cause piano-related injury:

Teaching students important injury prevention and safe practice techniques appears to be the first step of a lengthier process. What is done with that information is the critical link to injury management and prevention. Simply because a student has received education does not mean that he or she will use it, as evidenced by several respondents reporting never or rarely using injury prevention education principles in daily practice sessions. The most frequently used education principles were the employment of proper posture and body mechanics and decreasing practice when fatigued. Both of these are important techniques to decrease the likelihood of sustaining overuse injuries. In isolation, however, they may not be adequate to remain injury-free.402

One of the principles for developing a safe piano technique is to incorporate good posture as well as safe practice habits especially if practice sessions last for a long time. Redmond et al. mention that it is a demanding task for teachers to change their students’ bad practicing habits if they already play with poor posture. Despite the difficulty of this, teachers are responsible for guiding their students toward the development of safe practice habits:

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402 Blackie, et al., 145.
Teachers are influential models to their students dealing with playing-related disorders. They serve as trusted insiders to students and, together with a students’ peers, shape individual practice behaviors. It is much easier for a teacher to instill a correct playing habit than to correct a poor habit that has become engrained. Generally, playing habits are harder to change after the mid-20s.\textsuperscript{403}

Taylor, who writes about Cortot’s musical career and his teaching methods, highlights the important role of teachers in guiding their students toward piano techniques which are not likely to cause injury:

With students who are technically immature or less adept, a teacher must often dwell at length on basic disciplines (the fixing of posture and hand position, the reinforcement of reflexes essential to mechanical control and fluency, as well as the analysis of motions appropriate to specific musical contexts) prior to, and concurrent with, work on the interpretive side of performance. If the physiological component is weak, the student may easily begin resorting to any means, even the most ineffective, to realize the musical aims posed, and may end up with severe tension, stiffness and other problems that in time become chronic and perhaps incapacitating. To have the student work on technique extensively, moreover, is not enough; it is the “how” of the study that makes all the difference. Hence, it is essential that the teacher supervise the work closely, in order to verify that it is of a nature to bring the pupil closer to the ultimate goals, rather than leading him/her into new or greater problems.\textsuperscript{404}

Cortot and Tausig share many of the same ideas for building technique as part of a daily routine; but they have different methods and their exercises are designed quite differently. Both pianists provide great detail about physical gestures, body posture and hand positioning for each exercise. Cortot focuses more on relaxation of tension in the body in order to avoid discomfort while practicing his exercises. On the other hand, Tausig’s method emphasizes strengthening the muscles of both hands and developing powerful fingers. In comparing Cortot’s and Tausig’s exercises with each other and looking carefully

\textsuperscript{403} Redmond, et al., 33.  
\textsuperscript{404} Taylor, 398-99.
at medical articles, both students and teachers should find themselves in a better position to make educated choices about which method can best build solid piano technique and minimize the possibility of injuries. By comparing both methods and referencing medical sources, this author advocates Cortot’s exercises as the most effective way to improve piano technique without injury. However, naturally, some teachers and pianists may take another point of view.

Pain is a frustrating symptom and it indicates dysfunction in piano technique.405 Symptoms of pain would be “muscle tightness to prolonged and unbearable pain due to damage to the nerves, muscles, tendons, and skeletal structures.”406 Students have significant differences in physical playing-related condition.407 Safe practicing depends on many factors, including the level of teacher supervision. In any case, it is critically important for both teachers and students to reference the many articles written about piano-related hand pain in order to develop the best strategy for developing an injury-free piano technique.

406 Furuya, et al., 112.
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