An Analysis of Terminology Describing the Physical Aspect of Piano Technique

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Thesis submitted to the Faculty of Graduate and Postdoctoral Studies in partial fulfillment of the requirements for the MA degree in Music.

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Abstract

Mastering the physical aspect of piano technique has long been a topic of great interest and importance to pianists. This is borne out in the numerous pedagogical approaches on the topic of piano technique. Despite the many contributions from pedagogues and scholars in developing an understanding of piano technique, many conflicting approaches often cause more confusion than clarity. After reviewing the literature on pedagogical approaches to piano technique, this study determined that problematic language might lie at the root of the confusion. Core concepts identified in the review of literature as recurring areas of misunderstanding were tension, relaxation, co-contraction, arm weight, and hand and finger shape.

The purpose of this study is to seek where issues of language exist in contemporary piano pedagogical approaches and to show how these problems may contribute to the systemic confusion in piano technique. To do this, the language that is used to describe and define the core concepts identified in the review of literature is analyzed in five modern pedagogical approaches. Five authors who have developed approaches that reflect current trends in piano technique have been selected for this study: Barbara Lister-Sink; Dorothy Taubman; Thomas Mark; Fred Karpoff; and Alan Fraser. The first step of this study entails collecting data from each of the five pedagogical approaches. The data is then analyzed for consistency and accuracy. Problems in language that contribute to the inconsistencies and inaccuracies are examined and illustrated with material from the data collection.

This study concludes by identifying the main sources of confusion in the use of language: inconsistent and inaccurate use of terms; wavering between scientific, common, and invented language; challenges in describing opposing qualities that come from tension and relaxation; and failing to discern between the individual subjective experience and the mechanics of movement. By recognizing where the problems in language exist, this study represents an important first step for the pedagogical community to reach a common understanding of the language used to describe the physical aspect of piano technique.

Acknowledgements

I would like to express my sincere gratitude to several people for their support in helping me to prepare this thesis. Special thanks to my thesis advisor, Dr. Gilles Comeau, for his positive, constant, and constructive encouragement and guidance. His commitment and passion for piano pedagogy research have been truly inspiring. I would also like to thank physiotherapists, Bob Dunlop and Victoria Agar for the long hours of discussion and explanations of anatomy. Their generosity in sharing their knowledge and friendship has made this project possible.

A later in life endeavor, I am especially grateful to my family who have cheered me on. My husband, Michael has given me unwavering support and patience. My children, Anna, Genevieve, and Max have all inspired me with their perseverance and excellence in their individual pursuits. Lastly, a very special thank you to Anna, whose adept computer skills helped me out many times.

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Introduction

Making music is considered one of the most challenging and complex human activities (Altenmüller & Schneider, 2009). Making music at the piano integrates emotional, mental, and physical skills and knowledge. Even though these elements are all intertwined, it is the physical aspect of piano playing that has been considered the gateway to fulfilling musical expression (Schultz, 1936; Bernstein, 1991; Fink, 1992; Gerig, 2007; Wingsound, 1996, 2008).

Throughout the long history of the piano—from its predecessors, the clavichord and harpsichords in the 1500s, to the present—pedagogues, keyboard players, and scientists have attempted to unravel the complexities of the physical skills required to play the instrument with varying degrees of success. Today, numerous books, audiovisual guides, symposiums, and websites, many promising to reveal the "secrets" of piano technique (Gerig, 2007), attest to the mystery surrounding this topic. Faced with a myriad of technical approaches, a pianist can become confused and uncertain how to master the physical aspect of piano technique (Prater, 1990; Bressler, 2000; Turon, 2000). Dreams of playing the piano with joy and freedom are rarely realized, and in some cases, faulty technique may lead to pain and injury (Bernstein, 1981; Fraser, 2003; Mark, 2003).

Many scholars point to imprecise and inconsistent use of terminology within the pedagogical literature as a reason for preventing pianists from understanding key concepts related to piano technique (Martinez, 1990; Prater, 1990; Gordon, 1991). Often, physical movements are incorrectly explained and reflect a poor understanding of the scientific principles underlying physical movement (Wristen, 1998; Bloomfield,

Golandsky, Schnitzer, Taubman, Urvater, & Yaguspsky, 2001; Vant, 2007). The vague language leads to disagreement on how to teach technique. Indeed, widely varying approaches to piano technique can be found in the pedagogical literature and in piano studios. In 2000, Nadine Bressler investigated piano pedagogical practices in her thesis, *Behind Closed Doors: A Qualitative Study Exploring the Pedagogical Practices of Piano Teachers*, and discovered a wide spectrum of opinions among piano teachers regarding principles of piano technique. Though at first glance disagreement among the varying technical approaches seems ideological, a closer look reveals that they have more in common than appears. Often, discrepancies stem more from vague language and poorly defined concepts integral to piano technique (Martinez, 1990; Prater, 1990; Gordon, 1991).

Even the term technique has many different meanings. Bressler (2000) discovered that some teachers defined technique as a physical activity involving repetitive drills to build finger velocity, strength and independence, yet other teachers defined technique as an artistic endeavor and believed that repetitive drills should be avoided. In a doctoral thesis describing Barbara Lister-Sink's approach to injury-preventive technique, Osada Mayumi (2009) states that: "the term technique is ambiguous" (p.14), and suggests that technique is perceived as either a mechanical skill or an elusive, mysterious, and artistic talent available to a select group of pianists. Many renowned pedagogues believe piano technique is, in fact, a blending of the artistic and physical. According to Seymour Fink (1992), author of *Mastering Piano Technique*, "Piano technique is more than the physical ability to render the printed page of music accurately; it is the vehicle for interpretation,

the key to musical expression" (p. 11). Reginald Gerig (2007) describes the interweaving of the artistic and the physical in piano technique: "Technique is more than physical skill; it is everything making for artistic, musical piano playing" (p. 520). A complex skill or talent entailing all aspects of playing the piano, the definition of technique evokes a variety of responses from pianists.

Different terms and expressions have been used to describe the physical aspect of playing the piano: the art of piano playing (Gerig, 2007); motor control (Jacobs, 1992); the craft of piano playing (Fraser, 2003); keyboard choreography (Bernstein, 1991); injury-free technique (Lister-Sink, 1996, 2008); the kinetic aspect of musicality (Levant, 2006); 3-D technique (Karpoff, 2009); the study of motion (Bloomfield et al, 2001) and physical mechanics (Mayumi, 2009). Although a variety of definitions of technique exist within the pedagogical and scientific literature, the term technique is commonly employed to describe the physical mechanics of playing the piano. For the purpose of this paper, the term technique will refer to the physical aspect of playing the piano, recognizing that this is only one component of the multi-faceted nature of technique.

Chapter 1: Review of Literature

The following examination of the evolution of keyboard technique and pedagogical approaches considers how problematic language may contribute to the confusion on the topic of piano technique. This overview considers the pedagogical responses to the changes in the mechanical action and design of early keyboard instruments; the increasing technical demands inherent in piano repertoire; the lack of consensus on the scientific basis for prescribing movement at the piano; highly individualized theories; and recent approaches claiming to be based on anatomical and biomechanical principles. The evolution of keyboard technique is a vast topic. This review does not attempt to address all the numerous pianists, pedagogues, and scientists who have contributed to this field. Rather, important landmarks in the development of piano technique are identified to assist in understanding current problems related to ambiguous concepts and terminology in pedagogical literature.

1. Evolution of keyboard technique

Piano pedagogical literature often classifies piano technique into two schools: the finger action school and the arm weight school (Sandor, 1981; Fraser, 2003; Gerig, 2007). Each of these schools developed as a direct response to the peculiarities of the keyboard instrument that was played at that time. Early keyboard instruments such as the clavichord, harpsichord, and the Viennese pianoforte required a very light finger action. As the pianoforte evolved to the modern piano, a much more physical approach was needed and arm weight technique was eventually introduced. Criticized as either

cultivating too little movement or too much movement, these traditional approaches have become defining features of piano technique (Bernstein, 1981; Fraser, 2003). The following is an examination of the evolution and the chief characteristics of the finger action and arm weight schools.

1.1 Technique for early keyboard instruments

A brief overview of the evolution of some early keyboard instruments and how they were played provides insight to the various approaches to modern piano technique today (Rowland, 2001; Gerig, 2007). Fulfilling a wide range of functions—from church music, chamber music, dance music, to concert hall music—these instruments distinctive sounds and characteristics demanded different playing techniques. The following discussion examines particular technical approaches arising from these instruments' mechanisms, techniques that have percolated into approaches to modern day piano technique.

In his treatise on *Organ Playing, Its technique and expression,* Hull (1981) contends that the most important principle of organ technique lies in its touch. The mechanism of the key is such that the pressure and release of the key opens and closes a long narrow lid that allows air pressure in the pipes. A precise pressure and release is paramount to producing a satisfactory tone. Describing the hallmarks of this touch, Hull (1981) writes: "What the key requires is simply *pressure* smartly applied, firmly sustained, and suddenly removed" (p. 25). The degree of pressure from the fingers depends on the key resistance of each particular instrument, nonetheless minimal finger pressure and economical movement are recommended as the most efficient approach. Playing the organ also requires great adeptness, activity, and coordination from the whole

body. In addition to activating levers and stops to achieve a wide array of tone colours, both feet play pedals, and hands may switch to different keyboard levels. The tremendous variety found in the design and action of organs demands a keen ear and a responsive physical approach that can readily adapt to the different demands of individual instruments.

Like the organ, the clavichord's extremely responsive mechanism demanded great aural and physical sensitivity, leading many pedagogues to extol the benefits of learning to play the clavichord before the harpsichord (Rowland, 2001). When the keys are depressed, metal tangents strike the strings to produce a delicate and singing tone. The tangent maintains contact with the strings for the duration of the time the key is depressed. The instant the key releases' the sound ceases (Albarda, 1975). The clavichord's simple design allowed the player to have direct control of the sound from the fingers and thus demanded great sensitivity to subtle changes in touch. The technical approaches for the clavichord focus on the fingers' activity and touch while maintaining a quiet body and arms (Gerig, 2007). Minimal effort is required to depress the keys. Indeed, too much force can stretch the strings and compromise the tuning (Albarda, 1975). Special attention is given to the finger's after-touch as subtle variations in the pressure from the fingers on the key can result in fine dynamic and tonal nuances. This elegant mechanism allows for a special vibrato touch that is unique to the clavichord. The great depth of expressive possibilities made the clavichord a popular instrument among many musicians.

Even though the clavichord's intimate and sweet tone was admired in Germany and northern European countries for over 500 years (Brauchli, 1998), other countries

preferred the more robust sound of the harpsichord. Often used to accompany dances, the harpsichord was associated with a more vigorous physical approach that required more energy and articulation and less delicacy than that which is associated with the clavichord (Rowland, 2001). When the key is depressed, a quill mounted on a wooden jack plucks the string, producing a bright, highly articulated sound. When the key is released, gravity allows the jack to drop back down to its original position and a piece of felt attached to the jack dampens the string's vibration. Unlike the clavichord, changes in how the key was struck did not significantly change the sound, nor did the player have any control of the sound once the key was depressed (Albarda, 1975). Similar to the clavichord, minimal force was needed to depress the key. The fingers maintained close contact with the key as too much extraneous motion could cause much mechanical sound. Playing techniques emphasized active fingers moving from the knuckles maintaining a mostly stationary arm and body. The close relationship between the length of the sound and the plucking mechanism's activation and dampening of the sound demanded special consideration of the release of the keys. In addition, harpsichord music required great finger agility and dexterity as much of the music featured elaborate passages with rich textural changes and ornamentation.

By the early 18th century, in response to the dynamic and tonal limitations of the clavichord and harpsichord, Bartolomeo Cristofori built a *gravicembalo col piano e forte*, an instrument capable of a broad spectrum of dynamic range, and the instrument that became the basis for the modern day piano (Gerig, 2007). Even though Cristofori's invention evolved from the clavichord and harpsichord, the pianoforte's action and tone differed so greatly that it became an entirely different instrument from its predecessors

(Albarda, 1975). Although the pianoforte hammer strikes the string in the same manner of the clavichord tangents, the important difference is that the hammer immediately falls back and the sound cannot be controlled once the note has sounded. Though Cristofori's instrument allowed greater dynamic range, keyboard players did not readily embrace this instrument at first, complaining of its weak tone and difficulty in controlling the sound. Intrigued by Cristofori's design, other instrument makers modified and improved upon his model with evolving ranges, string tension, action, and frames. Eventually a whole school of pianoforte makers was established and became known as 'The Viennese Action' (Good, 1982). Recognized by its extremely light action, shallow keybed, and responsiveness, the Viennese action required little effort to activate the keys and the earlier keyboard technical approaches of a quiet arm and hand with active fingers prevailed.

Distinctive from the Viennese pianoforte, the English pianoforte was a more robust instrument with its heavier hammers, stronger frame, more strings, and complex action. These changes, combined with increasingly virtuosic repertoire, placed new demands on technique. The minimal involvement of the arm with maximum finger action no longer sufficed and a more physical approach was needed. Rather than adapting technique to conform to these rigorous demands, keyboard players responded by attempting to strengthen fingers to master this instrument and its challenging music (Love, 1969). By the beginning of the 19th century, new products designed to build pianists' finger power and independence emerged (Schonberg, 1987). In addition to numerous contraptions and physical exercises away from the pianoforte, pedagogues and composers wrote methodical and meticulous technical exercises as a means to develop

finger strength and facility. Principles of playing techniques from the earlier keyboard instruments form the foundation of these exercises. Primarily focused on carefully calibrated finger action, special attention is given to a unified and quiet arm, wrist, and hand with curved, and active fingers. Perhaps the most enduring principle was the belief that finger dexterity and strength could be cultivated by mechanically repeating exercises.

1.2 Finger technique: Developing strength and independence

The allure of attaining muscular strength, finger independence, and finger velocity, as touted in finger exercises, has spurred many pianists to engage in countless hours of tedious practice and continues to form the mainstay of many pianists' technical training (Gordon, 1991; Parakilas, 2001; Carew, 2007; Mayumi, 2009). Numerous composers and renowned pianists contributed to the canon of technical exercises. To illustrate this focus on developing finger facility, strength, and independence the following discussion highlights a sampling of some of the composers and the exercises that continue to shape the pedagogical direction in developing technique today.

Among the myriad of exercises, Carl Czerny (1791-1857) added to the canon with numerous volumes, including *The Art of Finger Dexterity* (1824, 1896) and *School of Velocity* (1824, 1993). Featuring technical drills and shorter study pieces, Czerny's advice summed up all the principles of the finger action school: quiet arms; a curved hand position that brought all fingertips into a straight line; independent fingers; and endless repetitions of these drills and studies to attain complete mastery of finger technique. Johann Cramer, (1771-1858) noted for his polished technique, published many exercises featuring the repetitive patterns favoured by Czerny but imbued them with more musical interest. In addition to exercises, Cramer (1812, 1839) published a piano method

book, *Instructions for the Pianoforte in Which the First Rudiments of Music are Clearly Explained and the Principal Rules on the Art of Fingering Illustrated with Numerous and Appropriate Exercises.* This influential work includes instructions recalling similar principles of technique from earlier keyboard instruments— bent fingers, minimum movement, and the cultivation of an even touch among all fingers (Gerig, 2007). Brahms (1833-1897) wrote a volume of 88 finger exercises comprised of scalar patterns, repeated notes, trills, and arpeggios. Letters from Brahms' students reveal that he placed great value in these exercises, meticulously observing and commenting on the hand and finger movements (Gerig, 2007). This fascination with finger exercises culminated with a contribution to the literature from a relatively unknown teacher at the time, Charles Hanon, whose repetitive five-finger exercises first published in 1873, continue to be promoted as a solution to remedy the uneven strength and agility of the fingers (Gordon, 1991, Parakilas, 2001; Carew, 2007).

Despite the popularity of these types of exercises, not all pedagogues believe that these drills live up to their promises. According to well-known piano teacher, Marc Durand, (1996) Hanon exercises are useless when not damaging (Approche psycho-pédagogique de l'enseignement du piano, piano pedagogy course given at Université de Montréal). Many pedagogues agree, arguing that playing Hanon exercises cannot change the anatomy of the fingers and differences in function and agility thus represent a colossal waste of time (Prostakoff & Rosoff, 1997; Bloomfield et al., 2001; Gerig, 2007). Edna Golansky (Bloomfield et al., 2001), piano professor at Julliard, expresses the same skepticism regarding the efficacy of these types of exercises and cautions that they lack a diagnostic approach, rarely providing solutions to technical problems that are relevant to

repertoire being studied. Golansky points out that technical issues can only be solved if they are addressed in the context of the repertoire. Parakilas (2001) condemns the mechanical type of practice typical of Hanon exercises: " The mind-numbing repetition of this sort of practicing produced generations of pianists whose fingers could surmount incredible difficulties but whose hearts had been closed to the beauties of music" (p. 131). The emergence of finger exercises two hundred years ago continues to play an important role in many technical approaches today; however, there is little agreement regarding their efficacy or the necessity of building finger strength and independence.

Continuing this overview of the evolution of piano technique, an examination of some of the differing 20th century approaches assists in understanding the ensuing confusion that has pervaded the literature. These 20th century developments can be categorized as theories of arm weight and relaxation, scientific approaches, and individualized approaches.

1.3 Arm weight and relaxation

By the late 19th century, the increasingly challenging repertoire and heavier action of the piano caused pianists to recognize that mere finger action could not convey the spectrum of the piano's expressive possibilities (Schonberg, 1987; Gordon, 1991). The limitations of finger action as a basis for piano technique propelled pianists to explore more physically engaging approaches to the piano (Gordon, 1991; Gerig, 2007). By the early 1900s, pianists and pedagogues Rudolph Breithaupt (1873-1945) and Tobias Matthay (1858-1945) introduced arm weight and relaxation as key components of piano technique. Although vital to their approaches, these concepts were not clearly explained and resulted in much confusion and debate among the pedagogical community.

Misunderstood concepts of arm weight and relaxation can be traced, in part, to the complex and convoluted language used to describe these concepts in the pedagogical literature (Prater, 1990; Gordon, 1991; Gerig, 2007). In a collection of articles from various pedagogues, Stewart Gordon points to the challenges in understanding earlier writings of influential pedagogues, Breithaupt and Matthay. Gordon describes the difficulty in grasping the meaning of "arm weight" as described by Rudolph Breithaupt in his noteworthy book from the early 1900s, *Die natürliche Klaviertechnik,* (1905). Breithaupt employs vague terms and convoluted language such as "massive arm weight" and "elastic muscular tension of the whole physical apparatus" (Gordon, 1991, p. 327). Analysis of his instructions leaves "more and more room for question, error, or misinterpretation as to exactly what he was communicating" (Gordon, p. 327). Gordon concludes that one cannot accurately discern what Breithaupt means, and states: "Thus, to fathom what Breithaupt was driving at, one must be satisfied with general impressions and be willing to trust one's psychological reaction to his choice of words rather than seek literal translations" (p. 326).

Matthay, an enthusiastic proponent of arm weight and relaxation, added other important concepts to lay the foundations of a radically different approach to piano technique. Dedicated to exploring, developing, teaching, and communicating his theories of playing the piano, Matthay wrote numerous books based on his empirical research that have had an enormous impact on piano pedagogy. His books encompass a broad range of topics related to playing the piano with *The Act of Touch in All Its Diversity* (1903) and *The Visible and the Invisible of Pianoforte Technique* (1932) addressing important principles of the physical aspect of technique. Gerig sums up Matthay's extraordinary

contributions: “It is safe to say that after Matthay, the English pianistic world would never be quite the same; all later English writers on technique were conditioned by him in one way or another” (p. 398). Combining an intensely analytical approach with the goal of refining physical sensations, Matthay’s priority was always to develop sensitivity to the musical aspects through listening and awareness of the inherent musical shape. Of the many concepts Matthay articulated, it is his reference to the invisible in piano technique that has resonated so strongly among pianists and pedagogues. Matthay warned that focusing on visible motions in piano technique detracted from addressing the more subtle, less obvious movements vital to a coordinated technique. Underlying the invisible motion was forearm rotation—a fundamental motion to many technique methods today. Unfortunately, many pianists, students, and scholars in the piano pedagogy field have difficulty deciphering Matthay’s thoughts due to his obtuse writing style and complex theories (Gordon, 1991; Gerig, 2007). Gordon describes Matthay’s convoluted writing: “his sentences are long, involved, and interlaced with descriptive words and phrases that are not clearly defined” (p. 330). Even Matthay recognized that his ideas about relaxation had been misconstrued to mean dropping arms with absolutely no control, leading to a flaccid and ineffective over-relaxed state (Bernstein, 1981). Although pedagogical literature of Breithaupt and Matthay’s time represents an enormous contribution to the development of piano technique, instructions and concepts have not always been clearly communicated, leading to further confusion and misconceptions in the pedagogical literature (Prater, 1990; Gordon, 1991; Gerig, 2007).

2. Scientific approaches

By the 1920s, pianists began to question the validity of the former approaches and looked to science to help answer questions about the mechanics of the physical aspect of playing the piano (Gerig, 2007). Individuals with backgrounds and knowledge in both science and piano began to conduct a more systematic and analytical examination of piano technique. The following is an overview of contributions from Otto Ortmann and Arnold Schultz to this important development of piano technique.

2.1 Otto Ortmann

The analytical and scientific approach to piano technique culminated with the work of musician and scientist, Otto Ortmann (1889-1979). In his own laboratory, with especially designed equipment, Ortmann undertook an objective and scientific analysis of the mechanisms of the human body and the piano. Topics included the body's skeletal, neural, and muscular functions; biomechanical and anatomical considerations; joint function; gravity and muscular function; as well as the effects of speed, force, and range of motion on muscular contraction and coordination. Two books by Ortmann, *The Physical Basis of Piano Touch and Tone* (1925) and *Physiological Mechanics of Piano Technique* (1929), changed the direction of subsequent developments in piano technique (Gerig, 2007; Gustafson, 2007). In a thesis analyzing Ortmann's research on tone production on the piano, Amy Gustafson (2007) contends Ortmann's work, *"*marked the turning point in the history of piano pedagogy and set a new standard for piano-related scholarship" (p. 1). Gustafson adds that most scholarly work on the topic of piano technique refers to principles established in Ortmann's work. Although recognized for his meticulous science-based approach to piano technique, Ortmann's writing has been

criticized as being too scientific and difficult to translate to the practical applications of pedagogy (Prater, 1991; Prostakoff & Rosoff, 1997; Gerig, 2007). While many of Ortmann's theories ring true today, continued research and dramatic developments over the past hundred years reveal some inaccuracies (Russell, 2006; Gerig, 2007; Vant, 2007). In an article that examines the relationship between piano pedagogy, piano technique and playing-related injuries, Donald Russell (2006) points to Ortmann's incorrect definition of weight and the resulting difficulty in understanding the concept of arm weight in piano playing. Scientific inquiry into piano technique is dynamic and our understanding of movement is constantly changing with technological advances. Despite the fact that scientific explanations of physical movement were often inaccurate prior to the 1950s, many recent pedagogical principles of piano technique are, to a certain degree, premised on Ortmann's findings (Prater, 1990; Gerig, 2007; Gustafson, 2007; Vant, 2007).

2.2 Arnold Schultz

Arnold Schultz (1903-1972), pedagogue and writer, built on Ortmann's findings to develop his own theories. Combined with an in-depth study of Ortmann's experiments, a solid knowledge of anatomy, physiology, physics and acoustics, a rigorous scrutiny of previous piano technique theories, and empirical analysis, Schultz advanced piano technique with his discovery of finger co-ordination (Newman, 1984; Gerig, 2007). Schultz's work culminated in two important books on piano technique: *The Riddle of the Pianist's Finger and its Relationship to a Touch-Scheme* (1936) explores the aspect of finger coordination and *A Theory of Consciousness* (1973) presents psychological considerations. Schultz considered finger coordination the crux of mastering technical skill. It was imperative that pianists understand the musculature and function of the

fingers. After an extensive examination of different combinations of muscles to move and fixate fingers, hand, forearm, and upper arm, Schultz concluded that pianists must coordinate the small finger muscles with various combinations of forearm and upper arm muscles for the most desirable control of tone, velocity and endurance. He recommended different types of movements based on a detailed analysis of various combinations of the muscular interaction of the fingers and different ways to stabilize joints. Schultz's own experiences ran counter to the dogmas of the popular arm weight and relaxation school; he realized that fixation at joints was necessary for movement and that complete relaxation was impossible. Believing that relaxation was more of a nervous issue, rather than muscular, Schultz stressed the importance of the psychological aspect of piano technique (Gerig, 2007). Schultz felt strongly that the excessive emphasis on relaxation in the pedagogical literature had contributed to erroneous concepts in piano technique. In part, he blamed the use of the terms "arm weight" and "relaxation," believing that this language did not accurately describe the pedagogues' true intent. Believing that the words "arm weight" and "relaxation" had infiltrated the pedagogical literature, Shultz contended that pianists had developed dangerous ideas of the sort of movement needed to play the piano (Gerig, 2007). Even though Schultz raised awareness of the dangers of arm weight and relaxation concepts and contributed significantly to the role of finger coordination in piano technique, scholars have criticized his writing as complicated and difficult to follow (Prater, 1990; Gordon, 1991; Gerig, 2007). Compounding problems in communication, Shultz developed a specialized terminology to explain complex concepts. Terms such as contra-fixation, trans-fixation, contra-weight, and contra-pressure describe intricate movements, a vocabulary that has not been widely adopted in the piano pedagogy

literature. Unfortunately, Schulz's complicated language and concepts prevented many of his ideas from reaching a wider audience (Prater, 1990; Prostakoff & Rosoff, 1997; Gerig, 2007).

3. Individualized approaches

Even though pedagogues from the early to mid-twentieth century provided valuable insight into the mechanics of piano technique, many pianists considered their objective methodology and language too scientific and clinical (Prater, 1990; Gordon, 1991, Gustafson, 2007; Gerig, 2007; Vant, 2007). By the middle of the 20th century, experts in the piano pedagogy field felt the artistic elements of piano playing had been overlooked and that piano technique needed to be couched in language easily understood by pianists (Prater, 1990; Gordon, 1991; Gerig, 2007). Combining previously established scientific and anatomical principles with personal experience and opinions, pedagogues developed their own approaches to piano technique to write numerous books on the topic. As a whole, this literature represents an extensive and valuable source of quasi-scientific and highly individualized theories and ideas. Recognizing that numerous influential teachers from this time period have contributed to the body of knowledge, this overview will focus on a selection of pedagogues that include Abby Whiteside, George Kochevitsky, Seymour Fink, and Seymour Bernstein. Writings from these authors highlight important changes in the direction of piano technique and the ensuing problems in the use of terminology.

3.1 Abby Whiteside

Abby Whiteside (1881-1956), an influential pedagogue, stands out for her original contributions to the topic of piano technique and her commitment to putting theory into practice in the piano studio. Although familiar with anatomy and Ortmann's writings, Whiteside departs from this scientific approach to form her own approach grounded in empirical research of playing and teaching. Whiteside's motivation to discover an efficient physical approach to playing the piano was rooted in her obligation to her piano students. Convinced that all students, regardless of talent and ability could master the physical technical aspects of piano playing with the appropriate guidance, Whiteside devoted her work to seeking solutions to overcoming physical hurdles students encountered when playing the piano. Two books by Whiteside describe her evolving theories and thoughts on this subject: *The pianist's mechanism* (1929) and *Indispensables of piano playing* (1955). A third book, *Abby Whiteside on piano playing & Mastering the Chopin Etudes and other essays* (Prostakoff & Rosoff, 1997), contains a posthumous collection of Whiteside's essays, compiled by two of her students, Joseph Prostakoff and Sophia Rosoff.

Adopting a holistic approach, Whiteside emphasized the interconnections between an acute sensitivity to the mental, aural, physical, and musical aspects of piano technique. Based on the premise that rhythm is the governing and generating force behind a coordinated technique, Whiteside encouraged students to feel the rhythm in the torso and then transmit this energy to the upper arms. Whiteside believed that the upper arm played a central role in technique, and that it "must run the show" (Prostakoff & Rosoff, 1997, p. 7). She strongly condemned any attention to muscular effort in moving the fingers; if

the torso, shoulder, upper arm and forearm were well coordinated, the fingers would assume their natural function. Whiteside also criticized the concept of relaxation: "Action does not necessarily mean the moving of a lever; it may mean simply holding that lever in alert readiness for movement. It certainly does not mean relaxation. It is the cat ready to spring—not the cat sleeping in the sun" (Prostakoff & Rosoff, 1997, p. 37). Believing that imagery stimulated the students' imagination and physical capacity, Whiteside's writing incorporates a myriad of inventive terms to convey movement patterns. A glossary of 25 terms and definitions in *Indispensables of Piano Playing* includes expressions such as "against the bone, traveling, outside the power stream, staying down, throw. drop. snap."

Even though Whiteside has attracted a large following, some scholars have questioned Whiteside's extreme position regarding the peripheral role of the fingers. Gerig (2007) warns, "In correcting the evil excesses of the older 'finger gymnastics,' she virtually ruled out the legitimacy of all pure finger action and adopted an almost Breithauptian point of view" (p. 467). Wristen (1998) also contends that Whiteside's emphasis on the role of larger muscles in playing the piano ignores the important role of the smaller muscles of the fingers in executing faster movements. In her doctoral thesis comparing methodic approaches of Josef Lhévinne and Abby Whiteside, Martinez (1990) argues that though there are many merits in Whiteside's approach, the exclusion of finger action can be limiting and advocates for a more balanced approach that includes more attention to the role of active fingers in piano technique.

3.2 George Kochevitsky

Although the title of George Kochevitsky's book, *The Art of Piano Playing: A Scientific Approach* (1967) suggests a method of piano technique premised on scientific

principles, this book represents a very personal theory that turned the focus from the physical to the mental aspect of piano technique. Kochevitsky felt the attention given to the anatomical and physiological methods failed to acknowledge the significant role of the central nervous system played in playing the piano: " It [the physiological and anatomical school] did not take into account the more important aspect of technique—the work of the brain, of the central nervous system, which directs and controls the activity of our playing apparatus" (p.10). Kochevitsky's work marks an important stage in the development of piano technique: prior technical approaches focused on what physical movements were needed to play and on how to execute these movements, but Kochevitsky began to consider a different point of view—how to think and regulate movements (Level, 1993). Based on the theory that movement originated in the brain and that the conception of the sound becomes the catalyst for appropriate physical motion, Kochevitsky placed great emphasis on developing mental control to reinforce proper nerve impulses to control muscles. Arguing that cultivating audiation was paramount to successfully developing optimal muscle tonus, Kochevitsky identified many benefits from his approach: precision, facility, dexterity, tonal control, and most importantly, the ability to project musical intent. Kochevitsky joined the ranks of other pedagogues such as Ortmann, Schultz, and Whiteside, raising concerns on the subject of relaxation and tension, once again noting that an absence of tension and a total state of relaxation negates any movement or muscular activity.

Pianists have recognized great value in Kochevitsky's original and important contribution to technique (Gordon, 1990; Gerig, 2007). Nonetheless, Wristen (1998) has identified inaccuracies and inconsistencies, pointing to Kochevitsky's erroneous theory

that undue workload on the muscles would result in atrophy. Wristen notes a few peculiarities such as Kochevitsky's advice to exert pressure into the key bed after the note has sounded. In addition, vague instructions, such as raising the fingers to cultivate sensitivity, not only runs counter to prevailing theories, but fails to specify how high the fingers should be lifted.

3.3 Seymour Fink

In 1992, Seymour Fink, a retired piano professor in the Department of Music at the University of New York, contributed to the canon of piano technique with his book *Mastering Piano Technique* (1992) and DVD, *Mastering Piano Technique* (1994). Along with concepts that are, in part, derived from the principles established by Ortmann and Schultz, Fink bases his findings on years of observation and analysis of physical movements at the piano. The book and DVD entail a series of ten fundamental movement patterns away from the piano involving the shoulder girdle, arms, hands, and fingers as well as three integrative movement patterns at the piano. Fink devises his own terminology to describe an extensive catalogue of movement patterns, including terms such as joggling, hand scoops, arm cycling, pulling midjoint touch and squeezing finger. Terms used to describe anatomy and directional movements blend scientific and non-scientific terms. In describing the anatomy of the thumb (p. 17), Fink mistakenly identifies three phalanges, whereas in fact, the thumb is comprised of two phalanges. Reviews of Fink's work have been mixed. Although a valuable resource, the content has been criticized as dry and somewhat disorganized (Adderly, 2006), perhaps a limiting factor in its broad appeal.

3.4 Seymour Bernstein

Seymour Bernstein's contributions to the piano pedagogy field spans many decades: an accomplished pianist, composer, clinician, pedagogue, and writer, Bernstein's popular books encompass the philosophical, psychological, and physical aspects of playing the piano. Two of his books, *With Your Own Two Hands* (1981) and *20 Lessons in Keyboard Choreography* (1991) are of special interest to the topic of piano technique. Bernstein addresses what he considers to be the most salient and commonly misunderstood concepts that have hindered many pianists' technique: arm weight, relaxation, and tension. Like Schultz, Whiteside, and Kochevitsky, Bernstein points to the pitfalls of extreme relaxation and the accompanying loss of control. He cautions against abandoning all muscular tension, stating: " Every activity in life demands a certain degree of muscular control" (Bernstein, 1981, p. 130). On the other hand, Bernstein warns too much tension may inhibit motion and enumerates different states of tension as organized tension, controlled tension, muscular tension, and emotional tension— all desirable states that contribute to a coordinated technique. *20 Lessons in Keyboard Choreography* (1991) presents an exploratory approach of a variety of movements away from and at the piano. Movements such as upper arm pushes, pulls, and rolls are represented with special symbols and then later synthesized for performance. After exploring a variety of finger shapes, Bernstein describes the most desirable finger shape as taut, a quality that provides flexibility and strength.

Bernstein's approach presents some very unusual tactics, including the use of arm weights to cultivate a sense of heaviness in the arms while playing the piano. Many practices run counter to prevalent theories, including exercises to stretch the knuckle and

lifting the fingers high to encourage independence. He is especially critical of the common practice to allow arms to fall freely and focuses on the active fingers' role in playing the piano. Contrary to Whiteside's belief that the centre controlled movement at the fingers, Bernstein states, "Always remember one thing: your taut fingers initiate all rotational movement. To put it another way, your fingers commence the movements of your arms, and not the other way round" (Bernstein, 1991, p.101). Favorable reviews reveal Bernstein's popularity (Cockey, 1997b), perhaps surprising, given Bernstein's readiness to criticize prevalent theories regarding tension, arm weight, and free fall and his diverging views regarding finger independence.

4. Injury-preventive approaches

Up to the mid-twentieth century pedagogical literature on the subject of piano technique focused primarily on improving performance. Even though playing-related injuries have plagued pianists for generations, acknowledgement of this significant problem has only come to the forefront over the past thirty years (Rogers, 1999; Turon, 2000; Bragge, Bialocerkowski, & McMeeken, 2005). Given the enormous physical, emotional, and monetary impact on a musician's wellbeing (Wu, 2007), musicians are extremely motivated to learn how to prevent injuries (Redmond & Tiernan, 2001). Many scholars and studies point to technique as both a risk factor and preventive measure in playing-related injury (Brandfonbrener, 1990; Wristen, 1998; Turon, 2000; Yoshimura Paul, Aerts, & Chesky, 2006). In an effort to establish an injury-free technique, pedagogues have looked to the sports medicine field, as well as biomechanics and anatomy, to learn how principles of efficient movement may be applied to piano technique (Norris, 1993; Wristen, 1995; Rogers, 1999; Lister-Sink, 1996, 2008). The convergence of

these fields and the attention to injury preventive strategies has resulted in the emergence of a variety of approaches to piano technique. An examination of the thrust of some of these popular methods highlights common threads that unite and distinguish these methods from each other.

4.1 Dorothy Taubman

Dorothy Taubman, widely recognized for her approach to injury-free piano technique, purports to prevent and even remedy playing-related injury, garnering her a reputation as "the pianist's medicine woman" (Harman, 1987). Taubman's theories stem from many years of teaching and observing pianists, a study of Ortmann's and Matthay's theories, and knowledge of anatomy and physiology (Turon, 2000). Taubman's approach continues to be espoused via seminars, lessons from specially trained teachers in her method, an active Taubman Institute and Taubman learning centers. An extensive set of DVDs entitled *The Taubman Techniques* (Bloomfield et al., 2001), containing twenty hours of lectures and demonstrations from both Taubman and her assistant at that time, Edna Golandsky, makes available her philosophy and detailed approach to piano technique. Based on the premise that physical misuse causes playing-related-injury, Taubman advocates physical movements that require minimum effort, that do not cause discomfort, and that follow 'scientific procedures'. The finger, hand, and forearm work together as a unit for unified movement with forearm rotation playing an integral role in a free and effortless technique.

Taubman dispels many traditional pedagogical practices by identifying harmful practices such as finger individualization, fixation, curled fingers, arm weight, dropping wrists, and an overly active upper arm. Frequent warnings regarding 'dual muscular pull',

defined as the simultaneous activation of opposing muscles, occur throughout the lectures and demonstrations in the DVD set. Taubman believes that dual muscular pull creates tension, and that even, "The slightest degree of tension will limit motion" (Volume 1, chap. 5). Similarily, fixation may impede free movement: "In fixating the arm while playing to move the fingers quickly, it could be compared to horses pulling along a train without an engine" (Volume 1, chap. 3). A specialized pianistic vocabulary emerges from Taubman's theories: 'resting down' is an important term that describes a state of equilibrium with weight distributed equally between the finger, arm and forearm in order to cultivate a sensation of being held up by the key. 'Walking hand and arm' refers to the unified movement essential to skeletal alignment. Shaping refers to the movement in and out of the black and white keys. Single and double rotations comprise the visible and 'invisible motion' as described by Matthay, a vital component of the Taubman technique. Taubman has attracted many adherents to her approach and she has been widely recognized as having made a valuable contribution to injury-prevention technique (Mark, 2003; del Pico-Taylor, 2005; Dybig, 2007). However, Wristen (1995) raises concerns about the necessity of the extra movements produced by the pronation of the thumb and questions the existence of rotational movements in faster passages (p. 68), a hallmark of Taubman's technique.

4.2 Barbara Lister-Sink

Over the past two decades, Barbara Lister-Sink has established a niche in the piano pedagogy field with her systematic approach to injury-preventive keyboard technique. Believing that excessive and accumulated muscle tension resulting from playing the piano is one of the prime causes of playing-related injury, the title of her

popular instructional DVD, *Freeing the Caged Bird* (Wingsound, 1996, 2008), first released in 1996, with a reissue in 2008, is a metaphor for the release of unnecessary muscular contraction during piano playing. A frequent contributing author to major music periodicals and professor at Salem College in North Carolina, Lister-Sink offers ongoing workshops and teacher training. Designed as a sequential method, the first step is to cultivate a kinesthetic sensitivity to the state of muscle tension to control rapid contraction and relaxation. The pianist must then perfect sound production using the "basic stroke". Lister-Sink breaks the basic stroke into four steps: easy and efficient lift, a free fall of the forearm with optimal skeletal alignment, appropriate muscle contraction at the moment of sound production, and an instantaneous release of all muscles. Lister-Sink instructs the pianist to "relax the arm muscles completely to a state of release to which the pianist must always return" (chap.1).

Terminology used in the Lister-Sink video is mostly limited to describing muscular states: excessive tension and contraction are viewed as undesirable states while release and relaxation are deemed the most advantageous for a healthy and coordinated technique. In a review of *Freeing the Caged Bird*, Sarah Day (1997) considers this DVD a valuable addition to cultivating injury-free technique, however she feels that the extreme emphasis on minimizing physical effort causes "the viewer to wish the pianist felt *more* musical involvement" (p. 1228). Cultivating this tension-free, ultra-relaxed state is the centerpiece of the Lister-Sink method, yet a potential source of confusion when considering other pedagogues' views of relaxation such as Ortmann, Schultz, Bernstein, and Taubman, who state categorically that total relaxation cannot exist in a coordinated piano technique. Lister-Sink defines relaxation in terms of metaphor and

similes, free fall of the arm should feel like dropping the arm like heavy bricks, an instantaneous sensation of lightness should feel as if the hand and arm was a ping-pong ball bouncing up. Although an effective pedagogical tool, this language does not always clearly define this muscular state integral to her method.

4.3 Thomas Mark

Thomas Mark (2003) offers a unique contribution to this field with his book and DVD (2003) both entitled *What Every Pianist Needs to Know about the Body* (2003). In addition to these resources, Mark offers courses and lessons for special training to cultivate an awareness of important anatomical principles relevant to playing the piano. Mark takes a very different approach and does not offer a step-by-step method to piano technique; rather, he provides an overview of anatomical principles relevant to piano playing. In order to cultivate a kinesthetic awareness of how we move, Mark believes that pianists need to understand how joints and muscles function properly. An in-depth study of key joints from the ankles to the neck and head is provided. Mark stresses that learning the anatomical terms and type of movement available at each joint reinforces an intellectual understanding of how the body works, which in turn, enriches kinesthetic sensitivity. Not knowing how to move in accordance with the body's natural design produces tension and stiffness, qualities which Mark views as negatively impacting movement and a chief cause of playing-related-injury. Other factors contributing to playing-related-injury include co-contraction, finger curling, ulnar deviation, incorrect rotation, excessive force, and awkward skeletal positions.

Pianists have found Mark's work of great value in providing a bridge between the anatomical and piano fields though the video format has been criticized for its very dry

and lackluster presentation (Berenson, 2005). Mark employs anatomical terminology, however, he is not always consistent. After a detailed explanation of the different joints that make up the shoulder complex, Mark provides the ambiguous statement: "There is a rotational release at the shoulder joint that is important for pianists" (p. 79). The reader is left wondering which shoulder joint and release he is referring to. Even though anatomical names of the joints are crucial to the overall thrust of Mark's book and video, he offers an apology for using technical terms and reverts to general labels at times, thus losing the ability to consistently convey precise information.

4.4 Fred Karpoff

In 2009, Fred Karpoff, acclaimed pianist and professor of piano at Syracuse University, introduced his own approach to piano technique, *3-D Piano Technique*, consisting of a set of six DVDs (280 minutes) and an accompanying study guide. Personal experience in overcoming playing-related-injury provided the impetus for Karpoff to develop an injury-free technique based on three-dimensional movement—gestures that Karpoff describe as moving from left to right, in and out, up and down. Karpoff incorporates principles of these movements with proper postural alignment, cultivating a quiet hand with non-playing fingers resting on the keys, transference of arm weight, free fall, and muscular release at the point of sound. Starting with single notes, and gradually adding 2, 3, 4, and 5 note slurs and then proceeding to technical elements such as scales, chords, arpeggios, octaves, tremolos, and trills, Karpoff blends both conceptual and pedagogical elements by demonstrating and then teaching each concept to students in a studio setting. Using the ubiquitous Hanon exercises to reinforce his concepts, Karpoff warns that Hanon's instructions to raise fingers can be very harmful,

but believes that "if practiced with a physiological sound approach, Hanon exercises are an ideal vehicle for developing 3-D technique". Like Taubman, Karpoff cautions that curled fingers will result in engaging opposable muscles simultaneously, thus limit free playing by creating undue tension. He believes the flexors and extensors must be used in alternation and that this "antagonist relationship must be respected".

Karpoff employs a mix of anatomical and general terms, at times specific in his description of joints such as metacarpophalangeal joint and sternoclavicular joint, at times more vague in his use of general terms such as shoulder and first digit of the finger. Descriptive terms describing physical gestures include free fall, elliptical shaping, cycling motions, and vibrato technique. Given that 3-D technique is a recent addition to the pedagogical literature, reviews are limited to positive personal testimonials.

4.5 Alan Fraser

Alan Fraser, professor of piano at the University of Novi Sad in Serbia, employs very different tactics in his approach to piano technique in his book, *The Craft of Piano Playing*, (2003) accompanying DVD (2003) and workbook, *A Study Guide to The Craft of Piano Playing* (2009). His most recent book, *Honing the Pianist Self-Image* (2010) builds on his skeletal-based technique. An active clinician, writer, and performer, Fraser offers workshops, writes extensively, and maintains an in-depth website offering advice, comments, and feedback on piano technique. Combining his background in Feldenkrais, Eastern Martial arts, and his association with pianist Kemal Gekich, Fraser's DVD, *The Craft of Piano Playing* (2003) leads the pianist through a series of exercises away from and at the piano to cultivate sensitivity to the skeletal structure and its inherent strength and function. In particular, the supported metacarpophalangeal joint is the key to optimal

playing in Fraser's approach. If the metacarpophalangeal joint provides a strong arch, fingers can form a solid bridge, and in turn, the arm, shoulder, and torso can participate with an optimal degree of tension and relaxation. Fraser eschews many of the commonly held negative views of stiffness, tension, active fingers, curled finger shape, and co-contraction, arguing that these all have a function and serve a purpose in piano technique. Unlike Taubman and Lister-Sink, his primary concern is not a technique founded on injury-prevention, "minimizing the risk of injury should not be the goal of technique, but it certainly can be a welcome byproduct, because as it turns out, the most effective way to maximize orchestral colour is also usually the healthiest!" (Fraser, 2003, p. 37). Nor does Fraser agree with the prevailing view that a technique should be premised on the most efficient movement for the least amount of effort. Fraser states, "Another, contrasting, idea is that sometimes an intense *effort* in the correct place is the best path to effective empowered relaxation" (p. 26).

Articulating his concepts with a distinctive lexicon, Fraser interlaces Feldenkrais and martial arts concepts, employing terms such as functional integration, Yin/Yan, and equates legato playing to T'ai Chi walking. Much of the vocabulary evokes an intensity that has been largely avoided in other literature. Words such as strength, vigor, galvanize, force, empowerment, activation, potent structure, cobra strike, whip, describing the "fingers of steel wrapped in velvet", banded fingers, all speak to the sense of power that Fraser promotes in the physical aspect of technique. Fraser's knowledge in anatomy is reflected in his use of anatomical terms, although these are not always used consistently. Mayumi (2009) believes that some of Fraser's exercises can present "physically challenging positions" and disagrees with some of the movements that encourage finger

individualization. In his review of the book for the journal *American Music Teacher*, Louis Nagel (2003) finds many merits to Fraser's book but warns that it can be difficult to read and some aspects demand careful consideration before putting into practice. Fraser's unorthodox approach has not been without controversy. On his website, Fraser features a lengthy debate on the subject of arm weight between himself and Raymond Banning, professor of piano at Trinity College, documented in letters from the UK Piano Teachers' Weekly Newsletter. At times, this debate seems to revolve more around the semantics and definition of concepts than the actual principles themselves. After much discussion, Banning concedes "it may be that, by and large, Alan and I agree on most things and just see the same matter from a different angle, or use different terminology" (http://alanfraser.net, retrieved October 29, 2010).

Chapter 2: Research Problem and Methodology

1. Research problem

As shown in the literature review, the main themes that mark the evolution of keyboard technique continue to resonate. The divide between the two schools of finger action and arm weight technique, the development of varied and highly personalized methods, and the difficulty in incorporating scientific knowledge with pedagogical approaches, continue to define the direction of piano technique.

Debates between the two schools of finger action and arm weight surface today just as they did when Matthay first introduced the concept of arm weight technique over a century ago. Schultz's attention to finger coordination differs greatly from Whiteside's view that all movement is initiated from the torso with minimal finger activity. Over sixty years later, these contrasts are echoed in Fraser's attention to finger activity and Lister-Sink's emphasis on the freely falling weight of the arm. Underlying these debates is a language that fails to clearly communicate the concept of arm weight. In a study comparing the methods by Josef Lhevinne and Abby Whiteside, Martinez (1990) points to the great controversies surrounding the concept of weight in piano playing: "Probably because of the lack of a clear definition of the concept, or the assumption that it means more or less than the actual word suggests, teachers and pianists debate the importance and correct use of weight to produce solid and beautiful sound" (p. 80). Indeed, the recent public disagreement on the merits of arm weight between Fraser and Banning has also

been blamed on a language that does not clearly communicate the meaning of arm weight.

Attempts to clarify often add to the confusion. Pedagogues introduce their own terminology with extensive glossaries of invented terms to describe and explain complex movement. This literature review revealed an enormous catalogue of personalized terminology from pedagogues such as Schultz, Whiteside, Fink, and Bernstein. For example, Schultz's terms 'contra-fixation' and 'trans-fixation' describe different ways to stabilize joints; Whiteside describes different motions as 'bone against bone,' and 'outside the power stream;' Fink invents terms such as 'joggling' and 'pulling mid-joint;' and Bernstein prefers to define tension as either controlled, muscular, or even emotional. Given this diversity of terminology, it is possible that these varying and sometimes complex terms have served to contribute to the confusion rather than clarify.

In reviewing current approaches, similar tendencies to use inconsistent terminology were found when authors referred to the parts of the body important to playing the piano. There is an attempt to use anatomical terms, but in many cases, the authors blend personalized terminology with anatomical and borrowed terms and even invent their own metaphorical terms. This vast array of terminology is shown in Tables 1.1-1.5 when authors Lister-Sink, Taubman, Mark, Karpoff, and Fraser use different terms to describe anatomy commonly referred to in piano technique. Switching from anatomical to colloquial to highly imaginative language, the authors lack a common language in what to call the shoulder, arm, hand, and fingers.

Table 1.1 *Terms to identify joints: Lister-Sink (1996, 2008)*

Body Part	Anatomical Terms	Common Terms	Invented Terms[1]
Shoulder complex	Sternoclavicular joint	Shoulder blades, Shoulder girdle, Shoulder joint, Ball and socket joint	Shoulder lever
Arm	Radius, Ulna. Sternoclavicular joint	Arm, Upper arm, Forearm	Forearm Lever
Wrist	Carpal bones	Wrist joints, Wrist joint	
Hand	Metacarpal area of the hand	Hand	
Fingers	Phalanges	Fingers	Levers

Table 1.2 *Terms to identify joints: Taubman (2001)*

Body Part	Anatomical Terms	Common Terms	Invented Terms
Shoulder complex		Shoulders	
Arm		Upper arm Forearm	
Wrist		Wrists	A bridge to forearm and hand Wrist as fulcrum
Hand		Hand Knuckles	
Fingers	Phalanges	Fingers	Nail joints, "This joint"

Table 1.3 *Terms to identify joints: Mark (2003)*

Body Part	Anatomical Terms	Common Terms	Invented Terms
Shoulder complex	Clavicle, Scapula, Sternoclavicular joint, Glenoid fossa of the Scapula, Gleno-humeral joint	Collarbone, Shoulder blade, Shoulder joint, Shoulder	
Arm	Sternoclavicular joint Humerus, Ulna, Radius	Arm, Lower arm of forearm,	
Wrist	Carpal bones, Carpometacarpal (CMC) joints, Midcarpal joint, Radiocarpal joint Articulation of radius and wrist bones Joint and structure	Wrist joints	Not a simple hinge joint
Hand	Metacarpals, Metacarpophlangeal (MCP) joints	Main knuckle	
Fingers	Phalanges Proximal interphalangeal joints Distal interphalangeal joints		Second joints of the fingers, End joints of the fingers.

[1] These invented terms include borrowed terms with authors adding a new meaning to describe structure of joints.

Table 1.4 *Terms to identify joints: Karpoff (2009)*

Body Part	Anatomical Terms	Common Terms	Invented Terms
Shoulder complex	Sternoclavicular joint	Shoulder joint	Levers
Arm		Arm	
Wrist		Wrist	
Hand	Metacarpophalangeal joints	Knuckles	
Fingers	Phalanges	Finger tips	
	First phalanx	Finger joint	

Table 1.5 *Terms to identify joints: Fraser (2003, 2010)*

Body Part	Anatomical Terms	Common Terms	Invented Terms
Shoulder complex	Sternoclavicular joint	Shoulder girdle	
Arm	Radius	Arm	
Wrist		Wrist	Double hinge joint 4-way hinge joint A chain
Hand	Metacarpophalangeal (MCP) joints, Metacarpals,	Knuckle 2nd knuckle joint Top knuckle	Stable platform Firm base Oilrig platform Ultra-proximal phalange Fourth set of phalanges (describing metacarpals) Hummocks (describing MCP joints) Little hummock Knuckle mounds Ridge of knuckles Hillock MCPs
Fingers	Distal phalange Medial phalange Proximal phalange Middle phalange Distal interphalangeal joint Proximal interphalangeal joint Metacarpophalangeal joint	Fingers Digits Middle joint	Pylon Supporting pylon Yin and Yan fingers

These tables show that although all of these authors purport to base their approaches on anatomical principles, the language used to identify the shoulder, arm, hand, and fingers does not always reflect this. Taubman stresses the importance of a science-based technique, but almost always uses general terms. Similarly, Karpoff uses mostly general terms with little detail to explain what part of the hand or fingers to which he is referring. Mark argues that using general terms to describe anatomy fails to impart specific and accurate information, as is demonstrated in the detailed anatomical terms he uses. Fraser also employs anatomical terms and adds to this with an invented and extensive vocabulary to describe hand and fingers with terms such as metacarpophalangeal joints to stable platforms, knuckle hummocks, and pylons. Not only is there little consensus in how to identify joints among the approaches, there is often inconsistency within the approaches. For example, Mark clearly identifies all the different joints of the shoulder complex, but then uses the general term 'shoulder joint'—a term that he criticizes for failing to provide enough specific information. Lister-Sink uses many general terms, 'shoulder', 'fingers', but then switches to terms such as 'sternoclavicular joint' and 'phalanges'. Attempts to blend anatomical information with invented terms result in a degree of inaccuracy. Although Fraser stresses the importance of knowing that the thumb consists of two phalanges—he also refers to the thumb as having three phalanges, inventing the term 'ultra-proximal phalange' to encourage more mobility at the thumb. This example of how pedagogues use inconsistent terminology, among and within their pedagogical approaches, points to the possibility that problematic

language may be indeed at the root of the confusion that was found in this literature review.

Concerns that the inconsistency and inaccuracy of pedagogical usage of scientific language is more widespread have been raised in a recent study involving the fields of biomechanics and piano pedagogy. In a study entitled *Driving point impedance measurements during piano playing*, Vant (2007) identified the gap between language and knowledge that exists between the two fields of biomechanics and piano pedagogy: "Expertise and language in the two fields are considerably different and thus the two fields are divided by a great expanse, which results in an imprecise use of terminology" (p. 34). The biomechanical concepts Vant identified as having inaccurate and inconsistent meaning in the piano pedagogical literature included relaxation, tension, and co-contraction. She also found that many early piano methods recommend a wide range of contradictory hand and finger shapes. These same concepts have also been identified in this review of literature as problematic: as we have seen, relaxation, tension, and the degree of joint stabilization offered by co-contraction were strongly criticized as being a cause of confusion by authors Schultz, Ortmann, and Bernstien. A wide variety of finger and hand shapes can be found throughout the literature. From the rounded hand position with active, curled fingers found in early keyboard technique to a natural hand structure with loose fingers recommended by proponents of the arm weight school, there is still little agreement when its comes to describing hand and finger shape to play the piano.

As shown, piano technique is a topic with a myriad of approaches that present seemingly conflicting and often complex explanations. There is evidence to suggest that one of the possible reasons for this continual cycle of disagreement and confusion is due

to problems in language. This is clearly demonstrated in the wide array of terminology that today's pedagogues use to identify joints of the shoulder, arm, hand, and fingers. There is a need to get to the root of the problems in the usage of pedagogical language and to find out how these issues of language may contribute to the confusion in piano technique.

To do this, this research will: 1. Seek where issues of language exist in piano pedagogical literature, and 2. Show how these problems may contribute to the systemic confusion in piano technique. In bringing to light the problems of language, the pedagogical community can begin to become more aware of the confusion that language may cause and can perhaps eventually develop a consensus in working towards a language that serves to clarify and improve the communication of core concepts of piano technique.

This research will conduct an in-depth investigation of how language is used in five current pedagogical approaches: *Freeing the Caged Bird* with Barbara Lister Sink (Wingsound, 1996, 2008); *The Taubman Technique*, (Bloomfield et al., 1995, 2005); *What Every Pianist Needs to Know about the Body,* (Mark, 2003); *3-D Piano with Fred Karpoff,* (Karpoff, 2009); and *The Craft of Piano Playing* (2003) and *Honing the Pianist Self-Image* (2010) by Alan Fraser. The language used to describe and define five core concepts of piano technique identified in this literature review (tension; co-contraction; relaxation; arm weight; and hand and finger shape) will be the focus of this research. The analysis will focus on two specific issues: consistency and accuracy. This undertaking is particularly important as certain scholars have examined, debated, and drawn attention to the discrepancies among the definitions of concepts of prominent pedagogues up to the

twentieth century; however, to date, no studies have conducted an analysis of the terminology used to describe piano technique of the methods of the twenty-first century. By investigating current usages of pedagogical terminology this research represents an important first step in improving communication and bringing more clarity to the language used in the pedagogy of piano technique.

2. Methodology

The following section provides information regarding the material used for this study; the design of the tables used to collect data; the steps taken to collect and summarize data; and the procedure to analyze the terminology.

2.1 Materials

The materials used for this study are divided into pedagogical approaches and scientific resources. These materials are identified and described in the following section.

2.1.1 Pedagogical materials

Even though numerous piano approaches have emerged over the past ten years, this research will be limited to five approaches presented in the literature review: *The Taubman Technique*, (Bloomfield et al., 1995, 2005); *Freeing the Caged Bird* with Barbara Lister-Sink (Wingsound, 1996, 2008); *What Every Pianist Needs to Know about the Body* (Mark, 2003); *3-D Piano with Fred Karpoff,* (Karpoff, 2009), *The Craft of Piano Playing* (Fraser, 2003) and *Honing the Pianist Self-Image* (Fraser, 2010). These approaches have been selected to provide both a breadth and depth for this analysis. The variety found within these approaches allows for an effective analysis of concepts, while the manageable number provides an opportunity to examine the concepts in more detail.

Moreover, these approaches represent current trends in piano pedagogy in their stated attention to anatomical and biomechanical principles, their intensive focus on the physical aspect of piano technique, and the mediums in which they are communicated. All of these approaches include an audio-visual component through the use of DVDs, on-line lessons, and significant presence on the worldwide web.

The following is a brief explanation and description of these materials:

1. *The Taubman Technique* (Bloomfield et al., 1995, 2001) includes a set of ten DVDs containing twenty hours of lectures, demonstrations, and master classes. The first DVD, entitled *Introductory Principles and Concepts* will be used for this study. Throughout this DVD, Taubman's assistant at that time, Edna Golandsky, reads from Taubman's lecture notes and demonstrates how to apply Taubman's principles and concepts at the piano. In addition, clips from master classes with Taubman and students are provided. For this reason, references to both Golandsky and Taubman are found in this study when referring to Taubman's work.
2. Thomas Mark's book and DVD, both entitled *What Every Pianist Needs to Know about the Body* (2003) present an overview of anatomical principles relevant to piano playing. Mark's work is based on a somatic approach called Body Mapping®. Developed specifically for musicians by Barbara Conable, Alexander teacher and founder of Andover Educators and Body Mapping®, the premise of her work is that the brain's internal representation of our skeletal structure affects the way we move: the more accurate this representation is in shape, function, and size, the more we move with greater

ease and freedom. Thus, Mark's approach delivers in-depth information about the skeletal structure in a manner that is relevant and accessible to musicians. The DVD provides an overview of the principles found in the book, but in less depth. For this reason, the book was used to gather data for this study.

3. Alan Fraser's book and DVD, both entitled *The Craft of Piano Playing* (2003) presents an approach based on Feldenkrais principles. Blending explanations with exploratory exercises, both DVD and book cover the same material. The book provides more detailed information regarding definitions of principles and concepts. Thus, this is the resource that was used for this study. In addition, data is gathered from Fraser's most recent book *Honing the Pianist Self-Image* (2010), a work that builds on principles found in Fraser's first book and DVD.
4. Barbara Lister-Sink presents a systematic approach to learning injury-free technique in a DVD, *Freeing the Caged Bird* (Wingsound, 1996, 2008). Lister-Sink explains principles and demonstrates this step-by-step method with the assistance of an Alexander Technique instructor and piano students. The content of this 160-minute DVD includes an exploration of the piano's mechanism, a slow motion analysis of movement, an examination of harmful playing habits, and steps to avoid accumulating tension while playing virtuosic repertoire.
5. Fred Karpoff's set of six DVDs, *3-D Piano with Fred Karpoff*, (Karpoff, 2009) features Karpoff presenting and demonstrating his method in unscripted lessons with twelve different students. Organized into sequential units, the

premise of Karpoff's approach is that fluid movement occupies three planes of space. The first three units are identified by Karpoff as laying the groundwork for the concepts and principles of his method. These are the units that are used for this study.

2.1.2 Scientific materials

As outlined in the research problem, the confusion in the language in current approaches often results when pedagogues incorporate anatomical and biomechanical principles into their methods. Because the fields of anatomy and biomechanics have established a standardized and recognized definition of these principles among the scientific community, these definitions will be used as benchmarks to determine the accuracy of the pedagogical usage of terminology. The following scientific materials have been selected for the manner in which they target an audience not familiar with the field of anatomy and biomechanics and are recommended resources from Andover Educators. These materials include *"Move Well, Avoid Injury"* by Andover Productions (2009) and the *Anatomy of Movement* by Blandine Calais-Germain, (1993). Other scientific materials provide standardized definitions and explanations of the concepts identified in the research problem and have been recommended by registered physiotherapists, Victoria Agar and Robert Dunlop, for providing clear explanations of the structure and function of joints and muscles. These materials include *Grant's Atlas of Anatomy* (Agur & Lee, 1999); *Applied Anatomy and Biomechanics in Sport* (Ackland, Elliott, & Bloomfield, 2009); and *The Stark Reality of Stretching: An Informed Approach of All Activities and Every Sport* (Stark, 1997).

Two theses that bridge the scientific and piano pedagogy fields are also consulted. Brenda Wristen (1998) conducted a qualitative analysis of movement patterns for selected technical tasks at the piano, *Overuse injuries and piano technique: A biomechanical approach*. This study examines specific technical tasks and recommends movement based on biomechanical principles. Christiane Vant's (2007) thesis, *Driving point impedance measurements during piano playing* conducted inter-disciplinary research between biomechanical engineering and piano pedagogy and provides definitions of tension, relaxation, and co-contraction. An additional study provides relevant and recent scientific information regarding the mechanics of arm weight technique in piano playing: *Effective utilization of gravity during arm downswing in keystrokes by expert pianist* (Furuya, S., Osu, R., & Kinoshita, H. 2009).

Personal communication with registered physiotherapists, Robert Dunlop and Victoria Agar assist in clarifying this information. Lastly, attendance and participation in a seminar on Body Mapping® conducted by Jennifer Johnson provides background information on the skeletal structure and function relevant to playing the piano.

2.2 Tools for pedagogical data collection

Tables are used to input data from the five approaches. There are several tables, with each author's work and each concept allotted a table. The following categories are included in each of the tables: context; definition/description; terms; role (positive and/or negative); and summary. The 'context' category considers the particular situation in which the concept is discussed. In this manner, patterns of association may be identified. The 'definition/description' category provides the ability to gather a broad and detailed definition and description of the concept from each author. The 'terms' category allows

for the collection of specific terminology associated with each concept. The ‘role’ category, positive and/or negative, shows whether or not the concept plays a positive or negative role in piano technique. The ‘summary’ category consolidates the information and allows for an efficient manner to gain an overview of how the concepts are defined. An example of this table is shown below in Table 2.

Table 2 *Example of table for data collection for each concept*

Context	**Definition/Description**	**Terms**	**Role**	**Summary**

After the data was collected the tables were grouped together by concept. In this manner, similarities and differences in how the authors use language to define and describe the concepts can be more easily viewed and analyzed. The descriptions and definitions of the concepts vary according to whether they contribute positively or negatively to piano technique. For this reason, summary tables synthesize the data to determine how the positive and negative role changes the manner in which the concept is defined, the underlying causes, effects, and ways to address the concept. The design of this table is shown in Table 3.

Table 3 *Example of table for summary of each concept*

Role	**Terms**	**Summary**
Positive		Usage: Causes: Effects: How to address:
Negative		Usage: Causes: Effects: How to address:

2.3 Data collection

There are two parts to the data collection. First, the data from the five pedagogical approaches is collected and recorded. Secondly, data from the scientific material is collected and recorded. The steps to collect this data are outlined below.

2.3.1 Pedagogical data collection

The process began by gathering a broad scope of definitions and terms from the pedagogical material list, with each step designed to further condense and summarize the data. The first step involved viewing the audiovisual material and reading the books listed in the pedagogical material above. This allowed for a broad overview of the material. The second step entailed recording data into tables (see Table 2 above) as the material was re-viewed and re-read from the beginning to the end of each DVD and each book. Each time the concept was mentioned in the material, the information was systematically recorded into tables. After all the raw data was collected, the entire material was reviewed and summarized into tables (see Table 3 above) for each concept and each author,

2.3.2 Scientific data collection

To become familiar with anatomical and biomechanical terminology relevant to the concepts identified in this research problem, the scientific material listed above was viewed and read. Attendance at a Body Mapping® workshop provided a deeper understanding and experience of the role of anatomical principles in playing the piano. Discussions with registered physiotherapists, Agar and Dunlop, assisted in clarifying the material. After becoming familiar with basic anatomical terminology for joints and

muscles and the scientific definitions of the concepts, the defining principles for tension, relaxation, co-contraction, arm weight, and hand and finger shape were summarized and presented in paragraph format for this research.

2.4 Data Analysis

Each concept is presented and analyzed one at a time in the following order: tension, relaxation; co-contraction; arm weight; and hand and finger shape. To introduce each concept and put in context, an overview based on material from Appendix B summarizes how each of the authors uses the language to define and describe each concept. This is followed by an analysis of the consistency of the language among the approaches and an analysis of the accuracy of the language.

To analyze the consistency among the approaches, Appendix A is consulted to identify how often the authors associate the concept with contributing positively or negatively to piano technique. Tables show the frequency of references to the positive and negative role of each concept (See Table 4). These tables allow for an overview of whether the authors consistently or inconsistently associate the concept with a positive or negative role. Appendix A and B are consulted to determine if and how problematic language may contribute to the consistencies and inconsistencies in the frequency of references to the concept's positive and negative role in piano technique. This analysis is explained and illustrated with data from Appendix A and B in written format.

Table 4 *Frequency of references to each concept as playing either a positive or negative role*

Author	Positive	Negative
Lister-Sink		
Taubman		
Mark		
Karpoff		
Fraser		
Total references from all approaches		

Terms that describe the positive and negative role of each concept as found in Appendix A and B are gathered and organized into tables. These terms are grouped into scientific, general, and invented terms as shown in Table 5. The analysis is conducted by identifying consistencies and inconsistencies of the use of language as found in the terms presented in Tables 4 and 5. Possible problems in language that contribute to consistencies and inconsistencies are examined, explained, and illustrated with the data from Appendix A and B.

Table 5 *Example of table showing scientific, common, and invented terms used by authors to describe the positive and negative role of each concept*

Author	Scientific	Common	Invented
Lister-Sink			
Taubman			
Mark			
Karpoff			
Fraser			

The analysis of consistency concludes by addressing the research problem: where do issues of language exist in piano pedagogical literature; and how do these problems contribute to the systemic confusion in piano technique.

To analyze the accuracy of the language, the pedagogical usage of the concepts is compared to the scientific definitions. First, the scientific definition of the concept is

presented and summarized into main points. These points provide a framework to organize the pedagogical material. The pedagogical usage of the concept according to the scientific definition is determined by using data from both Appendix A and B. The outline below shows how this analysis is organized.

Tension

Scientific Usage

The scientific use is summarized into main points represented as a, b, and c.

a.
b.
c.

Pedagogical Usage

The pedagogical language is presented and analyzed for its accuracy according to the 3 summary points of the scientific use.

a.
b.
c.

Lastly, the analysis of accuracy concludes by addressing the research problem: where do issues of language exist in piano pedagogical literature; and how do these problems contribute to the systemic confusion in piano technique.

Chapter 3

3. Tension

The following summary examines how each author describes and defines tension, its effects, and possible remedies. Based on the data gathered in Appendix A and the summary of the data in Appendix B, these summaries show how tension figures in each of the selected approaches.

3.1 Summary of tension

Lister-Sink

Lister-Sink explains that tension results when the brain sends signals to the muscles to contract. She believes that many people have not learned to turn off these signals because they have become so habituated to a state of tension they are not aware of its presence. Over time, the continuous contraction of muscles leads to a state that Lister-Sink refers to as 'chronic tension'. Lister-Sink believes that this type of tension creates many harmful effects. 'Blocking power', 'impeding movement', 'interfering with a free flow of energy and arm weight into the key's, tension can eventually 'paralyze and lock joints in place' (chap. 2) and become a principal cause of stress, pain, and playing-related injury. Despite these significant negative effects, Lister-Sink does acknowledge that a degree of tension is needed to stabilize joints at the moment the finger has impact with the key. However, the amount of tension is minimal. In Lister-Sink's words: "it is a question of finding the right amount of tension—no more, no less" (chap. 2). As soon as the muscles contract to support the joints, all the tension must be released. Learning to release tension instantaneously and constantly at the moment of impact with the key is

paramount to mastering the ‘basic stroke’, the foundation of Lister-Sink’s method. There are three steps needed to eliminate tension: first, the pianist must become aware of the sensation of muscle tension; second, the pianist must learn how to consciously control muscle contraction and release; and third, the pianist must learn how to apply this awareness and muscular control so that tension continuously and instantaneously releases at the moment of impact with the key.

Taubman

Taubman and Golandsky describe tension as occurring when two opposing muscles contract simultaneously. Referring to this as ‘dual muscular pulls’, Golandsky explains that this “is another name for tension…anytime that you move in a way that activates these muscles at the same time you will end up with tension” (chap. 3). Problematic finger shapes and movement are singled out as a major cause of ‘muscular pulls’ that create tension. Molding fingers into unnatural positions, curling fingers, clenching fingers, lifting and curling fingers, moving the fingers without the help of the forearm, and pushing the fingers into the key-bed after point of sound are all possible causes of tension. In addition, any twisting motions and initiating movement from the upper arm create tension. Viewing tension exclusively as a negative attribute, Taubman and Golandsky warn that tension ‘limits motion’, ‘weakens power’, ‘compromises the ability to play quickly’, ‘interferes with efficient coordination of muscles’, and eventually becomes a major cause of injury. Golandsky states: “To fixate or mold is nothing more than forms of tension, however much the amount…even a little bit would be wrong” (chap. 5). It is not a matter of telling muscles to tense or relax, but the pianist must cultivate a quality of movement that does not create tension. Aligning the forearm, hand,

and fingers so they move as a ‘unified structure’ is an important feature of creating a ‘tension-free movement’. Any deviation from this arrangement will cause harmful tension.

Mark

Mark defines tension as meaning “excessive muscular work—work in excess of what is needed to accomplish the task at hand” (p. 1). Tension figures as the most important concept of his approach, with repeated references to its negative effects. Borrowing Taubman’s term ‘dual muscular pull’ to describe opposing muscles contracting at the same time, Mark explains that this type of contraction produces “static muscular activity” (p. 53), also known as tension. Tension is mostly associated with poor skeletal alignment. Rather than moving in accordance with the skeletal structure, many people end up using too much muscular effort to compensate for poor alignment. Other causes of tension include traditional pedagogical approaches that promote curled fingers, focus on active fingers, and the stabilization of joints. Tension creates many negative effects: excessive muscular contraction puts the skeletal structure out of alignment; restricts range of movement; and impedes movement. These situations can lead to so much pain and injury that Mark contends the damage can be permanent. Avoiding tension is a major focus of Mark’s whole approach. Like Taubman, he advocates for a quality of movement free of tension that comes from an aligned skeletal structure. He explains,“ With movement organized around the bony structure, stability is achieved without tension. The muscles can release” (p. 112). In turn, releasing tension allows the skeletal structure to find its optimal alignment. Mark considers this the ultimate goal for a piano technique that is effortless and injury-free.

Karpoff

Karpoff explains that tension occurs when opposable muscles, in particular the extensors and flexors contract at the same time. Causes of tension include poor alignment of the forearm, hand and fingers, static hand and finger positions, and curled fingers. Tension can produce imbalance in the hand and eventually lead to injury. Karpoff associates playing without tension as playing with "no extra muscular effort" (Unit 6, chap. 13). To this end, he continuously instructs students to release the hands and fingers, with special attention to the non-playing fingers. Other strategies to address harmful tension include stretching the hands and the fingers during and after practice sessions. Karpoff also recommends slow, attentive playing to bring awareness to any unnecessary tension that comes from habits of poor movement.

Fraser

Fraser considers tension as contributing both positively and negatively to piano technique. Acknowledging that, "without tension, there is no life" (2003, p. 38), he also recognizes that too much tension can impede and inhibit motion. Thus, Fraser's description of tension revolves around learning to find and employ the appropriate degree of tension. To differentiate between positive and negative tension, Fraser recommends using two different terms. The terms 'muscle tonus' or 'muscle tone' describe the "appropriate muscular effort needed to hold bones in place" (2010, p. 241). The term 'tension' describes "its negative manifestations where movement is blocked" (2010, p. 241). Fraser believes that balancing opposing forces is vital to achieving an empowered technique. He argues that the supportive function that comes from the simultaneous

contraction of muscles harnesses the positive energy of tension and permits freedom of movement.

Nonetheless, Fraser recognizes many harmful consequences of excessive tension. Many of the terms associated with too much tension are associated with a "contraction with no movement" (2010, p. 237). This sort of tension limits movement, impedes movement, causes immobility, and disturbs "the equilibration of overall muscle tonus" (2010, p. 12). To learn to use the optimal degree of tension, Fraser describes numerous Awareness Through Movement (ATM) exercises designed specifically to develop heightened kinesthetic sensitivity to the skeletal structure. Instilling strong, supported arches of the hand allows the bones to bear weight and tension so the rest of the body can release. Finding an appropriate amount of tension produces 'unstable equilibrium'—a place from which all movement is perceived as effortless. Fraser concedes that finding the optimal amount of tension is not as easy as it sounds, but demands enormous mental concentration and discrimination of both its positive and negative effects. His statement that pianists must "learn to use tension intelligently" (2003, p. 37), suggests that this is a concept that demands careful consideration. A significant concept to his approach, tension has the potential to empower piano technique or to pose serious limitations.

3.2 Analyzing consistency

Tension figures predominantly as an undesirable state in all of these approaches. All the authors view tension as playing a negative role in piano technique, with only two of the five authors referring to a positive aspect of tension. As shown in Table 6, when the authors do describe tension as positive, the references are sparse when compared to the negative aspect of tension (143/157). Opposing views depend on how authors define

tension: either excessive, unnecessary muscular effort that interferes with movement, often leading to pain and injury; or necessary, minimal muscular contraction needed to stabilize joints.

Table 6 *Frequency of references to tension as playing either a positive or negative role*

Author	**Positive**	**Negative**
Lister-Sink	2/22	20/22
Taubman	0/10	10/10
Mark	0/69	69/69
Karpoff	0/12	12/12
Fraser	12/44	32/44
Total references from all approaches	14/157	143/157

Lister-Sink and Fraser acknowledge that tension is a necessity in providing important stability to joints. While Lister-Sink refers to positive tension just twice in her presentation, Fraser frequently reminds the pianist that tension is needed to keep joints in place. The terms in Table 7.1 below show that it is the amount of tension that determines its positive role. Both authors describe a minimal amount of tension needed to stabilize joints. Describing this as appropriate and necessary muscular effort, Fraser suggests that a 'natural muscle tonus' is a sign of the right amount of tension. Both Lister-Sink and Fraser allude to this muscle tonus as a tangible quality in their approaches: Lister-Sink uses physical touch to make the student aware of excess tension in the shoulders, arm, and hand; similarly, Fraser also points out that tension can be verified by checking the muscle tonus of the flesh. Of note, Fraser also expands the positive role of tension to include a tensile strength and potential to transform 'internal tension' into finger action.

Table 7.1 *Scientific, common, invented terms to describe tension as playing a positive role*

Author	Scientific terms	Common terms	Invented terms
Lister-Sink	Muscle contraction Tension Stabilize	Minimal tension Stabilize "Just the right amount of tension—no more, no less" (chap. 2).	
Taubman			
Mark			
Karpoff			
Fraser	Co-contraction Muscle tonus Tensile strength	Appropriate muscular effort Necessary muscular effort Natural muscle tonus Reduced tension Minimal tension Stabilize	Internal tension Transformative tension

In contrast to its positive qualities, negative tension is associated with excessive and unnecessary muscle contractions that interfere with movement, often leading to immobility, pain, and injury. The authors use similar terms to describe negative tension as a static quality. Terms such as rigid, locked, paralysis, and static muscular activity are often associated with too much tension. As shown in Table 7.2, the authors quantify this type of tension as excessive, extra, undue, accumulative, and significant. At the same time, authors also describe a small amount or any degree of tension as playing a negative role. Lister-Sink speaks of 'emptying' the arm of tension so that the arm can fall freely. Reading from a Taubman lecture, Golandsky states: "The slightest tension will limit motion" (chap. 5). Similarly, Mark believes that "even a small amount of tension can lead to injury when repeated thousands of times a day over a period of years" (p. 1). Karpoff encourages loose fingers so that "nothing tenses up" (Unit 1, chap. 17). Fraser identifies tension in elbows as interfering with the 'flow of arm weight' to the fingers and states: "If any tension remains in the elbows, it will interfere with the free transmission of energy

from your arm to the key" (2010, p. 207). These statements, along with the terms shown in Table 7.2, demonstrate that the language describes either too much or very little tension as contributing negatively to piano technique.

Table 7.2 *Scientific, common, invented terms to describe tension as playing a negative role*

Author	Scientific terms	Common terms	Invented terms
Lister-Sink	Muscular contraction Tension	Tension; Chronic; Excess; Accumulative; Any; Unnecessary; Resistance; Paralysis; Locks; Dangerous; Harmful	Inner tension Hidden tension
Taubman	Tension Static muscular activity	Tension; Too much muscular effort; Slightest; Tremendous; Clenching; Fixating; Tightening	Dual muscular pull
Mark	Tension Static muscular activity	Tension; Excessive; Chronic; Continual; Muscular effort; Short, narrow muscles; Constant; Underlying; Upward; Repeated Small amount; Stiff; Strain; Gripping Fixed; Holding; Squeezed Stabilize; Counteract; Compensatory	Dual muscular pull
Karpoff	Muscular tension	Tension; Accumulative; Extra Unbalanced; Excess; Reduce; Cramped; Held; Lock	
Fraser	Tension Co-contraction Excessive muscle tonus	Tension; Muscular effort; Extra Excess; Negative; Unwanted Undesired; Undue; Useless Increased; Inappropriate; Overly effortful; Any; Too much Persistent; Superfluous Opposing forces; Counterproductive Compensatory; Constraint Destabilize; Stabilize Immobility; Blocking; Inhibit	Internal Inner

All authors agree that in order to address 'harmful tension', it must be released. Although 'release' is a term that occurs frequently and consistently in all of the approaches, there is inconsistency when describing how to execute this release. Learning to release tension by consciously controlling the activation and release of muscular contractions is at the core of Lister-Sink's approach. Conversely, Golandsky states that we cannot command muscles to relax and activate; instead, we must cultivate a quality of

movement that requires no tension—only in this manner can tension be released. Fraser advocates a completely different approach in addressing tension. Believing that a structurally secure hand will allow undue tension to release in the rest of the body, Fraser promotes a hand structure that is organized around strong and pronounced three bony arches of the forefinger, thumb, and metacarpophalangeal (MCP) joints. In contrast, the other authors advocate a very loose, natural hand position to avoid tension. In fact, Taubman believes the very hand position of a pronounced MCP joint that Fraser recommends as a remedy for tension is actually a cause of tension.

From this analysis, we can see that there are both consistencies and inconsistencies in how tension is viewed. Either seeking its total absence to facilitate ease and freedom, or discerning just the right amount to stabilize joints and empower technique, these differing ways of dealing with tension can be traced to how the authors define tension. In Lister-Sink's case, when tension is defined as a necessary but temporary muscle contraction in providing stability in joints, the approach focuses on a minimal contraction that is then completely released. If tension is viewed as too much muscular effort that blocks movement, the authors focus on a piano technique that ranges from reducing tension to completely eliminating tension. In contrast, Fraser's concession that there are two forms of tension—healthy and unhealthy—results in an approach that revolves around managing tension. Fraser's attempt to differentiate between healthy and unhealthy tension by using either the terms 'muscle tone' or 'tension,' though perhaps important steps in providing more clarity in how tension figures in piano technique, is not consistently used within Fraser's own approach; nor is it a term that is used by the other

authors. Nonetheless, Fraser's proposal to use different terms to refer to healthy and unhealthy tension recognizes that there is a problem in how the term 'tension' is used.

3.3 Analyzing accuracy

To analyze the accuracy of how the authors define and use tension, the scientific use of tension is presented. Main points of the scientific explanation serve as a framework to examine the accuracy of the pedagogical usage of tension.

Scientific definition

Tension is a force. All muscular contractions produce tension to create force about a joint motion for desired motion (Vant, 2007). Muscle contractions are classified into concentric, eccentric, and isometric contractions. A concentric contraction produces enough tension to overcome resistance against a limb, causing the muscle to contract. An eccentric contraction does not produce enough tension and is overcome by resistance against a limb, causing the muscle to lengthen. An isometric contraction does not produce enough tension to either overcome or succumb to resistance against a limb and the length of the muscle remains the same (Stark, 1997). The degree of tension corresponds to the amount of resistance to these contractions. Because there is always muscular activity in any healthy muscle, tension is always present and will increase or decrease depending on the amount, duration, and type of muscular activity (Vant, 2007). The scientific use of tension can be summarized into the following points and provide a framework to examine and analyze the accuracy of the pedagogical usage of tension:

a. all muscular contractions produce tension**;**
b. the amount of tension corresponds to muscular activity;
c. and a degree of tension is always present.

Pedagogical usage:

a. All muscular contractions produce tension*: Any muscular contraction, concentric, eccentric, and isometric produces tension to produce movement, control movement, or maintain a stationary position.*

Although all the pedagogues agree that muscular contractions produce tension, with the exception of Fraser, all pedagogues exclusively associate tension with an isometric contraction that serves to maintain a stationary position and impede motion. Thus, the majority of terms referring to tension found in the pedagogical approaches do not consider tension's role in producing and controlling movement. Terms such as fixate, tighten, hold, lock, and stiffen, repeatedly emphasize a static quality of tension. Fraser stands out as the only author who allows that tension is present in all types of muscular contractions. He argues that the supportive function that comes from the simultaneous contraction of muscles can free movement, describing positive tension as "two opposing muscle groups working purposefully one against the other, to achieve musical ends" (2010, p. 38). Nonetheless, Fraser does propose reserving the word 'tension' to describe a contraction that serves to block movement, not produce or control movement. In this manner, Fraser joins the other pedagogues in strongly viewing tension as a form of anti-movement, rarely as positively contributing to producing or controlling movement. Although it is true that tension can resist movement, the language found in the pedagogical approaches narrows the description of tension to a product of isometric contraction and fails to acknowledge its role in producing and controlling movement

from concentric and eccentric muscle contractions.

b. Amount of tension corresponds to muscular activity. *The degree of tension varies according to the amount, duration, and type of muscular contraction.*

There is a tendency among the pedagogues to present extremes of either too much or a total absence of tension with little reference to the possibility of something in-between to accommodate changing situations. The pedagogues share the common concern that poor movement patterns and poor skeletal alignment will lead to an increase of quantity and duration of tension. Extra effort is required to move; therefore, tension accumulates and is generally regarded as too much. According to Mark, tension decreases when using just the right amount of muscular effort to execute the task at hand. In this manner, there is an acknowledgement that tension increases and decreases with effort. However, there are challenges in finding an optimal degree of tension that will provide stability but not impede movement. In Lister-Sink's words: "It is a question of finding just the right amount of tension—no more, no less" (chap. 2).

c. Tension is always present: *Because there is always some degree of muscular activity in healthy muscles, tension is always present. This may be a very small amount of tension.*

The language found in the pedagogical approaches vacillates between acknowledgements that tension is always present or absent. Fraser states: "Without tension, there is no life" (2003, p. 38), pointing to the fact there is always a degree of muscular activity that holds the skeletal structure in place. Even though his overarching approach is that of finding an optimal balance of tension, directions to release all tension are found in his exercises. As shown in the analysis of consistency, instructions and

comments from the other pedagogues are also often directed towards playing with a total absence of tension. Many of these comments address concerns that most pianists play with too much tension. In efforts to cultivate a technique that is free, tension is not always used by the five authors as a scientific term, but seems to be used as a colloquial term that is associated with only negative attributes of tightness, impediments to movement, and static positions. While qualifying tension with terms such as minimal and excessive suggest the constant presence of tension, the pedagogues' directions to release 'all' tension mislead and misinform. In conveying tension as something that can be totally eliminated, the pedagogical use of tension does not align with the scientific fact that a degree of tension, albeit at times very small, is always present in healthy muscles.

This analysis of accuracy shows that although there are steps to move towards a more scientific use of tension, there are still inaccuracies in the pedagogical usage. Associating tension with only an isometric contraction, as the pedagogues clearly do, fails to acknowledge the role tension can have in producing and controlling movement. Using terms that qualify tension as an all or nothing state dismisses the possibility that tension fluctuates with the changing physical demands to play the piano. In part, the reasons for these inaccuracies are due to a tendency to waver between using tension as a colloquial term and a term that aligns with the scientific use. Aimed at piano students and teachers, the language is often used informally with common and broad meanings. Another reason for the gap between the scientific and pedagogical usage may be that the pedagogy is so focused on the feeling of tension, it fails to make the distinction between the subjective and objective nature of tension. Lister-Sink raises the point that a degree of tension is needed to stabilize the hand, however it will not be felt thus. These contrasts of

scientific and colloquial, subjective and objective, are some of the problems in how the language is used to define and describe tension in the pedagogical approaches. In going back and forth from one to the other, tension is not always communicated accurately.

Chapter 4

4. Relaxation

The concept of relaxation, closely related to the release of tension, has also been identified as a misunderstood and confusing concept in the literature review and research problem. At times figuring as a central concept, at times scarcely mentioned, the following summary shows how the term ‘relaxation’ continues to have different meanings depending on the approach.

4.1 Summary of relaxation

Lister-Sink

Learning to completely and continuously relax the muscles by releasing tension is a central tenet of Lister-Sink’s approach. In illustrating the neuromuscular system as a light switchboard, Lister-Sink explains that muscles are relaxed when the brain is not sending messages to the muscles to contract. Training muscles to turn off and on in an instant is paramount to creating conditions for free and effortless movement. Lister-Sink demonstrates exercises to contract and relax muscles, as shown in her instructions to fully relax muscles between contractions: “Relax the muscles completely, a state of release to which the pianist must always return” (chap. 1). Though the overall focus of Lister-Sink’s approach is directed towards total relaxation, Lister-Sink also draws attention to the harmful effects of over-relaxing. Extreme relaxation can produce a constant state of heaviness in the arm, a misleading notion that fails to return the weight of the arms back to the support of the torso. Too much relaxation can cause the wrists to extend with the added stress of having to support heavy relaxed arms, situations that place too much

effort on the wrists and may cause injury. Despite these negative effects, mastering Lister-Sink's whole approach hinges on learning to completely relax at the right time, for the right amount of time.

Mark

As shown in the previous analysis of the language used to describe tension, Mark devotes an enormous amount of attention to the negative aspects of this concept. Although tension and relaxation are closely related in their colloquial meanings, surprisingly, Mark produces only one reference to relaxation. Describing optimal posture as "relaxed, balanced, poised" (p. 33), Mark only makes reference to relaxation once. Instead of using the term 'relaxation' to describe a release of tension, Mark simply provides instructions to 'release tension'. To release tension, Mark encourages a kinesthetic awareness of muscle tension and an accurate map of the body's whole skeletal structure. Once the skeletal structure is balanced correctly, tension can release.

Taubman

Taubman and Golandsky also advocate for movement without tension, but clearly state that this does not mean relaxation. In describing this complex connection between relaxation and tension, Golandsky makes the contradictory statement: "Relaxation is going beyond the lack of tension point. Relaxation is an activity" (chap. 10). Rather than try to relax muscles, she believes it is more important to cultivate a quality of movement that is free of tension. As Golandsky states, "our philosophy is that we should move in a way that there is nothing to relax from. Relaxation, often, makes the problem much worse, rather than eases it" (chap. 6). Indeed, she states that too much relaxation can produce harmful tension. Relaxing in one part of the body can trigger counter-productive

tension and muscular effort in a different area of the body. Defining relaxation as a situation in which both active and passive muscles are relaxed, Taubman and Golandsky argue that trying to move from this state demands a great deal of effort and thus produces excessive tension. For these reasons, relaxation is viewed solely as contributing negatively to piano technique.

Karpoff

Conversely, Karpoff views relaxation as always playing a positive role. Describing a desirable hand position as "a very relaxed hand" (Unit 3, chap.12) and forearm rotation as "a very relaxed motion" (Unit 6, chap.16), Karpoff uses the terms 'quiet' and 'release' to encourage relaxation. He continuously reminds the viewer and students to release the non-playing fingers and hand, stating, "this relaxation of the other fingers is really essential" (Unit 6, chap. 12). This quality of relaxed, quiet, and loose hand and fingers is vital to mastering Karpoff's three-dimensional movement patterns and considered an important element of effortless and injury-free technique.

Fraser

Fraser describes in detail the importance of finding the right balance of muscular tension and relaxation. Discerning the optimal degree of muscle relaxation results in a neutral muscle that is "not overly contracted and not overly lengthened either, free from parasitic contraction and co-contraction, possessing the appropriate amount of muscle tone—alive" (2010, p. 241). Attaining this fine balance of tension and relaxation requires tremendous kinesthetic awareness and sensitivity. It is important to relax neither too much, nor too little, but "just enough so your muscles work well" (2003, p. 41). Fraser claims this kind of relaxation provides many benefits: improved muscle function; freer

and more effortless movement; a heightened sense of arm weight and skeletal structure; and greater mental focus. Using his characteristic vivid language, Fraser describes this neutral, optimal relaxed state with words such as ‘alive stability,’ ‘intentionally active’ and ‘empowered relaxation’. Nonetheless, Fraser warns against the pitfalls of over-relaxing and echoes Taubman’s concerns that too much relaxation compromises the skeletal structure—excessive muscular effort compensates for the imbalance and undesirable tension ensues. Despite these detailed descriptions of finding the correct balance of muscular contraction, instructions to ‘completely relax’ are interspersed throughout his ATM exercises.

4.2 Analyzing consistency

Relaxation has different meanings depending on the approach. At times vital to mastering technique, at other times producing harmful tension, the term is used inconsistently among the approaches. This is borne out in the frequency of references to both its positive and negative roles as shown in Table 8. Three different roles of relaxation are presented. Either viewed as only negative, only positive, or both positive and negative, one cannot assume that the term ‘relaxation’ has the same connotation in each approach.

Table 8 *Frequency of references to relaxation as playing either a positive or negative role*

Author	Positive	Negative
Lister-Sink	7/10	3/10
Taubman	0/5	5/5
Mark	1/1	0/1
Karpoff	6/6	0/6
Fraser	14/27	13/27
Total references from all approaches	28/49	21/49

Taubman and Karpoff present two contrasting consequences of relaxation. As shown in the table above, Taubman finds no place for relaxation in piano technique. Rather than reduce tension to improve movement, Golandsky maintains that relaxation creates tension that impedes movement. In contrast, all of Karpoff's references to relaxation are positive. As shown in the summary, relaxation of the non-playing fingers and hand is essential to mastering the three-dimensional movement that is at the core of Karpoff's approach. Lister-Sink and Fraser present a more pragmatic view, citing the importance of finding the correct degree of relaxation to enhance technique but also warn that too much is counter-productive. If relaxed too much, the skeletal structure collapses and tension results. Most of Lister-Sink's comments are directed to the positive aspects (7/10), reserving only a few comments to address negative aspects (3/10). Fraser believes it is not simply a matter of relaxation contributing positively or negatively to technique; it is a matter of finding a delicate balance of tension and relaxation. Finding this balance is reflected in Fraser's equable references to relaxation's positive and negative role (13/27, 14/27).

In looking to the different terms used to describe positive relaxation, there are consistencies and inconsistencies in how the language is used. As shown in Table 9.1 below, similar qualities of suppleness and release of muscle contraction describe positive relaxation.

Table 9.1 *Scientific, common, invented terms to describe relaxation as playing a positive role*

Author	Scientific terms	Common terms	Invented terms
Lister-Sink	Release tension Release muscular contraction	Relax Refresh No tension Heavy Released Completely relaxed A state of release	Empty of tension
Taubman			
Mark	Release tension	Relax	
Karpoff	Release muscle contraction	Relaxed Released hand and fingers Quiet Loose	
Fraser	Release tension Neutral muscle Soft muscle tonus Neutral muscle: neither overly contracted or lengthened	Relax Looseness Softening Loose muscle tonus Flopping Flapping Shaking Limp Supple	Alive stability Effective stillness Stable relaxedness Empowered relaxation Full looseness

While some of the terms shown in the table above suggest a total absence of muscle activity such as ‘completely released’, ‘no tension’, and ‘limp’, Fraser uses terms that evoke a degree of activity. Combining opposing qualities that convey a duality of vitality and stillness, Fraser describes positive relaxation with terms such as ‘empowered relaxation’ and ‘effective stillness’—qualities that comes from discerning a muscle contraction that is neither too much nor too little. In contrast, Lister-Sink and Karpoff describe positive relaxation as completely relaxed and absent of all tension.

The confusing connection between relaxation and tension continues when looking to the terms used to describe negative relaxation. As shown in Table 9.2 below, Taubman describes relaxation as producing a ‘tremendous amount of tension’. Finding no

redeeming qualities in relaxation, Golandsky's confusing statement, "If people are very relaxed they have a tremendous amount of tension" (chap. 10), underscores the paradoxical relationship she describes when referring to tension and relaxation. As noted in the summary, she believes that a great deal of effort is needed to move from a relaxed state. Fraser echoes this sentiment by equating total relaxation with flaccidity and a state of deadness, as can be seen in the terms below. Nonetheless, Fraser associates these negative qualities with too much relaxation, and as noted, is careful to distinguish that it is the degree of muscle contraction that will determine whether relaxation contributes positively or negatively.

Table 9.2 *Scientific, common, invented terms to describe relaxation as playing a negative role*

Author	**Scientific**	**General**	**Invented**
Lister-Sink		Relaxation school	
Taubman		Relaxed Sagging Tremendous amount of tension	
Mark			
Karpoff			
Fraser	Muscle tonus	Inactive Over-relaxation Total relaxation Total inactivity Excess relaxation Looseness Hyper-relaxed Loose muscles Flaccid Phlegmatic	Contagious A state of deadness

Despite the different connotations of the term 'relaxation', all of the authors present similar ideas of a muscular state needed for effortless movement that is evident in some of the descriptions of relaxation. However, they use different words to describe this. Fraser describes an 'alive stability' that comes from a 'neutral muscle' with the

appropriate degree of relaxation. Lister-Sink describes the feeling of effortlessness that comes from knowing how to contract a muscle "no more—no less" (chap. 2), yet speaks often of needing to completely relax the muscles. Taubman also describes the same sort of 'in-between' state that allows free movement with her term 'resting down' (chap. 4), but clearly states that 'resting down' is not relaxation. Mark echoes a similar quality but describes this as being in a state of balance, making no reference to relaxation at all. Although the authors present the concept of relaxation differently, the muscular state they promote as vital to an effortless, free technique appears to bear many similarities.

From this analysis of consistency, it is possible to identify where the problems of language may exist when describing relaxation. Although there is general agreement that relaxation means a reduction or release of muscle contraction, the result of this release has different implications. Either freeing movement or impeding movement, relaxation is used differently depending on how each author interprets relaxation. Notably, the surprising omission of the term 'relaxation' from Mark's work perhaps is a recognition that using this term contributes to the confusion. Given Mark's enormous attention to tension, and the release of tension, this omission of relaxation seems significant. One may surmise that Mark recognizes that relaxation is so misunderstood that he has chosen to avoid the term altogether. Nonetheless, as discussed, the authors describe a similar muscular state that allows for free movement. Because relaxation has different connotations, the pianist can be easily confused in how to achieve this optimal muscular state that allows for free movement: completely relax; do not relax at all; or find an appropriate degree of relaxation.

4.3 Analyzing accuracy

To analyze accuracy, the scientific use of relaxation, as found in the scientific materials identified in the methodology, is presented. Main points from this definition provide a framework to examine the accuracy of the pedagogical usage of relaxation.

Scientific definition

Muscular relaxation occurs when there is reduced neural input to muscles causing muscular activity to decrease and myofilaments to elongate. Because all muscular activity produces tension, the state of relaxation can be viewed as "the release of tension" (Vant, 2007, p .44). There is always some neural activity to and from a muscle and a muscle will be activated to some small degree, therefore a healthy muscle can never be totally relaxed (Stark, 1997). In addition to muscular relaxation, the term can also be applied to joints. Relaxing muscles surrounding joints can produce a relaxed position and impact the quality of movement at that joint: "A relaxed position of the joint is the neutral position. This is the position at which the joint is 'loosest' or has the most give or play in it and can be approximated by the mid-range of the joint" (Vant, 2007, p. 48). The scientific use of relaxation can be summarized into the following points:

a. there is always some degree of muscular activity in a relaxed muscle;
b. relaxation releases tension;
c. and a relaxed joint position provides greatest range of motion.

Pedagogical usage

a. ***There is always some degree of activity in a relaxed muscle:*** *There will always be some degree of muscular activity present in healthy, functioning muscles. A muscle and joint can never be completely relaxed.*

The five authors use language that conveys a degree of muscular activity in relaxed muscles, however, there are times when they imply that a muscle can be completely relaxed with no activity at all. Lister-Sink's comparison of the neuromuscular system to a light that can be switched on to contract a muscle and off to relax a muscle does point to a lack of neural input, and in part, aligns with the scientific use. However, referring to a relaxed muscle as a muscle that is turned completely off incorrectly implies that there is no muscular activity. Golandsky's statement that "relaxation is an activity" (chap. 10) aligns with the scientific use, however her portrayal of relaxation as an undesirable state from which all movement is difficult, leaves no room for the possibility that a degree of relaxation may contribute positively to piano technique. As noted, though Mark does not use the term 'relaxation', he often encourages the pianist to release 'all tension'. Fraser's explanation of a relaxed muscle as a neutral muscle as neither overly contracted nor lengthened describes a muscle with reduced activity but allows for a degree of neural input. Nonetheless, when Fraser alludes to the negative effects of over-relaxation he states, "total relaxation equals total inactivity" (2003, p. 42), a statement that incorrectly represents the scientific use of muscular relaxation. Put in context though, equating total relaxation with no activity stems from Fraser's criticisms of the traditional relaxation school that advocated total relaxation. These different statements from the five authors show that although they accurately describe a degree of activity in a relaxed

muscle, there is also a tendency to use language that suggests an absence of activity in a muscle that is overly relaxed.

b. Relaxation releases tension: *Relaxation describes a decrease in muscular activity due to a reduction of neural input. This lack of activity allows for the release of tension.*

To varying degrees, all authors, with the exception of Mark, relate relaxation to a release of tension. However, they describe the release of tension in the muscles as producing three very different conditions: first, releasing all tension allows for total relaxation and is the key to finding freedom and ease in movement; second, too much relaxation produces tension and makes movement difficult; and third, fine-tuning the appropriate degree of muscular tension and relaxation can empower piano technique. Although Lister-Sink's approach revolves around learning to relax muscles by contracting and releasing muscular tension, descriptions of a total state of release or relaxation do not completely align with a reduced neural input found in the scientific definition. The relationship between relaxation and the release of tension is less clear in Taubman's approach. It is difficult to discern the meaning of Golandsky's description of relaxation as "going beyond the point of tension" (chap. 10). Taken literally, this is a statement that does not accurately reflect the scientific definition of relaxation, as there will always be a degree of tension. Karpoff does speak of a release of the hand and fingers to describe a relaxed state, however 'release' is used as very general term. Fraser brings more depth and detail to this discussion. By considering a range of different muscular tonus, relaxation becomes a relative state that involves fine-tuning the release of muscular contraction.

c. A relaxed joint position provides greatest range of motion: *Relaxing muscles that surround joints results in a relaxed joint position, the mid-range position that allows for optimal mobility.*

The five authors agree that it is important to allow the joints to move freely and that this requires acute kinesthetic sensitivity to muscle activity and movement at joints. Although they share the same desired outcome of free mobility at joints, the language fluctuates between encouraging total relaxation and a total release of tension to achieve this state. The relationship between relaxation and tension and its impact on mobility at joints is very complicated. The pedagogical approaches present arguments that either too much tension impedes movement at the joints or too much relaxation can compromise skeletal alignment and functionality and lead to harmful tension. Though Mark avoids the term 'relaxed' to describe joint position, his comments are always directed towards finding the best range of movement at joints, advising a mid-range position for the best mechanical advantage (p. 141). As shown, the exception is Fraser's attempts to describe varying degrees of relaxation and tension. His lengthy and somewhat complex language shows that describing the balance between relaxation and tension to allow for optimal movement of joints is a challenging task. Despite the varied language, all five authors present a fairly accurate representation of reducing muscular activity, thus relaxation, as allowing greater mobility of joints.

This analysis of accuracy shows that there are efforts to align the pedagogical meaning of relaxation with the scientific use. However, challenges persist.

As seen with tension, describing how much to relax when playing the piano is no easy task. Often, the pedagogues slide into the colloquial use of relaxation with terms such as

‘relax completely’, ‘total relaxation’ or ‘very relaxed motion.’ Nonetheless, they also acknowledge that relaxing the appropriate degree is crucial—neither too much nor too little. In Fraser’s words, “enough so your muscles work well” (2003, p. 41). Comments from registered physiotherapist, Victoria Agar, may help to clarify why the authors struggle to convey just the right amount of relaxation. Agar argues that relaxation is a relative term and does not accurately define muscular property or joint function (personal communication, June 2011). Because its’ meaning can only be considered within the context of existing state of muscles and joints, the term brings very little meaning to muscle or joint function. The problem in the pedagogical usage of ‘relaxation’ perhaps does not so much lie in how the authors use ‘relaxation’ but in the term itself.

Chapter 5

5. Co-contraction

The concept ‘co-contraction’ refers to a situation when muscles activate at the same time around a joint. A critical concept in how we conceive muscle function in facilitating or impeding movement of the joints, the following summary examines the language that each author uses to describe co-contraction.

5.1 Summary of co-contraction

Lister-Sink

Lister-Sink does not use the term co-contraction, but describes muscular contractions needed to stabilize joints at the moment the finger makes contact with keys. The muscular contractions must release the instant the finger makes contact with the key. If done correctly, she describes this as ‘efficient muscle use’ that offers important stability to the joints. However, if the muscular contractions fail to release at the right time and lasts longer than necessary, Lister-Sink uses the term ‘fixate’ to describe joints that are held in a position that impedes piano technique. She does not specify which joints require stabilization, but her demonstrations suggest that it is important to provide stability to the fingers, hand, and wrist. As already mentioned in the previous summary and analysis of tension and relaxation, mastering the muscular contraction and release to stabilize joints is a concept that figures prominently in Lister-Sink’s approach.

Taubman

Taubman uses the term ‘dual-muscular pull’ to describe how flexors and extensors contract at the same time to fixate joints and to lift and curl fingers. Taubman strongly discourages any dual muscular pull and believes that contracting muscles at the same time to fixate joints, especially the elbow, wrist, and fingers, is a chief cause of impediment to movement and injury. Reading from Taubman’s lecture notes, Golandsky states: “In fixating the arm while trying to move the fingers quickly, it could be compared to five racing horses pulling along a train without an engine” (chap. 3). Nonetheless, Taubman describes situations that would logically require some joint stability. She refers to joints as behaving as fulcrums to provide movement to the playing apparatus; in particular, the elbow acts as an important fulcrum in forearm motions, and the wrist as a fulcrum for hand actions.

Mark

Mark defines co-contraction as a condition when opposing muscles around a joint fail to release. Borrowing Taubman’s term ‘dual-muscular pull’ to describe this situation, co-contraction is identified as a major cause of impediment to movement, pain, and injury. Mark suggests that people who believe joints need to be fixated to facilitate movement have a false representation of the mechanics of body movement. He considers fixation and stabilization as having the same meaning and that any kind of joint stabilization should be discouraged. Moreover, he argues that the language we use to describe joint fixation will not change the negative outcomes: “The problem is not solved, it is only papered over by shifting the vocabulary—calling the joints ‘fulcrums’ instead of ‘joints’ or using the word ‘stable’ instead of ‘fixed’ ”(p. 68). Instead of fixing

at joints, Mark encourages a feeling of support and stability that comes from the core of the body. In this manner, joints can move freely from a point of balance.

Karpoff

Karpoff does not use the term co-contraction but refers to an antagonist-agonist relationship of flexors and extensors providing stability to joints. Although Karpoff recognizes the importance of this antagonist-agonist relationship, he also warns stability can also negatively affect flexibility and speed. To address this issue, Karpoff states: "This antagonistic relationship must be respected. Learning to use opposable muscles in alteration will result in maximum freedom at the piano" (Unit 1, chap. 17). Little detail is given in how to 'respect' and use opposable muscles alternately. Nonetheless, the overarching themes of a quiet, released hand and fingers, along with three-dimensional elliptical movement of the hand and forearm, suggest that these practices will assist in cultivating a functional antagonistic relationship of the muscles to stabilize joints without compromising facility.

Fraser

Fraser uses both Taubman's term 'dual-muscular pull' and the scientific term 'co-contraction' to describe muscles contracting to provide stability. However, he makes the distinction between healthy and unhealthy co-contraction. Explaining that healthy dual-muscular pull plays "a crucial role in fine-tuning the degree of stability offered by any given joint" (2010, p. 228), Fraser states that this type of co-contraction is an absolute necessity in any type of movement. The alignment of joints is critical to finding the appropriate degree of muscular contraction to provide stability. Even though Fraser points to necessary stabilizing muscular activity for all joints, he also suggests that if

joints are optimally aligned there is no need for fixation. He explains that when forces are transmitted through perfectly aligned bones with healthy co-contraction, but with no fixation, a situation of 'unstable equilibrium' occurs, a place from which movement feels effortless. Fraser suggests that although unstable equilibrium results in a degree of muscle tonus around the joints for stability, it is not perceived thus. If stability is felt, this is an indication that muscles are over-working. Defining unhealthy co-contraction as "a co-contraction that results from a cross-motivation where the degree of antagonism rises too high" (p. 238), Fraser explains that this creates a high degree of muscle tonus that serves to block movement.

5.2 Analyzing consistency

The five authors describe opposing muscles contracting simultaneously to stabilize joints. However, they view the outcome of co-contraction differently. As seen in Table 10 below, these differences are reflected in the frequency of references to co-contraction as playing either a positive or negative role with a tendency to view co-contraction as playing mostly a negative role. The exception is Fraser, who considers co-contraction as playing a slightly more positive (9/16) than negative (7/16) role.

Table 10 *Frequency of references to co-contraction as playing either a positive or negative role*

Author	**Positive**	**Negative**
Lister-Sink	½	½
Taubman	0/4	4/4
Mark	0/4	4/4
Karpoff	1/3	2/3
Fraser	9/16	7/16
Total references from all approaches	11/29	18/29

The terms the authors use to describe the positive and negative role of co-contraction provide some insight into why co-contraction is viewed as playing both a positive and negative role. Lister-Sink, Karpoff, and Fraser consider co-contraction of antagonistic muscles as providing necessary and positive stability to the joints. Although Lister-Sink describes this as a 'significant' muscle contraction, Karpoff and Fraser use language to suggest the contraction is slight. Karpoff cautions, "this antagonistic relationship must be respected" (Unit 1, chap. 17). Fraser conveys the same ambiguous but subtle degree of contraction when he explains "a certain amount of tonus in a joint maintains its fluid stability without hindering movement" (2010, p. 228).

The terms in the following table (Table 11.1) show that Fraser employs a wide range of both common and invented terms to describe positive co-contraction when compared to the other authors. These terms often convey a combination of suppleness and stability. Fraser explains that when the hand 'stiffens' and the hand 'plasticizes' the "balance of opposing qualities of forces creates a symbiosis" (2003, p. 39). Acknowledging that co-contraction is crucial in facilitating and controlling movement, Fraser admits that the language used to describe this state is paradoxical. Movement is effortless, but it feels "almost like a non-movement" (2010, p. 239). These paradoxical qualities are reflected in his combination of words such as 'flexible stability', 'fluid stability' and 'unstable equilibrium.'

Table 11.1 *Scientific, common, and invented terms to describe co-contraction as playing a positive role*

Author	**Scientific terms**	**Common terms**	**Invented terms**
Lister-Sink	Stabilize Significant muscle contraction	Stability	
Taubman		Fulcrums	
Mark			
Karpoff	Antagonistic Opposable muscles	Stability	
Fraser	Co-contraction	Opposing forces Stiffening Plasticizing Rigidify Stabilize Fluid stability Crucial Tension Certain amount of muscle tonus No fixation	Healthy dual muscular term Effortful fixation Working purposefully Flexible fixation Unstable equilibrium Extensor described as 'a brake' Almost like a non-movement

In describing co-contraction that negatively impedes movement, all authors, apart from Karpoff, use the term 'fixation' as shown in the terms in Table 11.2. Taubman uses a strong metaphor to describe the arm fixating as similar to "five horses pulling a train without an engine" (chap. 3). Even though fixating has a stronger, more negative connotation among most of the authors, Mark contends that the words used to describe how joints stabilize, fixate, or joints acting as fulcrums, should not change the meaning and that all these situations should be avoided.

Table 11.2 *Scientific, common, invented terms to describe co-contraction as playing a negative role*

Author	**Scientific terms**	**Common terms**	**Invented terms**
Lister-Sink	Tension	Fixate Tension	
Taubman	Antagonistic movements Tension	Fixate	Dual muscular pull A battle for your fingers "Five racing horses pulling along a train without an engine"
Mark	Co-contraction Static muscular activity Excessive co-contraction	Stabilize Fixate Fulcrums Excessive force	Dual muscular pull
Karpoff	Antagonistic Opposable muscles	Stability	
Fraser	Co-contraction Antagonism is too high Overly high muscle tonus Tension	Unbalanced Tension	Unhealthy dual muscular pull Anti-movement

To describe negative co-contraction, all of the authors use language that conveys a combative quality of muscles working against each other. While observing a student's performance, Taubman exclaims, "The extensors are pulling, the flexors are pushing…such a battle for your fingers to move" (Bloomfield et al., 1995, 2005, chap. 12). Her assistant, Edna Golandsky describes 'dual-muscular pulls' as muscles "pulling against each other" (Bloomfield et al., 1995, 2005, chap 1) a situation she clearly instructs pianists to avoid. Mark explains that movement requires one muscle group to contract while the other muscles lengthen, however, co-contraction occurs "if the opposing muscles do not release, then the two muscle groups are working *against* each other" (Mark, 2003, p. 105). Fraser describes a similar conflict between muscles with his

term ‘anti-movement’. Nonetheless, he also clarifies that pitting the muscles against each other only describes unhealthy co-contraction—not its healthy qualities when the muscle contractions are optimally balanced.

This analysis of consistency shows that apart from Fraser, there is a strong tendency to emphasize the negative role co-contraction and the conflict that exists between muscles. A lack of consensus regarding the necessity of stabilizing joints adds to the confusion. Nonetheless, the tendency to use the terms ‘stability’ and ‘fixate’ to differentiate between positive and negative stabilization, though the different meanings are only implied and never clearly articulated, is perhaps a step in distinguishing between a co-contraction that facilitates or impedes movement. Of note, without Fraser’s contribution to the terms describing positive co-contraction, one would have no idea of the nature of positive co-contraction. It may be this scarce attention to positive muscle co-contraction that confuses pianists. With so much attention focused on what not to do, there is little insight into how muscles contract to stabilize joints.

5.3 Analyzing accuracy

This analysis of accuracy considers the scientific use of co-contraction. Main points provide a framework to observe and compare the accuracy of the pedagogical usage with the scientific definition.

Scientific definition

The scientific literature defines co-contraction as the simultaneous contraction of two or more muscles with opposing actions about a joint (Vant, 2007). Muscles activate to produce forces in opposing directions to stabilize joints to a place of balance, allowing

limbs to move with greater accuracy. Studies point to a high degree of co-contraction observed in people who are less experienced and tentative in executing tasks (Ackland et al., 2009). With practice of a skill, co-contraction decreases. Although co-contraction serves as an effective strategy to control movement when learning new skills, "movement flexibility and smoothness is compromised [i.e. when the antagonist's action resists the agonist muscles during performance of movement]" (Ackland et al., 2009, p. 214). Excessive co-contraction causes muscles to resist movement; an optimal degree of co-contraction offers enough stability to joints to move freely. Co-contraction is a necessity in any movement.

The scientific definition of co-contraction can be summarized with three main points:

a. muscles co-contract to stabilize joints;
b. muscles co-contract to control movement;
c. and co-contraction tends to increase with lower skill levels.

Pedagogical usage

a. Muscles co-contract to stabilize joints: *Co-contraction results from the simultaneous contraction of two or more opposing muscles about a joint.*

The description of co-contraction found in the approaches as two opposing groups of muscles contracting simultaneously around a joint aligns with the scientific definition. However, the pedagogical language focuses on just two muscle groups, namely the flexors and extensors. Indeed, this definition is conveyed in the term 'dual-muscular pull', a term that Taubman coined over fifteen years ago, and continues to be used today by Mark and Fraser. In considering the accuracy of this definition, Agar, physiotherapist,

explains that this is a simplistic description of what is really happening and that co-contraction is a complex coordination of the activation and de-activation of other stabilizing muscle groups (personal communication, May 3, 2011). In defining co-contraction as meaning the simultaneous contraction of only two groups of muscles with the commonly used term of 'dual-muscular pull' , Taubman's term neglects the important role of many different muscles throughout the body that contract to stabilize joints. Of note, Mark's comment that movement should be supported from the body's core perhaps recognizes that there are many other muscles at work to stabilize joints—even though he prefers not to use the word 'stabilize'.

b. Muscles co-contract to control movement: *Co-contraction stabilizes joints to provide a steady position that facilitates and controls movement.*

Even though all five authors agree that opposing muscles contract to stabilize joints, they present three varying views regarding the desirability of joint stabilization to control movement: joints should never be stabilized; joints should be stabilized for as little time as possible; and joints should be stabilized to provide a controlled and fluid movement. To suggest that we can move without stabilizing joints runs counter to the biomechanical description of movement. All movement requires a degree of stability in the joints; otherwise, we could not move. Likewise, describing stability as lasting only "a fraction of a second" (Lister-Sink, chap. 2), fails to acknowledge the important role of co-contraction in controlling movement. Nonetheless, many of the comments found in the approaches that are directed towards avoiding stabilization, at all or for a split second, stem from concerns that pianists typically contract muscles excessively, thereby blocking movement. Indeed, as noted in the analysis of consistency, the pedagogical language

tends to convey conflict between the muscle groups, suggesting an undesirable outcome. While it is true that co-contraction results in the contraction of opposing muscles and can impede movement, language that focuses on muscles always pitted against each other to prevent movement fails to recognize that muscles work together, in concert, to control movement. Of note, Fraser stands out as defining co-contraction that is in line with the scientific definition, describing co-contraction as providing necessary stability, as well as facilitating and controlling movement.

c. ***The degree of co-contraction tends to increase with lower skill level.*** *Excessive co-contraction resists movement, compromising flexibility and smoothness, but serves as a useful learning strategy when developing new skills. Co-contraction decreases with more practice and skill.*

The pedagogical description of excessive co-contraction resulting in resistance to movement aligns with the scientific descriptions. The five authors focus mainly on the negative consequences arising from increased resistance to movement. Even though science supports many of these statements, exclusive attention to the negative outcomes of co-contraction ignores the essential and positive outcomes of improving accuracy and control of movement, especially when learning a new skill. Fraser is the sole voice suggesting that there may be some benefits from too much co-contraction. Because excessive co-contraction results in a heightened muscle tonus that controls movement, Fraser points to the possibility that this heightened state of co-contraction may serve a purpose in learning new skills. He argues that stability controls movement and increases accuracy, thus providing positive outcomes when playing the piano.

This analysis revealed that although attempts to describe how muscles contract to provide necessary stability can be found in the pedagogical approaches, the authors do not always accurately articulate the meaning of co-contraction. The pedagogues focus so much on the negative outcomes of resisting and impeding movement from two opposing muscle groups, that the necessary co-contractions of muscles are overlooked. One of the reasons for so much focus on the negative aspect of co-contraction may be that what we feel is not necessarily what happens. Fraser raises this point when he says that although joints are being stabilized we will not feel this: conversely, if muscle contraction is felt, this is a sign of unhealthy co-contraction. Failing to discern between feeling and fact may be at the root of the inaccurate statements regarding the role of stability in controlling movement. However, there are steps towards a more informed definition of co-contraction. Lister-Sink and Karpoff bring attention to the two sides of co-contraction: necessary stability; but if overdone, compromised facility. Fraser has begun to deepen and expand our understanding of co-contraction in piano pedagogy by considering its role in controlling and facilitating movement. Like tension and relaxation, it is not a matter of too much or too little muscle contraction, but of finding an appropriate degree.

Chapter 6

6. Arm weight

Arm weight has been called the most important and the most misunderstood concept of piano technique (Prater, 1990; Gordon, 1991; Fraser 2003, 2010; Gerig, 2007). Depending on the point of view, arm weight can liberate piano technique and produce beautiful tone, or it can be the principal cause of technical limitations, injury, and harsh sound. Despite its integral place in piano technique, this summary shows that conflicting descriptions and advice continue to contribute to a muddled picture of arm weight.

6.1 Summary of arm weight

Lister-Sink

Lister-Sink does not use the term ‘arm weight’ but uses the term ‘basic stroke’ and ‘free fall’ to describe the weight of the arm falling into the keys. Believing that mastering the freely falling weight of the arm is the key to unlocking the freedom and power of piano technique, Lister-Sink’s whole approach centers on learning to allow the arm to drop freely into the keys. First, the student must cultivate a pendulous quality in the arms. Secondly, the students must allow the loose arm to fall freely into the keys. Lastly, the muscle contractions that support the bony arches must activate and release at the moment of impact with the key. Weight is given and taken in an instant—the pianist constantly regulates the transfer of weight to fingers into keys, and back into the torso. The result is a feeling of heaviness that turns instantly into a feeling of floating. Lister-Sink describes this feeling of falling combined with appropriate muscular contraction and

relaxation as “sort of like a falling brick transforming into a ping pong ball on contact” (chap. 2).

Taubman

The weight of the arm takes on a secondary role in Taubman’s approach. First and foremost, the forearm, hand, and fingers must be unified; only then can arm weight be directed from the arm to the finger to overcome the resistance of the key. If the elbow, wrist, hand, and fingers are not unified, these breaks in the structure direct the weight to other parts of the body and can cause harmful tension. Finding the right amount of weight is critical to acquiring a state referred to as ‘resting down’—a state from which all movement will feel effortless. Golandsky describes this fine balance: “When we talk about weight, we talk about the correct amount of weight that will allow us to feel like we are resting down without holding up” (chap. 4). ‘Resting down’ allows the weight of the key to hold up the finger, hand, and arms and the weight of the arm to fall freely behind the finger. Describing the weight as something that can be regulated to achieve musical effects, Golandsky encourages students to “free a little bit of arm weight behind the finger you want to bring out” (chap. 10). Although she encourages the “arm to fall freely behind [the hand]” (chap. 10), it is often the hand that is described as dropping into the keys—not the arm.

Mark

Mark completely dismisses the idea that arm weight plays a role in tone production in piano technique. He believes that “fantasies of ‘dropping weight’ can be dangerous” (p. 130). Dropping weight into the keys puts the whole skeletal structure out of balance and tension ensues. Rather than weight, he believes that tone production

depends on the speed of the finger activating the keys. Claiming that arms do not play a weight-bearing role, Mark believes that arms should be "free to function primarily as manipulating structures" (p. 65). Bringing awareness to the tactile quality of the fingers on the keys and places of balance in the skeletal structure will allow the arms to move freely without bearing weight.

Karpoff

The free fall of arm weight figures as a fundamental principle of Karpoff's approach and warrants a full chapter entitled 'free fall.' Karpoff encourages students to release muscular tension of the arms by taking the students' arms into their own hands and throwing the students' limp and heavy arms on to the piano keys, with exhortations to 'let go.' While throwing a student's arm onto the keys, Karpoff instructs: "don't do anything" reassuring the student that to "give up control is to gain control" (chap.7). Inferring that the body must not interfere with any muscular activity to control the arm's mass, Karpoff encourages students to allow gravity to assist in the free fall. Although most of the focus is on harnessing the downward force of gravity, he also describes gravity as providing buoyancy. In instructing a student how to lift off a two-note slur, he states "use gravity to allow the arm to float" (chap. 7). Karpoff speaks of giving and taking arm weight, and of slowing down and diminishing the amount of arm weight to achieve dynamic and tonal variety. He cautions that dropping suddenly into the keys expends all the kinetic energy as there is no momentum left to execute the three-dimensional cycling and shaping motions.

Fraser

Fraser notes that even though the weight of the arm acts with gravity, muscular activity always directs and controls the arm's mass (2003, p.42). Although Fraser concedes that a freely falling arm may produce maximum freedom, he suggests that this is not always desirable as the pianist forfeits control of tone and momentum. Fraser warns that we must discern between a letting go that can either impede or facilitate efficient movement of the joints. Critical of the inherent dangers of "uncontrolled freedom" (2003, p. 40) from abandoning muscular activity, so sought after by the arm weight proponents, Fraser argues that muscular activity and skeletal integrity must take precedent over arm weight. Fraser's directions to 'let go' are directed towards achieving a feeling of what he coins 'bone whips'—defined as "exact muscle contractions creating precise movements of unconstricted bones" (2010, p. 118). He explains that this relationship between muscular activity of the fingers and arm weight demands a high level of coordination and precise timing, cautioning against contracting the finger too early. Fraser strongly advocates for finger activity even when falling freely. However, he states that the effort of the fingers is so slight it is almost imperceptible: "In the instant your arm is in 'free fall', your finger has the opportunity to manipulate the key with such precision and tiny effort, it really seems your arm did it all, not your finger" (2010, p. 208). Many benefits come from properly employing arm weight: richer tone; looser joints; galvanized hand structure; greater facility in the fingers; heightened kinesthetic awareness of the skeletal structure; and the elimination of unnecessary muscular tension. Most importantly, Fraser states "one's playing becomes more human" (2010, p. 213).

6.2 Analyzing consistency

Considered as either completely positive, completely negative, or finding both positive and negative consequences from using the weight of the arm, the way in which arm weight contributes to technique depends how the term is defined. When the meaning of arm weight is defined literally as a dead weight and inert mass, it can impede motion and contribute to injury. However, when viewed as a dynamic matter that can be modulated, regulated, and transformed, the weight of the arm becomes a great boon to piano technique. These varying views of the positive and negative role of arm weight are reflected in the following table (Table 12).

Table 12 *Frequency of references to co-contraction as playing either a positive or negative role*

Author	Positive	Negative
Lister-Sink	18/18	0/18
Taubman	3/8	5/8
Mark	0/3	3/3
Karpoff	15/15	0/15
Fraser	18/28	10/28
Total references from all Approaches	54/72	18/72

The authors commonly use the term ‘free fall’ to describe the positive use of the weight of the arm falling freely into the keys. However, the meaning of ‘free fall’ is defined and explained inconsistently. Lister-Sink and Karpoff present a literal translation of this term, providing preliminary exercises to encourage the students’ arms to fall freely. Instructing students to ‘let go’ and ‘give up all control,’ they throw the students’ limp and heavy arms onto the keys. In contrast, Golandsky conveys the idea of falling freely very differently. Using language that depicts much more discretion and control,

Golandsky says it is important in "allowing the arm to fall freely behind it….drop a little bit….free a little bit of arm weight behind the finger you want to bring out" (chap. 10). Fraser also describes the positive role of a freely falling arm, but he qualifies the weight of the arm as being an "active, intelligent mass, flexible in its actions" (2003, p .41).

It is the time immediately after the free fall that the authors describe with vivid language that directly opposes all the qualities of heaviness and arm weight. Lister-Sink describes the transformation of falling arm weight as falling bricks turning into a ping-pong ball. Similar paradoxical sensations of weight and weightlessness are found throughout the other approaches and are shown in Table 13.1 below. Taubman describes weight as dropping into the hand but also describes the arms as feeling light and buoyant—never heavy. Even Mark who firmly believes that arm weight technique is a fallacy, describes a floating quality and sensations of buoyancy in the arms that comes from skeletal alignment. Karpoff conveys a similar feeling when he tells a student to "use gravity to allow the arm to float" (chap. 4). Fraser describes the 'flowing weightlessness' sensation that comes from allowing the torso's weight to rest on the finger, "Your bones line up to bear this not inconsiderable weight, everything falls into balance, and a strange phenomenon occurs: your arms seem to disappear—its weight becomes imperceptible." (2010, p. 211-12).

Table 13.1 *Scientific, common, invented terms to describe arm weight as playing a positive role*

Author	Scientific terms	Common terms	Invented terms
Lister-Sink	Gravity Weight shift Weight bearing Weight of the arm	Free fall Gravity Weight shift Weight bearing Transfer weight Weight of the arm Heavy Light Buoyant Ever-changing weight Falling weight Relaxed arms	Falling bricks transforming into ping pong balls
Taubman	Arm weight	Drop Fall Weight of the arm falls Limp Heavy Arm weight	Resting down Free the arm weight
Mark			
Karpoff	Gravity	Arm weight Free fall Let go Be loose Utilize gravity Weight of arms Drop Float Integrative motion Kinetic energy of arm weight Float Transfer weight	
Fraser	Arm's mass	Arm's mass Free fall Arm weight Not dead Limp Loose Distinctly heavy Totally relaxed	Bone whips Active, intelligent mass Flexible mass Capable freedom Flowing weightlessness Inner activity

The authors employ a wide range of general and invented terms to describe positive arm weight, but as shown in Table 13.2 below, there are fewer terms to describe its negative role. The terms that are used to describe negative arm weight stem from literal translations of falling arm weight. Mark strongly criticizes this practice, describing this as 'dropping weight' with 'excessive force'. Although 'excessive force' brings a great deal of muscular effort to mind, Fraser's terms convey the opposite. Using terms 'arm thunk' and 'almost dead', Fraser believes that although a free fall of the arm's weight can provide great freedom there are many dangers of literally equating free fall with arm weight, stating a free fall; " is almost dead… like jumping out of a plane without a parachute is free" (2003, p. 40).

Table 13.2 *Scientific, common, invented terms describing arm weight as playing a negative role*

Author	Scientific terms	Common terms	Invented terms
Lister-Sink			
Taubman			
Mark	Weight-bearing	Dropping weight Excessive force	
Karpoff			
Fraser	Arm's mass	Free fall Almost dead	Uncontrolled freedom Arm thunk Like jumping out of a plane without a parachute is free

The term arm weight wields considerable power. This analysis of consistency shows the authors are faced with having to justify that the experience of arm weight is not what the term implies. In its positive role, the weight of the arm produces a sense of floating, lightness, and a freedom. In its negative role, arm weight is literally translated to mean a heavy and inert mass. The pedagogical literature describes positive arm weight as something that is given and taken, transferred to the key and back to the torso, slowed

down and speeded up— arm weight is constantly in flux. But the term arm weight itself conveys a static quality. Opposing qualities of gravity and buoyancy, distinguishing between the feeling of arm weight from what is actually happening, the paradox of letting go and retaining a sophisticated control—all these issues contribute to problems in how to communicate the complex process of employing arm weight. The authors resort to using a bewildering array of paradoxical terms. It is this contradictory language that signals that using arm weight to play the piano is not what the word means.

6.3 Analyzing accuracy

To analyze the accuracy of arm weight, two scientific studies referred to in the methodology are consulted. A recent study, *Effective utilization of gravity during arm downswing in keystrokes by expert pianists* conducted by Furuya, Osu, and Kinoshita (2009), examined how beginning and expert pianists struck keys to determine if there was a relationship between gravity and muscular force at the elbow joint during the downswing in keystrokes. This study, along with Wristen's *Proposed Theoretical Procedure for Biomechanical Analysis of Piano Technique* (2000) provide defining characteristics of arm weight technique that offer a framework to analyze the accuracy of the pedagogical language describing arm weight.

Scientific definition

Furuya and his colleagues analyzed movement and measured muscular activity during the arm downswing movement as expert and novice pianists struck keys. The experts' forearms descended to the keys with minimal activation from the biceps to resist gravity. The triceps (agonist) remained almost at resting level, except for a small amount of activity at the very end of the downswing. Playing louder dynamic levels resulted in an

increase of deactivation of anti-gravity muscles to harness gravity forces and generate more speed of the downswing. When the novice pianists' forearms descended to the keys, the triceps activated during the mid-point of the downswing to control the descent. Increased amount and duration of muscular force corresponded to an increase in dynamic levels. Although this study was isolated to examining movement at the elbow joint, the authors acknowledged the importance of the assistance of gravity force at other joints, including the shoulder and wrist complex.

The authors concluded that experts used gravity with minimal assistance from the agonist muscles to facilitate a free fall of the forearm. A skilled downswing involved a high level of muscular coordination between the upper arm and eccentric contraction of muscles at the elbow. Modulating dynamic levels demanded complex motor skills to synchronize muscular and gravitational forces. Conversely, novice pianists used a high degree of muscular force and less gravity to assist in the speed of the downswing with activation of anti-gravity muscles to control movement at the elbow.

Similar themes of using the force of gravity with coordinated muscular activity are found in Wristen's *Proposed Theoretical Procedure for Biomechanical Analysis of Piano Technique* (2000). Though Wristen avoids the use of the term arm weight, her recommendations to allow gravity to assist movement, the coordination between muscular momentum and gravity, the complex coordination of movement between the shoulder complex, upper arm, forearm, hand, finger muscles and joints corroborate the findings of Furuya et al.'s study.

These studies do not fully capture the complexities and integrative aspect of movement at the piano, however, they do provide information to provide a framework to

assist in analyzing the accuracy of arm weight in the pedagogical literature. The main points include:

a. skilled arm weight technique is assisted by gravity and complex muscular coordination with minimal muscular activity;
b. producing tonal variety involves skilled motor skills and muscular activity to act with the forces of gravity;
c. and movement at joints is assisted by gravity.

Pedagogical usage

a. Skilled arm weight technique is assisted by gravity and complex muscular coordination with minimal muscular activity. *A skilled free fall of the forearm is facilitated by gravity, minimal muscular activity, and a complex coordination and timing of muscular activation and de-activation.*

Free fall, gravity, and muscular coordination are important elements that can be found in all of the pedagogical approaches, with the exception of Mark. While the other four authors agree that free fall, gravity, and muscular coordination constitute important elements of using arm weight, the importance attached to each of these elements differs. Lister-Sink and Karpoff emphasize ‘letting go’ to allow the arms to fall freely with the forces of gravity with less attention of muscular coordination. In efforts to overcome unwanted muscular contractions, Lister-Sink and Karpoff evoke a state of little to no muscular contraction with terms such as limp, fully released, totally relaxed, heavy, supple, and loose. This overwhelming emphasis on releasing muscle contractions to succumb to gravity perhaps detracts from the highly sophisticated relationship between the free fall of the arm and muscular activity. Moreover, directives to ‘let go’ and ‘do

nothing' may compromise the sensitive degree of muscular coordination needed for this action. Nonetheless, Lister-Sink's attention to the timing of muscular contraction and release as the finger passes through the point of sound suggests a very fine degree of muscular coordination and control. The language from Taubman and Fraser bring a different emphasis to muscular coordination, free fall, and gravity. Taubman speaks of freeing some of the weight of the arm into the hand, but in incremental amounts. Fraser clearly states that muscular activity and skeletal structure take greater precedence over gravity. Fraser believes that mastering these two elements before introducing the forces of gravity is of utmost importance. We can see that the pedagogical approaches do consider the same elements of the scientific study when describing arm weight technique: free fall, gravity, and muscular activity. However, the complex relationship between these elements receives varying degrees of attention.

b. Producing tonal variety involves skilled motor skills and muscular activity to act with the forces of gravity. *Changes in dynamics to the sound demand highly evolved motor skills to coordinate the speed of the arm's motion.*

Within the pedagogical approaches, the authors describe a sensitive regulation of arm weight to provide a broad spectrum of tonal and dynamic variety. Lister-Sink suggests that an increase in weight results in more volume, recommending adding weight from the shoulder and torso for a larger sound while weight from the forearm suffices for more refined repertoire such as Haydn. Karpoff demonstrates how weight from the body can change depending on the body position, with instructions to "take the arm weight out by leaning backward"

(chap. 5) to achieve a pianissimo sound, with no reference to corresponding muscular activity. Golandsky also infers the amount of arm weight affects how voices project, with more arm weight for more sound, and less weight for less sound. Conversely, Mark points to the velocity of the fingers striking the keys, not weight, as being the sole determinant in achieving dynamic changes. If weight does not factor as providing speed than one can only assume that he believes that gravity does not play a factor in producing tone. Therefore, increased muscular force provides the speed—an action that the scientific study associates with novice pianists. Fraser focuses more on muscle activation, describing an "internal muscular activity" (2003, p. 44), not the momentum from the arm weight as producing a variety of musical sound. Although he considers 'inner activity' an important factor in directing arm weight and achieving tonal control, there are scarce details to define its meaning.

c. ***Movement at joints is assisted by gravity:*** *The elbow joint moves freely to allow the free fall of the arm.*

The emphasis of the pedagogical literature on maximum freedom of movement at the joints is in line with the scientific consideration that joints other than the elbow may utilize gravity. All five authors draw attention to the role of well-aligned and loose elbow joints, cautioning that tension in the elbows will impede free movement and block the energy of the arm to the key. As noted, Mark does not consider arm weight a component of piano technique, however he points to the importance of cultivating alignment for maximum freedom and ease of movement in all joints. Although the pedagogues agree that a loose elbow plays an important role in arm weight technique, they hold differing views of the position and function of the wrist. Lister-Sink states that the bony arches of

the hand and arm support the arm weight, with the arm serving as a bridge and the underside of the wrist as the keystone, a place that must provide structure for the weight to be transferred. Karpoff takes a different approach. Demonstrating free falls with the wrist often dropping below the keys, he believes that these under motions act to absorb the kinetic energy of the arm weight. Fraser questions this practice of loose wrists, stating that "the forces of the arm never even make it through the wrist joint, not because of blocked-ness but simply a total lack of connection" (2003, p.177). He believes that allowing the wrist to be too loose compromises the structure between the arm, hand, and fingers; thus, the arm weight is never fully directed through to the fingers.

In addition to the elbow and wrist, all five authors consider how the joints from the shoulder complex to the fingertips impact arm weight. In particular, any tension in the shoulder complex seriously impedes the effective application of arm weight. Taubman identifies the shoulder as the fulcrum for whole arm movement and cautions against dropping shoulders that will result in displacing all the weight into the fingers, thereby incapacitating them. Lister-Sink cautions against raising the shoulder blades, stating, "the energy and the weight needed to flow through the arms into the key is trapped in those tight muscles" (1996, 2008, chap. 2). She believes that overly contracting the muscles around the shoulder blades prevents the weight of the arm to fall freely into the keys. Although Karpoff does not specifically point to the shoulders, he stresses the important role proximal muscles play in freely falling to the keys. In contrast, Fraser draws little attention to the shoulder area, focusing rather on the hand structure. Fraser cautions against introducing arm weight too early in the pianist's developing years, as this can compromise skeletal structure of the hand, in turn, the whole playing apparatus becomes

misaligned and unnecessary muscular tension compensates. However, he also points out that if applied correctly, arm weight as a useful tool in cultivating a kinesthetic feeling of skeletal alignment. Although the pedagogical language aligns with the scientific study's emphasis on skeletal alignment to harness the force of gravity, the five approaches present a wide range of opinions regarding the role, position, and range of motion from each joint. These varying views contribute to confusion in how to apply arm weight technique.

This analysis of accuracy demonstrates that the pedagogical usage of arm weight considers the same elements identified in the scientific definition: gravity; muscular activity; timing of muscular activity; skeletal structure; and coordination of arm, hand, and finger. However, the interaction and nature of each of these elements is explained differently among the pedagogical approaches. While Lister-Sink and Karpoff place more importance on free fall and gravity, Fraser stresses skeletal structure as the most important element of arm weight. Despite these differences in the importance attached to each element, this analysis of accuracy has demonstrated that both science and pedagogy recognize many interdependent elements that make up arm weight technique. Arm weight cannot be considered in isolation. Yet, the term 'arm weight' implies a very limited meaning that fails to take all these other factors into consideration. The term itself may be at the root of the confusion. In the end, the weight of the arm is only one small element of arm weight technique. If considered on its own, there is consensus that this is harmful and limiting to piano technique. However, if considered as one element of many others, including muscular activity, coordination of muscles, and skeletal structure, then arm weight takes on an entirely different meaning.

Chapter 7

7. Hand and finger shape

The following summary examines the language the authors use to describe hand and finger shape. Despite being considered an essential component of piano technique, this summary shows that hand and finger shape often reflects individual preferences and misunderstanding of anatomical principles.

7.1 Summary of hand and finger shape

Lister-Sink

Lister-Sink describes the best hand shape as the one that is "built into our skeletal structure" (chap.2). This shape occurs when the arm hangs by the side of the body. She acknowledges that a minimal amount of tension is needed to support the hand arch when playing, but this will not be felt. The hand shape is considered as part of a whole arch structure of the forearm to the fingertips that allows arm weight to transfer to the fingers and back to the torso. The elbow and fingertips serve as the end points of the bridge, and the underside of the wrist as the apex of the whole structure. Even though the wrist is considered the apex, Lister-Sink encourages students to "relax the wrist muscles so that the hand is hanging from the wrist joint" (chap. 1). In describing the desirable finger shape and state, Lister-Sink uses terms such as supple and released, with special attention to the non-playing fingers to rest on keys without tension. She describes this as 'riding the keys'—a necessity in avoiding overworking the "finger-lifting muscles" (chap. 2). Discouraging flat fingers and high, curved fingers, Lister-Sink points out that these shapes divorce the fingers from the arm and contribute to poor coordination.

Taubman

A desirable hand and finger shape are closely related to a 'unified' forearm, hand, and fingers in Taubman's approach. This 'unified' structure means that the forearm and hand always move together in alignment. In describing this structure, Taubman compares the hand and arm to a straight road. She warns a young student that if there is a break in this road the car will fall off. Though she points to the MCP as the apex of this whole structure, she cautions against raising the main knuckle too high as this creates a pull between the muscles on top of the hand, eventually leading to tension, pain, and injury. The 'resting down' state assumes an important role in allowing the fingers to be supported by the hand and forearm. Curved fingers with a flat 'nail joint' are the most preferable shape. While pointing to the distal interphalangeal (DIP) and proximal interphalangeal (PIP) joints of the fingers, Taubman tells a student to "hold the joints perfectly straight" (Taubman, chap. 6). Conversely, curling fingers, clenching fingers, and thrusting fingers are strongly discouraged. Taubman explains that these finger shapes cause the flexors and extensors to contract simultaneously, creating 'dual muscular pull,' thus harmful tension.

Mark

Mark provides scarce details on hand shape, but points to the quality of movement as being the determinant of proper structure. The hand shape cannot be considered in isolation, rather its form and function will depend on the holistic alignment of the torso, shoulder complex, upper arm, elbow, forearm, wrist complex, hand, and fingers. Nonetheless he describe a bridge structure with the elbow and fingertips serving as the end points and the MCP as the keystone. When describing the structure of the hand and

fingers, Mark emphasizes the importance of knowing that the phalanges join the forearm at the carpometacarpophlangeal (CMC) joint. Mapping the joints thus will allow the fingers to span larger intervals with greater ease. Although Mark suggests that moving the fingers from the MCP joint allows for greater speed and facility, he later suggests that this is a very limited view of how fingers move. Promoting the natural curved finger shape as the most preferable, Mark explains that this is "the position in which the muscles are not working either to straighten the fingers or to curl them" (p.107). In addition, the best place of contact with the key is on the finger pad, "a richer source of tactile information" (p. 130). Mark contends that the finger pad provides more awareness of the feeling of the key and thus becomes an important source of information for the brain.

Karpoff

Karpoff describes the natural curvature of the hand as providing the best playing structure. He explains that this shape occurs when the hand hangs at rest beside the body. Instructing a student to play with this position he states: "draw the relaxed hand up to the keyboard….and honour the structure of the hand (Unit 1, chap. 17). It is imperative that the fingers align behind the forearm so that the tendons align in a manner that creates no stress and injury. The fingers should be gently curved, moving from the MCP joint and playing on "the fleshy part of the first digit" (Unit 1, chap. 17). Karpoff frequently describes this desirable hand and finger shape as 'quiet,' 'released,' and 'natural'. Critical of traditional methods that teach 'cup-shaped' hand positions and curled 'claw-like' fingers, Karpoff instructs students to "respect the natural structure" (Unit 7, chap. 2). Despite the emphasis on natural, released, quiet fingers, Karpoff also encourages a degree of support and stability at the DIP joint, a joint he refers to as the 'first digit.'

Fraser

The arch structure of the hand is the cornerstone of Fraser's whole approach. Providing stability and facilitating activity, his comprehensive exploration and descriptions of the opposing qualities of stability and instability that comes from this structure distinguishes his method from all the others. Comparing the hand's arch to Gothic arches, Fraser identifies significant structures: the thumb and fifth finger forming two sides of a transverse arch with the second MCP as the apex; and the forefinger and thumb assembly forming the traditional Russian pianists' arch with the second MCP again serving as the apex of this arch. The second MCP supports the entire structure and is integral to providing form and function to all aspects of piano technique. Discouraging any static quality, Fraser describes the structure as providing support but enabling constant movement, the same state that has already been described in the previous sections, as 'secure instability' and 'unstable equilibrium'. Fraser combines opposing qualities to describe the 'potent' hand. From firmness to flexibility, floating to standing, buoyancy to stability, likening the hand platform to an oilrig platform and a humming bird, the hand's structure is the key to providing a supported structure from which the fingers move.

Fraser advocates a variety of finger shapes, providing detailed descriptions of how each shape contributes to a variety of musical results. In the following description and explanation of various finger shapes he links both form and function of this concept:

> You need to either curl, curve, or flatten your finger depending on the context. The more it's curled, the more the work of the lumbricals is usurped by skeletal structure (in the 'hammer), or the long and short flexors (in the 'hook' or the 'cat-scratch'), each variation giving a specific articulation and colour. The more it's flattened, the more your lumbricals activate, creating really juicy sound and expanding the potency of the metacarpal-phalangeal joints, consolidating their prominent position (2010, p. 169).

Differentiating the metacarpals from the phalanges provides facility, freedom, and power in the fingers. With the metacarpals moving in opposite and equal direction from the phalanges, the metacarpals serve as a platform from which the phalanges move—powered by the lumbricals. In this manner, the pianist feels as if the bones of the finger manipulate the key—not any extra muscular effort, nor the weight of the arm.

7.2 Analyzing consistency

Although there is great variability in the description of hand and finger shape when considering the frequency of references to its positive and negative role, the numbers shown in Tables 14.1 and 14. 2 below reflect the focus and the importance that each author brings to this concept. The most striking result is Fraser's overwhelming attention to both positive role of hand shape (36/38) and finger shape (35/37). Though not as dramatic, the same trend can be observed among the other authors, with the majority of references to the positive role. The exception is found in Taubman's more numerous references to the negative role of finger shapes (7/10).

Table 14.1 *Frequency of references to hand shape as playing either a positive or negative role*

Author	**Positive**	**Negative**
Lister-Sink	3/4	1/4
Taubman	4/5	1/5
Mark	6/8	2/8
Karpoff	11/17	6/17
Fraser	36/38	2/38
Total references from all approaches	60/72	12/72

Table 14.2 *Frequency of references to finger shape as playing either a positive or negative role in piano technique*

Author	**Positive**	**Negative**
Lister-Sink	3/5	2/5
Taubman	3/10	7/10
Mark	2/4	2/4
Karpoff	11/14	3/14
Fraser	35/37	2/37
Total references from all approaches	54/67	16/67

In looking to the terms that the authors use to describe positive hand and finger shape, contrasting qualities of softness and stability emerge. Often, the authors describe a hand shape that occurs naturally and requires little effort. Lister-Sink's instruction to find the curve that is "built into our skeletal structure" (chap .2) is akin to Karpoff's statement to "honour the structure" (Unit 1, chap. 17). Terms found in Table 15.1, such as quiet, released, neutral, evoke minimal muscular involvement in a positive hand shape. Fraser's metaphor "There's a sense of the bones of the hand swimming in a sort of muscle soup " (2003, p. 45) also suggests a looseness and effortlessness. Amid the language that describes this loose, natural hand position is an attempt to describe an arch structure that provides important support and stability. However, apart from Fraser, terms to describe this quality are used sparingly. In contrast, Fraser uses a strong vocabulary to describe the actions needed to maintain a potent hand, stating: "the hand must be galvanized into

action" (2003, p. 21). Terms evoke a muscular activity and effort that the other authors largely avoid. To combine the opposing qualities of stability and flexibility, Fraser employs an extraordinary array of invented terms as shown in the table below.

Table 15.1 *Scientific, common, invented terms to describe a positive hand shape*

Author	**Scientific**	**Common terms**	**Invented terms**
Lister-Sink		Natural arch; Curved; Arm arch; Hand muscles; Built-in arch; Hand; Knuckles	
Taubman		Unified; Straight (forearm and hand)	Hand and arm "like a road going on to a bridge…the road has to be perfectly straight" (chap. 4). Resting down
Mark	Metacarpals, Metacarpophlangeal (MCP) joints	Free; Little finger orientation; Self-supporting; Strong; Stable Not rigid; Efficient; Main knuckle	
Karpoff	Metacarpophalangeal joints	Knuckles; Quiet; Released; Open; Cluster position; Stable bridge Natural curvature; Relaxed	
Fraser	Metacarpals 2^{nd} MCP (Keystone of arch) Metacarpophalangeal (MCP) joints Metacarpals,	Strong; Empowered; Potent; Activated; Supple; Stiffened; Rigidify; Flexible; Fixed Grasping; Capable; Firm; Natural; Neutral; Knuckle; Fully potent; Active; Strong; Buoyant Natural; Balanced; Russian arch	Functional entity; Flexible solidity; Standing base Stable platform; Stable structure; Hand-platform; Secure base; MCP likened to a hip; Stable platform; Firm base Oilrig platform; Moveable stability; Bones swimming in liquid hands; Harpsichordist hand; Helium balloon buoys up metacarpals; (describing metacarpals); Hummocks (describing MCP joints); Little hummock; Knuckle mounds; Ridge of knuckles; Hillock MCPs

Similar patterns of consistencies and inconsistencies in attempts to merge two opposing qualities of suppleness and strength can be observed when describing finger shape. Terms in Table 15.2 such as 'soft' and 'loose' focus on the natural curvature of the fingers. In bringing more detail to what this means, Mark describes this natural curve

as "the position in which the muscles are not working either to straighten the fingers or to curl them" (p.107). Along with this quality of neutrality is a recognition that the DIP and PIP joints must not collapse. Karpoff provides specific exercises to encourage stability at these joints. Although Taubman advocates for a natural curve of the fingers, while pointing to the PIP and DIP joints of a student, she instructs the student to "hold the joints perfectly straight" (chap. 6). In typical fashion, Fraser articulates this duality of flexibility and security with a vast and inventive catalogue of terms.

Table 15.2 *Scientific, common, invented terms to describe a positive finger shape*

Author	**Scientific**	**Common terms**	**Invented terms**
Lister-Sink		Supple; Released Resting; Hanging from the apex; Riding the key	Finger lifting muscles
Taubman	Phalanges	Lightly curled; Aligned; Unified (with hand and forearm); Perfectly straight joints (pointing to the DIP and PIP); Curving	Resting down Flat nail joint
Mark	Phalanges Proximal interphalangeal joints (PIP) Distal interphalangeal joints (DIP)		
Karpoff	Phalanges; First phalanx	Quiet; Released Aligned; Slight curve Gently curved; Supported Stable	
Fraser	Minimum natural tonus Phalanges Distal phalange Medial phalange Proximal phalange Middle phalange Distal interphalangeal joint (DIP) Proximal interphalangeal joint (PIP) Extensors Interosseous Superficial flexors Deep flexors	Active; Stiff; Strong Absolutely secure; Galvanized; Vital Immobile; Natural Floating; Natural curve Not straight; Moveable Soft; Free; Neutral Digit; Sensitive; Flexible Flat; Moderately curved Loose; Natural state of soft muscle tonus; Fleshy Powerful; Fingers; Digits	Thumb-forefinger assembly likened to pelvis and two legs Whole banded finger group Standing finger Pylon Yin and yan fingers Hammer action Cat scratches Loose curved-ness Firm implantedness Secure state of standing Curling in a special way

When looking to the language used to describe negative hand shape, inconsistencies are observed. Apart from Fraser, the authors are critical of imposing a structure on the hand that results in too much tension. Lister-Sink suggests that the traditional teaching methods that advocates for a rounded hand position creates ‘tight hand muscles’. Similarly, Karpoff describes the commonly taught ‘cup-shape’ as producing ‘conflict within the hand’. In contrast, Fraser warns that not cultivating appropriate skeletal support leads to collapse and severely compromises facility, leading to conditions of compensatory tension that impedes movement.

Table 16.1 *Scientific, common, invented terms to describe a negative hand shape*

Author	**Scientific**	**Common terms**	**Invented terms**
Lister-Sink			Tight hand muscles
Taubman	Abductors Adductors	High knuckles	
Mark	Ulnar deviation	Thumb orientation	
Karpoff		Cup-shaped Fixed Swiveling	Conflict within the hand
Fraser		Collapsed Phlegmatic Hyper-Extended Wrist as keystone Natural	

Familiar patterns of inconsistencies in describing negative finger shape can be observed in Table 16.2 below. With the exception of Fraser, the authors describe negative finger shape with terms such as curled, clenched, grabbing, and flat—the very qualities that Fraser encourages to achieve a wide range of musical effects. The other authors raise concerns that these finger shapes create conditions of undue tension, impeding movement and possibly leading to injury. Fraser makes a case for flat fingers, curled fingers, claw-like fingers, believing that when used with appropriate effort and differentiation of the phalanges from the metacarpals, these shapes open up a wide range of tonal possibilities.

Table 16.2 *Scientific, common, invented terms describing a negative finger shape*

Author	Scientific	Common terms	Invented terms
Lister-Sink		High, flat	Finger muscles
		High, curved	Finger-lifting muscles
Taubman	Tight long flexors	Curled	Overworked finger muscles
		Clenched	
		Grabbing	Nail joint
		Hanging	
		Straightening motion	
		Thrusting	
Mark		Stiff—no internal activity	
Karpoff	Extensors	Hyper-extended	
	Flexors	Activated	
	First phalanx	High	
		Not released	
		Curled	
		Claw-like	
Fraser		Poking	

This analysis of consistency shows that, on the surface, there appear to be many opposing views on how to describe positive and negative hand and finger shape. All the authors recognize that the hand and finger shape must allow for free movement with adequate support. However, with the exception of Fraser, attention to a supple, natural structure often overshadows the need for stability. Wary of creating any harmful tension, the language does not always communicate a sense of supportive structure and one is easily convinced of Fraser's argument that a natural hand shape produces a "flaccid, phlegmatic" structure. In part, the problem may stem from the challenges in describing the dual qualities of a hand and finger shape that is both secure and supple. Though Fraser's paradoxical descriptions can overwhelm, his terms encapsulate the duality that can be observed in some of the other author's terms. Nonetheless, the solidity and strength that is underscored by Fraser's terms contrast starkly from all the other

approaches and represents a large gap in how language is used to describe hand and finger shape.

7.3 Analyzing accuracy

Although hand and finger shape do not fall within the same established scientific definitions of the other concepts of tension, relaxation, and co-contraction, recommendations from Wristen's study provide some parameters to evaluate the accuracy of the language used to describe hand and finger shape.

Scientific definition

In a qualitative study of motions used in specific technical tasks, Wristen (1998) remarked that piano pedagogues recommend a wide array of hand positions and finger shapes, often based more on tradition and personal preferences than anatomical and biomechanical rationale. Moreover, many pedagogical approaches present inaccurate anatomical information. Wristen contends that although many scientific studies have examined different hand positions and finger shapes to play the piano, they fail to take into account the complex motions and physical coordination of the whole body that is needed to meet constantly changing musical and technical demands. To come to a better understanding of a piano technique that provides the best biomechanical advantage, Wristen conducted a qualitative analysis of movement patterns for selected technical tasks at the piano. Her research led to several recommendations to avoid harmful practices and to adopt motions that provided more biomechanical efficiency to prevent injury. Recommendations relevant to hand and finger shapes included avoiding static finger and hand positions and playing in a manner that allows for optimal skeletal alignment. The overarching premise is that situations that create undue tension should be

avoided while integrated, coordinated movement should provide the basis of a healthy technique.

In addition to Wristen's study, this research problem identified inconsistencies and inaccuracies in how pedagogues identified anatomy specific to the hand and fingers. Based on Wristen's recommendations and the wide variety of terms used to describe anatomy that was identified in this research, the following topics provide guidelines to analyze the accuracy of language describing hand and finger shapes:

a. Hand and finger shapes should avoid undue tension;
b. The language should reflect an accurate knowledge of anatomy.

Pedagogical usage

a. Hand and finger shapes should avoid undue tension: *Hand and finger shapes should avoid situations that create undue tension, in particular static positions.*

With the exception of Fraser, the authors promote a hand and finger shape that comes from its natural curve to avoid undue tension. As shown in the pedagogical language analyzing consistency, there is a shared sentiment that the hand and finger should not deviate from its naturally occurring shape. In contrast, Fraser argues that it is the very characteristics the other authors discourage that creates tension. Fraser suggests that the commonly taught position of a 'natural' curve often results in a hand that is too flat, adding that: "this hand shape exerts an insidious, perhaps unnoticeable strain on your system" (2010, p. 69).

Despite these differences in opinion, the pedagogues avoid using terms such as 'position' and 'shape' that evoke a static quality that may lead to tension. Instead, they focus primarily on the quality of movement. Nonetheless, some directives are

inconsistent with the desired outcome. Taubman's analogy of the unified forearm, hand, and fingers as a road that must stay straight so that cars do not fall off may lead students to contract muscles excessively just to maintain this position—a state she clearly discourages. Similarly, Lister-Sink's advice to place a hand over an orange to find the optimal hand shape contradicts her warnings not to impose an arch on the hand's structure. On the other hand, efforts to describe a quiet and released hand do not always impart a sense of structural integrity in the hand shape. Although many of Fraser terms avoid depicting a static quality with terms such as 'floating oilrig platform' and 'moveable stability', other terms such as 'stable base' and 'firm implantedness' convey a more stationary quality. Nonetheless, he discourages the use of the word 'hand position': " I hesitate even to use the word 'position', as it implies something fixed in space. No, this 'position' is simply the place in space where your fingers hang out if you just let them go" (2010, p. 84).

b. The language should reflect an accurate knowledge of anatomy: *The terminology used to describe anatomy should present an accurate representation of anatomical facts.*

A wide range of anatomical, general, and invented terms can be found within and among each of the approaches. From hand muscles to interosseous, nail joint to distal interphalangeal joint, there is little consensus among the five authors in what to call the different joints and muscles of the hand and fingers. Problems in conveying specific information occur when the authors refer to the apex of the arch structure of the hand differently. Taubman's descriptions of " the main knuckle is higher than the main knuckle"(chap. 6), though most likely attributed to a careless error, contradicts later

warnings to avoid raising the main knuckle as this produces too much muscular pull. Lister-Sink's description of the apex of the arch as the underside of the wrist and Karpoff's instructions to "honour the structure" (Karpoff, Unit 1, chap. 17) provide very general descriptions. In contrast, Mark stresses the importance of developing an accurate representation of the anatomical structure to move in accordance with structure. To this end, he uses anatomical terminology to refer to all joints of the hand and fingers. Similarly, Fraser uses anatomical terms but adds to this with his distinctive lexicon. In part, the reasons for these discrepancies come from having to adapt the terms to suit the audience the authors are addressing. In many cases, the audience may be unfamiliar with anatomical terms. Nonetheless, the wide range of anatomical, general, and invented terms found in the pedagogical approaches contributes to the confusion and it is not always clear what part of the body the pedagogues are referring to. For example, the term 'first digit' could mean the first finger, or the distal interphalangeal joint, or the thumb.

The analysis of the accuracy shows that there are challenges in using accurate terminology to describe hand and finger shape in the pedagogical approaches. The concepts that have been examined in this study—tension, relaxation, co-contraction—all come to play when describing hand and finger shape. Because the pedagogues do not always describe each of these concepts accurately, the face challenges in providing an accurate description of hand and finger shape. Lacking a language that distinguishes healthy tension from harmful tension, pedagogical descriptions focus on hand and finger shapes free of tension, leaning towards a state of too much relaxation. This is observed in such descriptions as a "very relaxed hand" (Karpoff, Unit 3, chap. 12) and in Lister-Sink's instructions to let the fingers hang from the wrist. Challenges in reconciling

stability with fluidity, all elements of healthy co-contraction, are observed in the stark contrasts between Fraser's call for a galvanized structure with strongly established arches that contrast with the others loose, natural hand shape. Lastly, the wide assortment of anatomical, general, and invented terms, as found in the approaches, contributes to the confusion and does not present accurate information.

Conclusion

This study set out to identify where issues of language may exist in current piano pedagogical approaches and to show how these problems may contribute to the confusion in piano technique. The extensive data collection of the language used to describe and define core concepts from the selected authors revealed significant problems with inconsistent and inaccurate language. An analysis of the language found various reasons that can be attributed to inconsistency and inaccuracy: there is an incomplete understanding of anatomical and biomechanical principles; the authors struggle to articulate the opposing dualities of stability and flexibility that typifies much of piano technique; the authors do not always distinguish feeling from fact; and the authors freely interchange scientific, common, and invented terminology. Rather than advancing and enlightening our understanding of piano technique, this problematic language often misinforms and misleads.

Although the authors claim to base their approaches on biomechanical and anatomical principles, this is not always the case. The language presents a confusing picture of muscle and joint function. Directives and descriptions often convey muscular states that can be turned completely off and on, referring to a total relaxation or total release of tension. The language often fails to describe varying degrees of muscle contraction that must correspond with the changing physical demands needed to play the piano. The belief that joint stabilization is a choice, not a necessity, clearly contradicts biomechanical principles. With so much focus on the total elimination of tension, or cultivation of complete relaxation, or little to no joint stability, the authors often ignore

the importance and necessity of managing these important concepts so that they may contribute positively to piano technique. Because these concepts are so interconnected to all other aspects of piano playing, in particular, arm weight and hand and finger shape, this very narrow and often incorrect picture of tension, relaxation, and co-contraction creates widespread misunderstandings. Instructions to completely relax muscles and release all tension to master the application of arm weight mislead pianists. Suggesting that the joints of the hand and fingers require no stability misinforms. Even terms describing specific areas of the hand and finger are not always accurately or precisely described. In part, the reasons for this inaccurate representation of tension, relaxation, and joint stability, comes from the difficulty in describing just the right amount of tension, and just the right amount of relaxation, to provide just the right amount of joint stability. Neither too tense, nor too relaxed, it is this state of stability and flexibility that often proves difficult to explain.

The authors confront enormous challenges in communicating this paradoxical quality that permeates so many of the aspects of piano technique. They struggle to articulate the fine balance between tension and relaxation; a stable and supple hand shape; fixated and flexible joints; heavy and buoyant arms. Lacking a terminology that adequately conveys these contrasting qualities, the language tends to focus on the desirable qualities of soft muscle tonus and loose joints, often overlooking the necessary qualities of stiffness and stability. All the authors attempt to describe the opposing qualities integral to piano technique, however it is Fraser who introduces a new vocabulary that directly addresses this dichotomy. Combining contrasting terms, Fraser describes fingers that are strong and flexible as loosely banded fingers; a hand provides

secure instability; relaxation is empowered and stable; and freedom is controlled. These descriptions can overwhelm with their contradictions; however, Fraser's extensive explanations underscore the challenges in describing the opposing dualities that define so much of piano technique.

In addition to a poor understanding of anatomical and biomechanical principles, and difficulty in describing the duality of tension and relaxation, the authors face challenges in reconciling the subjective experience from what is really happening. Viewed through the prism of feeling, the language does not adequately differentiate between sensation and the mechanics of movement. Indeed, both Lister-Sink and Fraser point to the fact that muscles do contract to stabilize joints, but this should not be felt—if there is a feeling of contraction or stability in joints, this is a sign that muscles are over-working. It is this feeling of absolutely no muscle contraction that the authors attempt to describe. In doing so, they often fail to discern between feeling and function. This problem is particularly evident when looking to the concept of arm weight. Recurring problems of distinguishing total relaxation and total release of tension from necessary muscular contractions produces contradictory terms and statements. A closer look reveals that the authors are attempting to describe two things at once—what is happening and what is being felt.

Indeed, the extraordinary array of scientific, common, and invented terms found throughout this study underscores the complexity of describing the mechanics and the feeling of physical movement. However, it is this wide range of terminology that often contributes to the confusion. Frequently switching between the terms, the concepts take on different meanings depending on how it is being used. There is little consensus in how

the concepts contribute to piano technique, resulting in conflicting advice. For example, as a scientific term, tension may mean a muscle contraction that is a necessity in all movement; as a common term, tension can mean a chronic state of tight muscles that blocks movement and becomes a primary source of playing-related-injury. Lastly, as an invented term, it can mean something that must be 'emptied' or a battle between muscles that must be avoided. This use of metaphorical language and imagery has long been recognized as a valuable teaching tool in the field of piano pedagogy. Therefore, the issue of how to reconcile metaphors with accuracy and consistency needs to be addressed.

As the results of this analysis evolve, there will be pedagogical implications. Pedagogy books may adopt anatomical terms and use more discretion in the use of terms of tension and relaxation. Exploring terms that describe the appropriate balance of tension and relaxation and of movement at the joints will lead to a more informed and open discussion of piano technique. The language used by pedagogues to discuss the mechanics of technique amongst themselves will not necessarily be the same language used to communicate concepts to young students; but it is important that language aimed at a younger audience is rooted in accuracy with a common understanding of its meaning. This study's scope was limited to pedagogical material directed at more advanced pianists. Although this allowed for a more intense investigation, research into similar issues of how the language is used in novice pedagogical material would be a valuable contribution.

This study has identified inconsistencies and inaccuracies in the language used to describe piano technique and sheds light on some of the issues contributing to these problems. To address these problems and issues, changes are needed. If piano technique

is promoted as being based on anatomical and biomechanical principles, then the pedagogical community has an obligation to ensure that the language they use accurately reflects this. This will require a solid understanding of anatomy and joint and muscle function along with a commitment to ensure that the language is consistent and accurate. This will require an effort to use language that clearly differentiates between the subjective experience and the reality, metaphor and science, and this will require an open discussion of the challenges pedagogues face when describing the opposing dualities that is the nature of piano technique. These represent some first steps in addressing the issues of how language is used. Ultimately, it is not just a matter of employing accurate language, but of developing a better understanding of the relationship of anatomy and mechanics of movement to play the piano. These are complex issues that require a consistent and accurate language. Moving towards a language that is clearly understood will facilitate advances in understanding the mechanics of technique. Piano technique need no longer remain a mystery, but a skill that can be explained logically and clearly to all students.

Appendix A: Data Collection

Legend for Role category

N: Negative Role. The concept contributes negatively to piano technique.
P: Positive Role. The concept contributes positively to piano technique.

A.1 Tension

Table A.1.1 Lister-Sink (Wingsound, 1996, 2008)

Context	Definition/Description	Terms	Role	Summary
Natural, pendulous use of the arms	Suggests that chronic tension in upper arm muscles and shoulders can be cured by allowing "the arms to hang freely as if they were pendulums" (chap. 1).	Chronic, dangerous tension	N	Chronic tension of shoulders and upper arm muscles common among pianists. Tension can be accumulated, but allowing arms to be supported by torso will prevent this "build-up of tension" (chap. 1).
Natural, pendulous use of the arms	Excessive, artificial movement at arms, including sticking arms out to sides leads to chronic tension and "blockage of power from torso and shoulder levers" (chap. 1).		N	Unnatural movements at arms, sticking arms out to support forearms lead to tension in the arms.
Efficient muscle use	"We only need any significant muscle tension at the very moment of impact...No noticeable tension in the arms and hands as they are lifted and none at all when they fall" (chap. 1).	Any significant muscle tension Release tension	P	Degree of tension varies with activity: some tension, but not noticeable, to lift hands and arms: no tension in arms and hands when they fall; tension to stabilize joints on impact of finger with key; tension is released at moment of impact of finger with key.

Overuse, misuse and accumulation of tension	"One of the greatest causes of discomfort and injury is the accumulation of muscular tension and the resulting stresses that tension places on the body and mind" (chap. 1).	Excess muscular tension	N	Accumulation of muscular tension is a major cause of playing-related injury and discomfort. Letting go of excess tension allows for freer playing. She acknowledges that we do need some tension to play—but people mostly play with too much.
Overuse, misuse and accumulation of tension	If muscles continually release, "it is possible to play in a way that muscle tension is never accumulated" (chap. 1).	Accumulate Release	N	If muscle tension is continuously released it will not accumulate.
Overuse, misuse, and accumulation of tension	Chronic muscle tension: continuous signals from the brain for muscles to contract. Commonly found in neck, shoulders, and arms. People often do not feel the tension due to "sensory overload amnesia" (chap. 1).	Chronic muscle tension Sensory overload amnesia	N	Continuous contraction of muscles results in chronic muscle tension. Pianists often become inured to this state, as they are unaware of the tension that has accumulated. Tension creates "stresses and injuries" (chap. 1).
Overuse, misuse and accumulation of tension	Steps to eliminate chronic muscle tension: 1. Awareness of the state of the tensed muscles, 2. Regain conscious control of the tensed muscles, 3. Learn and apply the principles and sensations of efficient muscle use (chap. 1).	Chronic Muscle tension Neuromuscular re-programming	N	Spells out steps of neuromuscular reprogramming to get rid of chronic muscle tension: develop awareness of tension in muscles; learn to consciously contract and release muscles; develop kinesthetic awareness of control of tension and release.
Overuse, misuse and accumulation of tension	"Resistance signals some muscle tension" (chap. 1).	Resistance	N	Resistance is a sign of muscle tension.
Playing groups of notes with basic stroke	If there is tension there is a "blockage of power" (chap. 1).	Excessive Chronic	N	Tension blocks power.

Applying good coordination to music repertory	Once ready to apply injury-free technique to music repertory, the emotional response may trigger body tension. Equates tension with effort and "loss of suppleness" (chap. 1).	Body tension Excessive Unnecessary Loss of suppleness	N	Emotional response and physical reaction to music may trigger excessive body tension. Tension opposite of supple and associated with effort.
Raised, tightened shoulders	Raising shoulder blades leads to chronic tension in neck and down the arms. "Mobility of our joints is lost, and the energy and the weight needed to flow through the arms into the key is trapped in those tight muscles" (chap. 2).	Tension	N	Chronic tension can trap weight and energy in tight muscles.
High, curved fingers	High curved fingers results in low wrist, arm arch collapses leading to "tension in the hand muscles and eventually paralyses and locks the joints in place" (chap. 2).	Locks and paralyses joints	N	A chain of events leads to counter-productive tension: high fingers produce low wrists; low wrists cause collapse of arm arch; and muscles tense excessively around joints to hold them in place. Movement becomes difficult.
Basic Stroke	Free fall of arm, "let go of all muscle tension throughout the arms and let them free fall" (chap. 1).	Let go	N	To experience free fall of arms let go of all muscle tension throughout the arms.
Basic stroke	To find optimal alignment and seating position at the bench, unnecessary tension must be released.	Unnecessary tension	N	Release unnecessary tension to find point of balance and alignment in seating position at piano.

Basic stroke	Learning how to lift forearm: Must learn to lift without any unnecessary tension. "Relaxing the entire arm completely" (chap. 1).	Free all tension Empty of tension Unnecessary tension Hidden tension	N	Forearm can be 'emptied' of unnecessary tension during lift. Release muscle tension on command. Releasing tension allows for free movement and power.
Basic stroke	Releasing muscles after contracting to stabilize joints for arm weight to be transmitted ensures that harmful tension is never accumulated.	Release Harmful tension	N	It is crucial to release any muscular tension used to stabilize joints to permit the transfer of arm weight. Tension can be accumulated; therefore, its constant release is important to avoid excessive amounts.
First steps to learning basic stroke	Teacher touches hand, shoulder, and arm as a means to bring awareness to tension to allow release of unnecessary tension.	Unnecessary tension Hidden tension	N	Physical touch from teacher helps to bring a kinesthetic awareness to allow student to release tension.
Artificially formed hand arch	Assuming natural hand arch allows for no feeling of the minimal tension needed to support the arch: "It is a question of finding just the right amount of tension—no more, no less" (chap. 2).	Minimal Just the right amount No more, no less.	P	Finding the right quantity of tension needed to support hand arch is important: "No more—no less" (chap. 2). Although the tension is present, it is not felt.
Applying free fall to more challenging music	Important to avoid physical tension associated with emotional intensity.	Harmful tension Unnecessary tension	N	Harmful and unnecessary physical tension may result when responding to the emotional intensity in music.
Applying free fall to more challenging music	"The secret to virtuoso technique is the mastery of impulsed fragments which prevents tension build-up" (chap. 2). Hand and arm feels weightless and released when tension-free.	Tension buildup Weightless Released Effortlessness Freedom	N	The key to mastering technique is avoiding tension build-up by using a practice technique of impulsed fragments—playing small fragments of music and immediately releasing all tension by allowing hand to drop in lap. Rest in between and then gradually build each of the 'impulsed fragments' to make longer phrases. A feeling of weightlessness associated with no tension.

Table A.1.2 Taubman (Bloomfield Golandsky, Schnitzer, Taubman, Urvater & Yaguspsky, 2001)

Context	Definition/Description	Terms	Role	Summary
Muscles involved in playing the piano	Important to know flexors and extensors that move fingers down and lift up are situated in the forearm. Golandsky[1] states: " they pull in opposite directions—so clearly they can never be used at the same time—and because if they are, what results is what we call 'dual muscular pulls' which is another name for tension. Anytime that you move in a way that activates those two muscles at the same time you will end up with tension" (chap. 3).	Dual muscular pull	N	Using extensors and flexors at the same time to lift fingers described as 'dual muscular pull' and always results in tension.
Joints as levers	Taking joints to extreme range of movement puts tension on the joints. Golandsky states: "Any motion that goes in extreme is in danger of creating an injury" (chap. 3).	Pull	N	Putting hand in extreme range of motion results in tension in wrist.

[1] Throughout this DVD, Taubman's assistant at that time, Edna Golandsky, reads from Taubman's lecture notes and demonstrates how to apply Taubman's principles and concepts at the piano. In addition, clips from master classes with Taubman and students are provided. For this reason, references to both Golandsky and Taubman are found in this study when referring to Taubman's work.

Finger movements	Clenching fingers to hold on to keyboard causes tension.	Clenching fingers	N	Tension created by fingers clenching to hold on to keyboard, because weight is not distributed properly.
Finger movements	Golandsky states: "To fixate or mold is nothing more than forms of tension, however much the amount…even a little bit would be wrong" (chap. 5). Reading from a Taubman lecture, she states: "The slightest tension will limit motion" (chap. 5).	Fixating Tighten Slightest tension	N	Do not fixate (tighten) fingers into position. Fixating fingers into hand positions causes tension. Any degree of tension will impede motion.
Finger movements	Quality of movement is what will ensure no tension—cannot command muscles to relax, activate.	Dual tensions	N	These muscles move involuntarily—cannot make commands to relax and activate—rather, the movement has to be of a quality that will not create dual tensions.
Finger movements	Curling fingers creates tension, movement is difficult.	Curling	N	Tension created by curling fingers impedes free and fast movement.
Causes of injury	Golandsky shows how pushing at bottom of key creates "a tremendous amount of tension" (chap. 8). Aim for the point of sound, but at the bottom "there is no more work, no more effort" (chap. 8).	Tension Pushing	N	Pushing into bottom of key creates tension. No effort at all is required once the point of sound is reached.
Finger movements	Fingers are moved with light muscles, but there is a lot of resistance of key at surface—so finger would have to move quickly.	Tense up Hovering up Holding up	N	Efforts to play softly by holding up to play slowly into key often causes people to 'tense up.'

Causes of injury	Golandsky: "Tension can come from tension —from overusing the muscles—it can come from tremendous relaxation where it takes a tremendous effort to move again…too much effort can be tension" (chap. 10).	Too much effort	N	Equates tension with too much effort or too much relaxation. A great deal of muscular effort is needed to get moving from a relaxed state, thus resulting in tension.
Causes of injury	Taubman states: "One of the by-products of a tense technique…it is assumed that to play with intensity you have to have your body feel tense, and the opposite is true…if you tense the only thing that happens is that the playing is laboured. You have to be free to make it intense…" (chap. 12).	Tense technique	N	Musical intensity should not come from a feeling of tension in the body. Rather, to convey intensity one needs to be free.

Table A.1.3 Mark (2003)

Context	Description/Definition	Terms	Role	Summary
Basic Concepts	"A motion that involves even a small amount of tension can lead to injury when repeated thousands of times a day over a period of years" (p. 1).	Small amount	N	"Small amount of tension" (p. 1) in a motion leads to injury.
Basic Concepts	Defines tension: "means excessive muscular work—work in excess of what is needed to accomplish the task at hand" (p. 1).	Excessive muscular work	N	Clearly defines tension as using more muscular work than required to execute a specific task.
Basic Concepts	"Tension can come from social or cultural attitudes" (p. 1). Misleading ideas of what constitutes good posture produce tension.	Tension	N	What is commonly believed to be 'good posture' creates tension.
Basic Concepts	"Teaching methods condone or even inculcate tense ways of moving" (p. 2).	Tense movement	N	Movement can be tense—byproduct of some teaching approaches.
Basic Concepts	Taubman considered movement at the piano as "easy or difficult, tense or free" (p. 4).	Tense movement	N	A movement that is not tense is free and results in a "better quality of movement" (p. 4).

Basic Concepts (Alexander observations)	Alexander "identified characteristic patterns of tension that interfere with breathing, speaking, and moving, sometimes causing severe impairment of those functions" (p. 4).	Characteristic patterns of tension	N	Alexander observed patterns of tension interfering with natural functions of breathing, speaking, moving.
Basic Concepts	"Piano playing that is accomplished by high-quality movement, in which each part contributes its proper share with no tension, will be free, expressive, and secure" (p. 5).	No tension Opposite of free (inferred)	N	Movement with no tension results in playing that is "free, expressive, and secure" (p. 5).
Basic Concepts	"Most actual movement falls somewhere in the middle, neither absolutely free nor completely tense" (p. 5).	Tense Opposite of free (inferred)	N	In real terms, most movement is not "completely tense" (p. 5) or completely free.
Basic Concepts	"Two movements of the hand and fingers may look outwardly similar, and yet one may be free and easy, the other stiff and tense" (p. 6).	Stiff and tense Limited Injurious	N	Difficult to visibly discern quality of movement as tense or free.
Discussion of commonly taught concept of still arm, active fingers.	Keeping arm still, moving only the finger "guarantees tense movement. Holding the arm still is accomplished by tensing it, and then, with the arm fixed and tense, the finger must work much harder" (p. 7).	Fixed and tense	N	Tensing associated with holding arm still, creates more work for the fingers.

Dangers of still arm active fingers	"Someone who diligently follows those instructions (still arm) will acquire a small repertoire of tense movements instead of a huge repertoire of free movements adaptable to any pianistic situation" (p. 7).	Tense movements	N	Keeping arm still results in tense movement, fewer movement possibilities than that which is free.
Basic Concepts	Instructing a pianist to "pace yourself to avoid any buildup of tension is fatuous" (p. 7).	Buildup of tension	N	Impossible to reduce tension by changing the amount of time when playing—the quality of moving is paramount—not quantity.
Basic Concepts	"Is the movement tense or free?" (p. 7).	Tense or free	N	Awareness of quality of movement important for injury-free (not tense) playing. Tense is opposite of free.
Basic Concepts	"Typically, they [pianists] fix or set their collarbones and shoulder blades when they play, which involves tension. But they are not aware of the tension as they play" (p. 7).	Fix Set Tension	N	Lack of awareness of tension in movement when playing leads to injury and pain. Tension associated with setting and fixing joints.
Basic Concepts	When concentrating on finger action, "I may be completely unaware of tension or movement in my back and neck" (p. 8).	Tense Fixed	N	Focusing on finger action can result in a lack of awareness of tension in back and neck.
Training awareness	"When we expand our awareness to include the parts that have been fixed and stiff, they come alive. We can notice tension and release it" (p. 9).	Fixed Stiff Release tension	N	Awareness of stiffness and fixation allows for an awareness of tension—in turn, this permits release of tension.

Skeletal alignment	"Minimum of help from muscular contraction" (p. 44) opposite of relaxed. "Do they [muscles] tense or stay relaxed?" (p. 45).	Inappropriate	N/P	Tension results from poor skeletal alignment. Appropriate muscular contraction allows optimal skeletal alignment.
Relationship between hand and arm	Inverse relationship: more arm tension=less hand strength. Less arm tension=more hand strength.	Compensatory Counter-productive	N	If skeletal structure lacking, counterproductive tension will compensate for this weak link.
Banded fingers	If structure of fingers and hands is weak, negative tension in the wrist develops; in turn, tension blocks the kinetic energy.	Excess Negative	N	Tension results from poor structural alignment of hand and blocks energy.
Whole arm acts as a finger	Shoulder tension created by "lack of physical connection to the keyboard" (p. 168). "Transform tension into finger action" (p. 168)	Transform tension	N	Tension caused by weak links in playing apparatus: can be transformed into positive use for finger activity.
Minimal movements of wrist	"Graceful movements supposedly designed to avoid tension" (p. 178).	Useless Destabilize Compensatory Stabilizing	N	Extraneous movements cause weak links in structure thus creates negative tension. Equates suppleness with a lack of tension.
Gesture in phrasing	Excess effort often occurs when preparing to play: "tremendous tendency to make some effort when we play, to prepare by contracting somewhere in our mechanism" (p. 341).	Effort Tension Contracting Absolute minimum	N	Tension equated with a lot of effort and muscular contraction. Minimal tension required. Extra effort (tension) prevalent in preparatory gestures. Impedes movement.

Playing with pulse	Tension is the opposite of mental and physical relaxation.	Constraint Any tension	N	Any tension limits musical outcomes, accuracy.
Gesture in phrasing	Musical response can create inner tension: "inner tension triggered by some emotion" (p. 343).	Over-try Press Inner tension Too Involved	N	Tension created by emotional reactions can interfere with musical intent.
Orchestration	Emotional tension manifests as physical tension.	Emotional tension Internal tension	P/N	Differentiate between emotional and physical tension for most musical outcome.
Natural hand and finger shape	The opposite of softening muscle tonus. Equated with effort. Natural hand shape is free of tension.	Effort Tension Superfluous	N	Surplus muscular tonus=effort=tension Interferes with natural finger shape.
Natural hand shape	Natural finger shape is free of undue tension.	Undue tension	N	Getting rid of undue tension will help finger to assume natural shape.
Finger shape.	Check tension by touching flesh.	Muscle tonus	P/N	Degree of tension is a tangible quality.
Finger shape	Less muscle tonus and effort equated with "naturally balanced muscle tonus" (p. 225).	Muscle tonus Effort Reduced Natural balanced tonus	P/N	Tension equated with degree of muscle tonus. Naturally balanced tonus optimal.
Training awareness	More kinesthetic awareness while playing the piano allows us to "notice a hint of tension building in our neck, so we release it" (p. 10).	Tension Release	N	Developing awareness of tension allows us to release it.
Body mapping	"Tension detracts from our piano playing" (p. 11).	Tension	N	Tension not a desirable quality for playing the piano.

Mapping the structure	If we are in balance "Tension can be released and we are free to approach piano playing from a position of mechanical advantage" (p. 18).	Release tension	N	Balanced skeletal structure allows tension to be released, brings about freedom of movement from a "mechanical advantage" (p. 18).
Mapping the structure	An incorrect kinesthetic sense of two jaws creates tension.	Creates tension	N	Incorrect body mapping of jaw creates tension.
Mapping the structure	An incorrect perception of support provided by processes of spine causes "back pain and tension" (p. 23).	Tension	N	Incorrect body mapping of processes of spine to bear weight and support the skeleton is a cause of tension. Tension is associated with pain.
Mapping the structure	Lengthening and gathering of spine occurs when there is no tension.	Tension	N	Tension can inhibit lengthening and gathering of spine, a vital function for pianists.
Mapping the structure	Natural lengthening and gathering of spine is "just the way your body works when it isn't tensed" (p. 25). Feeling "fully embodied, without tension" (p. 25) occurs "when you have a conception of the sound you want" (p. 25).	Tensed Fully embodied, without tension	N	Allowing the body to work naturally means that it is not tensed. A feeling of total embodiment and a clear sense of desired sound associated with no tension.
Mapping the places of balance	Posture myth: "we should not be tense or rigid" (p. 33). Adhering to the posture myth causes many people to "constantly hold muscles tense as they attempt to maintain prescribed posture" (p. 33).	Tense Rigid Hold muscles tense Effort	N	Posture myth is to stand tall with the chest out. However, many people "hold muscles tense" (p. 33) to attain this type of posture.

Mapping the places of balance	Analogy of an erector set for skeletal structure (p. 33). "Depending of the structure's design, continual tension on the strings might cause it actually to change shape. Or it might retain its shape despite the tension, with reduced mobility" (p. 34).	Continual tension	N	Continuous tension can cause changes in skeletal structure and/or impede mobility.
Mapping the places of balance	Imbalance of skeletal structure causes "muscular tension to counteract the imbalance…the chronic muscular tension that results from habits of imbalance restricts our movement and over time may distort our shape" (p. 34).	Muscular tension Chronic imbalance Restrictive	N	Muscular tension counteracts imbalance of skeletal structure, in turn distorts shape and restricts movement.
Mapping the places of balance	Imbalance of head causes us "to tense muscles in the neck so that the head be horizontal and the eyes can look forward instead of downward" (p. 34).	Compensations Tense muscles	N	Imbalance of head results in compensatory muscular tension.
Mapping the places of balance	"All the compensations described above involve muscular tension, and all of them have a tendency to pull the body in on itself, making it shorter" (p. 35). Tension is associated with Alexander concept of "downward pull" (p. 35).	Compensation Muscular tension Downward pull	N	Muscular tension compensates when head is imbalanced; causes a chain effect of imbalance and contraction of whole skeletal structure.

Mapping the places of balance	Tension in all muscles responsible for controlling arm movement results from imbalance of skeletal structure.	Tensing muscles Compensatory muscular work Gripping	N	Imbalance of skeletal structure causes muscles to compensate, creating tension in muscles of upper body responsible for controlling arms, thus impedes movement of arms.
Mapping the places of balance	Tension resulting from downward pull "is not usually perceived as tension" (p. 37). "Some people are very tense, yet they insist that they are 'relaxed' and 'free' " (p. 36).	Tense Infers that this is the opposite of relaxed and free Tension Stiffness	N	Common not to be aware of tension. Tension associated with downward pull, stiffness; infers that tension is the opposite of relaxed and free.
Mapping the places of balance	"As pianists, our goal is to sit in balance so as to eliminate tension and have maximum freedom in our arms" (p. 36).	No tension associated with freedom of movement	N	Sitting in balance facilitates elimination of tension, thereby allowing complete freedom of arms.
Mapping the places of balance	Balancing head, "Most of us have some tension in our necks" (p. 40). Alexander brought attention to the harmful effects of tension in neck. Crucial to release tension in the neck: "improving our use of the rest of our bodies depends on releasing tension in the neck" (p. 40). Important to keep neck free. Neck muscles have to work if head is out of balance. "Tension in neck is a serious issue" (p. 41). "Tense neck muscles inhibit the use of the arms" (p. 41).	Tension in neck Opposite of free Release tension Muscles work Chronically tight	N	Releasing tension in the neck vital for free movement in rest of body. (Alexander principle). Infers tension is opposite of free. Tight neck muscles that work to compensate for imbalance of head associated with tension and can impact movement at the arms.

Mapping the places of balance	"So developing a freely balanced head and releasing tension in the neck are crucial for recovering overall balance and free motion in the body" (p. 41).	Release tension	N	Chicken and egg scenario of imbalance creating muscular compensation; compensation creating muscular tension. Release tense neck muscles by balancing head: this leads to improved movement and balance.
Mapping the places of balance	"It may be that mismapping the neck is a major cause of the neck tension that drags us off balance in the first place" (p. 41).	Tension	N	Mismapping neck a cause of neck tension and a cause of imbalance.
Mapping the places of balance	Arching the back leads to "gripping and tensing" (p. 44). This can strain the lower back.	Tensing Gripping Strain	N	Imbalance of spine by arching the back leads to tense muscles in lower back.
Mapping the places of balance	Common to tense butt muscles, causing hips to be out of balance. Must release muscles to find proper balance.	Tensing Release	N	Must release butt muscles to find proper balance.
Mapping the places of balance	Sitting position: must release tense butt muscles. "The release of tense butt muscles is vital for sitting" (p. 47).	Release of tense muscles	N	Tense muscles must release to return hips to a neutral position when in sitting position.
Mapping the places of balance	Tense butt muscles cause outward rotation of the leg.	Release any muscular tension	N	Any tense muscles must release to return hips to a neutral position when sitting.
Mapping the places of balance	Butt muscles "are shortened and narrowed by tension, so as you free them they lengthen and widen" (p. 48).	Shortened Narrowed	N	Muscular tension makes muscles shorten and narrow. Releasing tension allows muscles to lengthen and widen.

Mapping the places of balance	Sitting in a 'back-oriented' manner "results in tension in the arms and back" (p. 49). Pianist must "compensate for the imbalance by tension torso and arm muscles" (p. 48).	Tension Compensate	N	Tension from imbalanced seating posture can create compensatory tension in arms and back.
Mapping the places of balance	Incorrect height of bench can "involve tension that can lead to problems" (p. 53). Compensations for incorrect height of bench "involve static muscular activity—tension—that limits freedom and can in time lead to injury" (p. 53).	Static muscular activity Tension Limits Injurious	N	Tension is clearly defined here as "static muscular inactivity" (p. 53), leading to injury and limiting freedom of movement.
Mapping the places of balance	Mismapping of knee joint "creates a lot of tension" (p. 56). If mapped correctly the knee is not tense.	Tension	N	Not clearly mapping the knee causes tension (he does not specify where this tension is).
Mapping the places of balance	Standing out of balance with weight backward "triggers tension throughout the body" (p. 58). Standing in balance releases tension.	Tension throughout the body Release	N	Imbalanced standing position causes tension; conversely, standing with balance allows tension to release.
Mapping the places of balance	Mismapping ankle when pedaling "causes a predictable pattern of tension and pain" (p. 59).	Predictable pattern of tension and pain.	N	Tension associated with mismapping of ankle when pedaling, leading to pain.
Mapping the places of balance	Imbalanced pedaling, this will cause "instability which will have to be compensated by tensing" (p. 61).	Tensing	N	Tension compensates for instability from imbalanced skeletal structure when pedaling.
Mapping the arm and hand	"Thinking of one part of the body as a fixed place from	Fixed joints Tensing muscles	N	Contends that it is wrong to think that we have to fix or stabilize a joint in order to move. Fixing or stabilizing a

	which to move another part of the body generates tension. The only way my shoulder joint, or any other joint, can act as a fixed place to move from is by my fixing it—that is, by tensing muscles….the problem is not solved, it is only papered over by shifting the vocabulary—calling the joints 'fulcrums' instead of 'joints' or using the word 'stable' instead of 'fixed' " (p. 68).	Stable		joint results in undesirable tension. Regardless of semantics, i.e., fixing vs. stabilizing, joints vs. fulcrum, the problem of tension remains. He believes that movement must come from support in the core and that there should be no fixing of joints at all.
Mapping the arm and hand	Holding collarbone and shoulder blade tense will prevent "humero-scapular rhythm" (p. 70).	Hold tense	N	Holding the collarbone and shoulder blade tense can prevent coordination and feeling of connection between arm and scapula.
Mapping the hand and arm	Muscles are tense if they are pulling shoulder blades and collarbones out of balance.	Muscles are tensed	N	Pulling shoulder blades and collarbones out of balance (a result of mismapping) causes muscular tension.
Mapping the hand and arm	Rotational release of shoulder joint: "Releasing that muscular tension allows the shoulder joint to rotate back to neutral and facilitates bringing the hands to the keyboard. If the tension is not released, then there will be tension in the shoulders underlying the playing of every note" (p. 79).	Muscular tension Releasing muscular tension	N	Releasing muscular tension important role in allowing 'rotational release' at the shoulder joint. This means that hands do not have to rotate to be in a playing position on the keyboard.

Mapping the hand and arm	"Setting the hand in advance, or holding it fixed in position, simply creates tension" (p. 94).	Holding Fixed in position	N	Holding hand in position created tension. Conversely, learning to spread the whole hand can release all tension.
Mapping the hand and arm	Mismapping the thumb creates tension and causes injury.	Mismapping Tension	N	Need to map the thumb from the CMC joint to avoid tension and injury.
Mapping the hand and arm	Passing the thumb under hand: "the thumb should move only as far as it can go without tension; it should not be fixed or squeezed under the hand" (p. 96).	Fixed Squeezed	N	Move thumb under hand without tension. Tension associated with fixing, squeezing.
Mapping muscles	Sitting in a back-oriented manner "involves constant tension of the arm muscles…cannot move freely if there is underlying tension" (p. 103).	Underlying tension	N	Back-oriented posture creates tension in the arm muscles, limiting free movement.
Mapping muscles	Tension in "muscles of the back, chest, and shoulder area" (p. 105) restricts movement.	Piano-playing muscles Habits of tension	N	Pianists are generally not aware of tension in muscles; they concentrate on the movement, not the muscles engaged to make the movement. Balanced structure can solve problems of tension.
Mapping muscles.	Ulnar deviation without thumb orientation results in no tension.	Ulnar deviation Thumb orientation	N	If hand positioned in ulnar deviation without thumb orientation, "the position is benign" (p. 108). If ulnar deviation is accompanied by thumb orientation, this produces tension and is injurious.
Mapping muscles	"Chronically thumb-oriented people have tension in the superficial muscles of the forearm" (pp. 108-9).	Thumb orientation	N	Thumb orientation creates tension in superficial muscles of forearm that move the fingers, creating more work for the muscles when trying to move fingers.

Mapping muscles	"A person whose habits involve tension at the piano cannot change those habits at the piano only" (p. 109).	Tension	N	Habitual tension in all facets of life will cross over to piano playing. Necessary to acquire "new habits of movement [that] will inform all life activities" (p. 109).
Mapping muscles	"Chronic departure from the position of equilibrium represents chronic tension of some arm muscles" (p. 115). If arm structure is imbalanced "then tension will be present before the first key is depressed and the playing of every single note will require some compensation for the underlying tension" (p. 115).	Out of equilibrium Upward tension	N	Eloquent analogy of the arm structure as suspension bridge with cables needing to be in equilibrium in the downward and upward support. If cables not in equilibrium, tension compensates and impedes free movement of the arms.
Mapping breathing	"…trying to breathe in accordance with the faulty map creates tension that inhibits the free use of the arms" (p. 119).		N	Simply breathing in a manner that is not based on a correct body map creates tension that impedes free movement of the arms.
Mapping breathing	Breathing and forcing the chest to expand forward (believed to be a common practice) "is damaging to piano playing since it is accomplished by tensing the muscles or our backs, inhibiting free movement of the arms" (p. 124).	Tensing muscles	N	Trying to assume a posture of chest expanding forward for deep breathing results in tensing the back muscles, thus impeding movement of the arms.

Forearm arch	"The arch of the hand and forearm can be the basis of playing without tension, yet with ease, control, and power" (p. 111).	Without tension	N	Important for the arch of hand and forearm to be in place to facilitate tension-free playing.
Mapping muscles	"Movement is organized around the structure, not based on tensing muscles. Muscles do not have to work as hard….with movement organized around the bony structure, stability is achieved without tension. The muscles can release" (p. 112).	Release Muscles do not have to work	N	Organizing movement around the stable structure of bony arch allows muscles to release but still provides stability—a tension-free stability.
Mapping the piano	"The sound can no longer be changed, so pressing down just represents unnecessary tension" (p. 128).	Unnecessary	N	Mechanics of sound production important to know. Contends the practice of pressing down after the note sounds is useless.
Mapping the piano	"Notice that tension in your face and neck interferes with listening" (p. 131).		N	Tension in face and neck negatively impacts quality of listening.
Injuries and retraining	"On the other hand, if a pianist persists in moving with tension, they can lead to permanent damage… Tendon problems often arise near joints where the tendons rub on ligaments or bones, and they also result from repeated tensing of the muscle-tendon unit" (p. 144).	Repeated tensing	N	Repeated tensing of the muscle-tendon unit can lead to tendon problems. Moving with constant tension can lead to lasting injury.

Injuries and retraining	"If I mismap the rotation of my forearm and use my arm chronically in a thumb-oriented way, the tension in the superficial muscles of my forearm leads to—indeed it amounts to—one or more of the physical causes of injury: co-contraction, awkward positions, static muscular activity, or excessive force" (p. 145).	Tension in superficial muscles	N	Tension creates other conditions for injury that Mark has identified: co-contraction, awkward positions, static muscular activity, and excessive force.
Injuries and retraining	Once body is mapped correctly one is able to move freely, "easily doing things that were formerly tense and difficult" (pp.147, 148).	Infers opposite of tense and difficult movement is free and easy movement	N	Moving with sensitivity to the body map allows movement that is not tense, but easy and free.
Injuries and retraining	Discussion of causes of injuries: "pianists' injuries are caused by tense movement, not by failure to warm up, take breaks, and so on" (p. 149).		N	Clearly identifies tense movement as the primary cause of injury, not some of the commonly cited causes such as not warming up.

Table A.1.4 Karpoff (2009)

Context	Definition/Description	Terms	Role	Summary
Foundations	Stretching 3-5 minutes during breaks and after practice sessions will help to reduce muscular tension and "rejuvenate muscles" (Unit 1, chap. 1).	Reduce tension Muscular tension	N	Stretching reduces tension. Described as a muscular property.
Foundations	Opposable muscles contract simultaneously to curl fingers for equal finger length: this results in tension.		N	Tension at the wrist and elbow associated with "cramped hand position" from the simultaneous contraction of opposing muscles to align fingers in a straight line.
Scales and continuous alignment adjustment	Pianists may play with excess tension in fingers (even with proper alignment). Curling fingers, holding fingers up also cause imbalance in the hand.	Excess tension	N	Excess tension can be present in fingers, even when in proper alignment.
Free fall	Ensure that there is a quiet hand, joint and fingers loose so that "nothing tenses up" (Unit 1, chap. 17).		N	A quiet hand and loose fingers have no extra tension.
Common hand positions	Cramped hand from playing with curled fingers results in tension.		N	Curled fingers with cramped hand position results in tension.
Common hand positions	Holding fingers up will create tension and "unbalances the hand" (Unit 1, chap. 17).	Unbalance	N	Tension from holding fingers up will lead to unbalanced hand.

Two-note slurs	Two note slurs are basic gestures of "tension and release" (Unit 2, chap. 2).	Expressive tension and release	N	Emotional tension and release in two-note slur is a fundamental expressive gesture.
Arpeggios	Shows a problematic example of student executing arpeggios, stating: "Thumb and fifth finger are tense and held out" (Unit 3, chap. 5).	Tense Held out	N	Tense thumb and fifth finger associated with holding them out: this can lead to injury.
Isolating the thumb in 2 octave arpeggios	No tension created with a quiet hand.	Quiet released	N	Quiet, released hand means no tension.
Vibrato Technique	Poor breathing patterns coordinating with extending arms causes chest muscles to become tense.		N	Tense chest muscles associated with poor breathing patterns.
Vibrato technique	Release abductor muscles in hand when spanning large intervals, otherwise tension "will accumulate in the hand" (Unit 6, chap. 9).	Release Tension accumulates	N	Engaging abductor muscles without releasing will result in tension in the hand.
Vibrato technique	Locking wrist associated with tension in the forearm and fingers.	Locking wrist	N	Playing octaves with locked wrist, raised fingers results in tension in forearm and fingers. Must release.
Trills	Trills: common for tension in non-playing fingers and hand. Important to release. Associates playing without tension as "no extra muscular effort" (Unit 6, chap. 17).	Release Play with no extra muscular effort	N	Tension in non-playing fingers and hands needs to be released. Pulling back finger 3 to keep in line with other fingers also adds tension. Play slowly to notice habitual movement patterns with excess tension.

Table A.1.5.1 Fraser (2003)

Context	Definition /Description	Terms	Role	Summary
Role in reducing injury	Tension does not always result in injury.	Use tension intelligently	P	Underplays the argument that tension contributes to injury: with discernment, it can positively contribute to technique.
Many movements contribute to piano technique	Strive to be "free of excess tension" (p. 37). To play effortlessly "you utilize all your movement capabilities" (p. 37).	Excess tension	N	If playing without excessive tension, there are more possibilities for a wider range of movement.
Common belief that tension limits movement	"Instead of trying to avoid excess tension, just make the music speak!" (p. 37).	"	N/P	Take the focus away from avoiding tension; allow the music to happen.
Dual muscular pull	Opposing forces of flexors and extensors will always be present.	Opposing forces Tension	P	Tension is always present: Opposing forces vital. "Without tension there is no life" (p. 38).
Arm weight	"Tense muscle tonus" (p. 42) interferes with fluid movement.	Muscular effort Tense muscle tonus	N	Overly tense muscle tonus inhibits free movement.
Arm weight	Relaxing to use arm weight results in muscular contractions elsewhere to compensate for over relaxing.	Muscular contractions Inhibit movement Counter-productive	N	Tension compensates for over-relaxing, particularly in misunderstanding arm weight.
Internal muscular activity	Arm becomes "overly tense" with poor "internal organization" (p. 44) for finger activity.	Overly effortful contraction	N	Tension compensates for poor internal organization when activating fingers.

Skeletal alignment	"Minimum of help from muscular contraction" (p. 44) opposite of relaxed. "Do they [muscles] tense or stay relaxed?" (p. 45).	Inappropriate	N/P	Tension results from poor skeletal alignment. Appropriate muscular contraction allows optimal skeletal alignment.
Relationship between hand and arm	Inverse relationship: more arm tension=less hand strength. Less arm tension=more hand strength.	Compensatory Counter-productive	N	If skeletal structure lacking, counterproductive tension will compensate for this weak link.
Banded fingers	If structure of fingers and hands is weak, negative tension in the wrist develops; in turn, tension blocks the kinetic energy.	Excess Negative	N	Tension results from poor structural alignment of hand and blocks energy.
Whole arm acts as a finger	Shoulder tension created by "lack of physical connection to the keyboard" (p. 168). "Transform tension into finger action" (p. 168)	Transform tension	N	Tension caused by weak links in playing apparatus: can be transformed into positive use for finger activity.
Minimal movements of wrist	"Graceful movements supposedly designed to avoid tension" (p. 178).	Useless Destabilize Compensatory Stabilizing	N	Extraneous movements cause weak links in structure thus creates negative tension. Equates suppleness with a lack of tension.

Gesture in phrasing	Excess effort often occurs when preparing to play: "tremendous tendency to make some effort when we play, to prepare by contracting somewhere in our mechanism" (p. 341).	Effort Tension Contracting Absolute minimum	N	Tension equated with a lot of effort and muscular contraction. Minimal tension required. Extra effort (tension) prevalent in preparatory gestures. Impedes movement.
Playing with pulse	Tension is the opposite of mental and physical relaxation.	Constraint Any tension	N	Any tension limits musical outcomes, accuracy.
Gesture in phrasing	Musical response can create inner tension: "inner tension triggered by some emotion" (p. 343).	Over-try Press Inner tension Too Involved	N	Tension created by emotional reactions can interfere with musical intent.
Orchestration	Emotional tension manifests as physical tension.	Emotional tension Internal tension	P/N	Differentiate between emotional and physical tension for most musical outcome.
Natural hand and finger shape	The opposite of softening muscle tonus. Equated with effort. Natural hand shape is free of tension.	Effort Tension Superfluous	N	Surplus muscular tonus=effort=tension Interferes with natural finger shape.
Natural hand shape	Natural finger shape is free of undue tension.	Undue tension	N	Getting rid of undue tension will help finger to assume natural shape.
Finger shape.	Check tension by touching flesh.	Muscle tonus	P/N	Degree of tension is a tangible quality.
Finger shape	Less muscle tonus and effort equated with "naturally balanced muscle tonus" (p. 225).	Muscle tonus Effort Reduced Natural balanced tonus	P/N	Tension equated with degree of muscle tonus. Naturally balanced tonus optimal.

Table A.1.5.2 Fraser (2010)

Context	Definition	Terms	Role	Summary
Introduction to concepts of sensory-motor learning	Lower back pain is not a matter of muscle weakness but the other way around: "the muscles work too hard, chronically contracting" (p. 12).	Chronically contracting muscles	N	Tension is associated with too much muscle contraction and a cause of pain that can inhibit movement.
Introduction to concepts of sensory-motor learning	Reducing tension results in "re-equilibration of overall muscle tonus" (p. 12) for improved movement.	Muscle tonus	N/P	Tension related to muscle tonus. Reducing tension results in a balanced muscle tonus for improved movement.
Arches empower hand	Finding the potent structure of the hands arches will allow shoulder tension to release.	Release tension Extra tension	N	Suggests that if the hand is empowered, tension will be released from the shoulders: " And your shoulder may drop slightly as its inadvertent extra tension releases in the hand's potent effect" (p. 53).
The potency of the hand	Illustration shows how "tensile wires increase arch strength" (p. 77). "The finger possesses the tensile strength of a geodesic structure, or an eggshell—able to bear considerable stress, but only along a certain path" (p. 82).	Tensile wires Tensile strength Tensile strength of a geodesic structure or an eggshell	P	The external downward force on the arches of the hand creates tensile activity that increases arch strength.
The potency of the hand	Tension in long flexors from curling at the DIP.		N	Curling fingers at the DIP creates tension in the long flexors.

Differentiating metacarpals/phalanges	Tension to support hand is "another telling sign the differentiation of finger from hand was not yet fully understood" (p. 92).	Let go loose	N	Tension used to support hand is a symptom that finger and hand is not fully individuated.
ATM exercise	"We tend strongly to associate immobility with tension: when we assume a particular position, our neuromuscular system tends to kick in and hold us there" (p. 95).	Immobility	N	Static positions reinforce neuromuscular patterns of tension. Thus, there is a strong association of tension and immobility.
ATM exercise	"The lower your arm's overall muscle tension, the more clearly you can feel all the details of inner movement" (p. 95).	Muscle tension	N	Relationship between muscle tension and sensation of inner movement: Less tension allows for more sensitivity to "inner movement" (p. 95).
Sensing tension in fingers	Often identifies tension in students' forefingers. Feels for tension in the pads of the fingers: "soften the tension" (p.101).	Spastic Effortful Counter-productive Soften	N	Tension can be felt in finger pads—associated with effort. Remedy by softening the tension.
Tension in leaping.	Leaping will trigger "pattern of muscular contraction and 'trying' that interferes with the leap" (p. 133).		N	Muscles often contract when attempting to leap, or even trying too much. Remedy by freeing movement.

ATM for getting rid of excess tension	Uses an exercise of thumb and 3rd finger clamping on to 2nd finger: "It is one of the weirdest ways I know to get rid of excess tension, but accomplishes a kind of relaxation not achievable by other means" (p. 141).	Excess	N	Provides an exercise to get rid of excess tension in 2nd finger muscles. Equates the opposite of tension as "a kind of relaxation" (p. 141).
Rotation	Explains the rationale behind Taubman's rotation: "If a muscle is doing A it cannot be doing B; i.e. the forearm rotation neutralizes or decouples any tendency towards unwanted tension that might be developing in the forearm. If the forearm is rotating, its muscles are prevented from contracting along the vertical axis" (p. 143).	Unwanted Undesired	N	Explanation of rationale behind Taubman's rotation and muscular organization that can prevent tension. While this all makes sense, he argues that trying to rotate on every single note interferes with musical phrasing.
Arm weight	"If any tension remains in the elbows, it will interfere with the free transmission of energy from your arm to the key" (p. 207).	Any tension Persistent Unwanted	N	Tension in elbow blocks energy from arm to key. Warns that tension in the elbow can be persistent. Be sensitive to undesirable tension when using arm weight to produce tone.
Ulnar deviation	Tension in wrist increases with ulnar deviation.		N	Hand in ulnar deviation position causes more tension. Must minimize tension in wrist when in this position.
Arm weight	Danger of arm weight is loss of structural integrity of hand from a "complete release of tension" (p. 215). .		N	The hand would slide right off the key if the arms were completely emptied of tension. Structure is compromised.

Exploration, discussion of tension	Defines necessary tension as " stabilizing muscular activity" (p. 237). Clarifies and proposes that we need different words for 'good' and 'bad' tension. "Contraction with no movement results in tension, not kinetic energy. A further distinction: let's call muscular tension necessary to maintaining optimal skeletal alignment muscle tonus or muscle tone, reserving the word 'tension' for its negative manifestations where movement is blocked" (p. 237).	Muscle tonus Muscle tone Necessary Stabilizing muscular activity	P	Clarifies the definition of tension: there has to be some tension, we would be jellyfish without it. Distinction between healthy muscle tonus holding joints together and too much tonus resulting in tension. Proposes using two different terms: Muscle tone=positive tension: Tension=tension that blocks movement.
Glossary of terms	"Tension: overly high tonus—muscular effort that blocks movement. Almost all co-contractions fall into this category. Tonus: appropriate muscular effort needed to hold bones in place" (p. 241).	Tonus Co-contractions Muscular effort	N	Provides two definitions of tension, bad and good. Bad tension: Muscular contractions resulting in excessive muscle tonus impede movement. Good tension: Tonus that keeps bones aligned.

A.2 Relaxation

Table A.2.1 Lister-Sink (Wingsound, 1996, 2008)

Context	Definition/Description	Terms	Role	Summary
Natural, pendulous use of the arms	Pianists often use "forced, artificial" movement in the arms, thinking that this will relax the arms (chap. 1).	Relax	N	Unnatural movements often used in efforts to relax the arms.
Muscle tension	Common advice is to take breaks so that muscles can relax and refresh.	Refresh Relax	P/N	Rather then take breaks so that muscles can relax and refresh, continuously release muscle tension.
Muscle tension	If brain does not send a signal to contract the muscle, "The muscle remains in a relaxed state" (chap. 1).	Relaxed state	P	Relaxed state associated with no signals from brain to muscles.
Coordination	Relaxing the arm muscles. Learn how to "relax the arm muscles completely…a state of release to which the pianist must always return" (chap. 1).	Completely relaxed No tension Released Heavy A state of release	P	To learn how to control arm muscles we have to learn how to "relax the arm muscles completely" (chap. 1). Relaxing muscles associated with releasing—resulting in refreshed muscles and avoids build-up of tension. If the arm is completely relaxed it feels heavy, with mobile joints.
Muscle tension	Important to learn to contract and relax. Injuries often stem from "inability to contract and release muscles appropriately" (chap. 1).	Contraction Relaxation Release muscles appropriately	P	Infers that the opposite of muscle relaxation is muscle contraction. Relax associated with release. Learning to control rapid contraction and relaxation of arm muscles crucial step in learning to play freely.
Muscle tension.	A completely relaxed arm will feel heavy. "It is critical that the pianist relax the arm muscles completely between strokes" (chap. 1).	All muscles released Heavy	P	Frequent instructions to relax arms completely while exploring range of movement and sensation of muscle contraction and release.

Muscle tension	Gives reason for instantaneous muscle release: "To relax and refresh the arm muscles between contractions since any real muscle effort after the moment of impact is wasted effort" (chap. 1).	Release Relax Refresh	P	Release of muscles results in relaxed muscles. Infers that muscle effort is the opposite of muscle relaxation. No need to engage muscles after the finger makes contact with keys.
Supported weight on lower wrists	Landing on a low, extended wrist stems from relaxation school to support arms weight.		N	Relaxing so that low wrists support arm weight can be harmful to wrist joint. Release of muscle tension in the arm can be too quick and misses the point of optimal alignment.
Heavy, relaxed arms	Free fall to produce tone with arm weight "is sort of like a falling brick transforming into a ping pong ball on contact" (chap. 2).	Like falling bricks turning into ping-pong balls	P	Equating relaxed arms with perpetually heavy arms can be misleading. Important to discern the moment of sound production to put weight of arms back to torso and feel a lightness. Gives analogy of falling brick turning into a ping-pong ball.

Table A.2.2 Taubman (Bloomfield et al., 2001)

Context	Definition/Description	Terms	Role	Summary
Principles and concepts	Resting down is not relaxation. Golandsky states: "There is no feeling of hovering" (chap. 4).	Resting down	N	Distinction between 'resting down' and relaxation. Resting down is not relaxation. Feel contact of keys with fingertip.
Principles and concepts	Dropping shoulders causes upper arms to relax, putting all weight into fingers means that fingers cannot move.	Relax	N	Dropping shoulders causes upper arms to relax, putting all weight into fingers—fingers cannot move.
Joints as levers	If we fixate, we are not relaxed. Infers that the opposite of relax is tense.	Fixate	N/P	Muscles need to be in a state of non-tension to move freely. Quality of movement is what will ensure movement that is not tense.
Joints as levers	Golandsky states: "Our philosophy is that we should move in a way that there is nothing to relax from. Relaxation, often, makes the problem much worse, rather than ease it" (chap. 6).	Relaxation	N	Quality of movement should be such that there is no need to relax. Rather than improving movement, relaxation often impedes movement.
Seated position	Golandsky: "To move freely, one muscle is active and one muscle is passive. When we relax, we relax both" (chap. 10). Demonstrates by just sitting—says she feels relaxed, but she is not, she does not feel any tension. But trying to move from a really relaxed sagging state, "it would take the muscles a tremendous amount of effort to get moving again, to create movement" (chap.10).	Sagging	N	Clearly defines relaxed state as one when both active and passive muscles are relaxed. If body is relaxed, muscles need a great deal of effort to get moving again. If not relaxed, one muscle group is active while the other is passive.

Seating position	Golandsky: “If people are very relaxed they have a tremendous amount of tension” (chap. 10). Yet, people who have tension resulting from relaxation are often told to relax even more. Golandsky states: “Tension can come from tremendous relaxation” (chap. 10).	Tremendous Tension	N	Equates too much relaxation with tension. But often told to relax more because they are tense. Extreme relaxation produces tension.

Table A.2.3 Mark (2003)

Context	Definition/Description	Terms	Role	Summary
Mapping the places of balance	Posture myth: “we should be relaxed, balanced, poised” (p. 33).	Relaxed	P/N	Posture myth espouses relaxation, balanced and poised. Questions what this means.

Table A.2.4 Karpoff (2009)

Context	Definition	Terms	Role	Summary
Common hand positions	Allow hand to assume natural curve when hanging at side of body. "Draw relaxed hand up to keyboard (chap. 17).	Natural curvature Relaxed hand	P	Best hand position is one with a natural curvature and relaxed hand.
Two-note slurs	When playing two-note slurs "keep thumb relaxed" (Unit 2, chap. 3).	Relaxed	P	Thumb should be relaxed for two note slurs.
Hanon exercise	Demonstrates under and over motions for playing Hanon exercise: "playing in this manner is very relaxed, but it uses way too much motion" (Unit 2, chap. 18).	Relaxed	P	Equates under and over shaping gestures with relaxed playing. However, gestures can be minimized to incorporate "larger macro gesture" (Unit 2, chap. 18) for optimal movement.
Playing arpeggios	Releasing hand over the thumb when playing arpeggios produces a "very relaxed hand" (chap. 11).	Very relaxed	P	Release of hand allows relaxed hand.
Trills	"This relaxation of the other fingers is really essential" (Unit 6, chap. 12).		P	Relaxing non-playing fingers vital to continuous, cycling motion for less effort.
Trills	Forearm rotation is a "relaxed motion…"it is very relaxed" (Unit 6, chap. 16).	Very relaxed	P	Describes forearm rotation as "a very relaxed motion" (Unit 6, chap. 16).

Table A.2.5.1 Fraser (2003)

Context	Definition /Description	Terms	Role	Summary Definition
Arm weight	Too much relaxation and the hand's structure is weakened, making fingers "overly inactive" (p. 42).	Inactive Contagious relaxation	N	Too much relaxation weakens structural integrity. Inactive muscles.
Arm weight	Both sets of muscles around a joint are overly inactive, the joint collapses—it does not maintain its optimal orientation to the rest of the body. "Relaxation does not equal a state of rest but of deadness" (p. 42).	Over-relaxation A state of deadness	N	Relaxation results from too much inactivity in muscles around a joint; destabilizes and causes collapse of skeletal structure.
Arm weight	"Total relaxation, which equals total inactivity" (p. 42).	Total relaxation Total inactivity	N	Total relaxation=total inactivity.
Arm weight	"Over-relaxation leads to excess tension" (p.44).	Inactive Over-relaxation Over Excess	N	Too much relaxation in trying to use arm weight leads to too much tension.
Posture	If skeletal alignment is optimal there is a "quality of effective stillness, the relaxed, alive stability" (p. 45) for freedom of movement.	Alive stability Effective stillness Alive Effective Stable relaxed-ness	P	Skeletal alignments allows for a positive state of "relaxed, alive stability" (p. 45), resulting in free movement.

Awareness through movement (ATM) exercise	A state of relaxation allows you to feel the arm's weight: "facilitates the imperceptible but crucial participation of all the appropriate muscles and bones in movement" (p. 45). "Be intentionally active to be effectively free" (p. 46).	Relaxed but not dead Exceptionally relaxed state	P	Relaxation allows for awareness of skeletal alignment (bones and muscles) and heightened awareness of the feeling of arm weight.
Thumb function	Relaxation allows for more awareness of how thumb should move.		P	Relaxation results in heightened sensitivity and awareness of range of movement in thumb.
ATM for hand structure	"By relaxing and softening rather than trying harder we can cultivate that quality of total body cooperation without exertion" (p. 95). "As if the bones of your whole skeleton constitute a series of dominoes" (p. 95).	Softening	P	Relaxing (softening) a factor in finding optimal skeletal alignment. Allows for feeling bones.
Relationship between hand and arm	Discriminate: where and how much relaxation is needed.		N/P	Too much relaxation is counter-productive; important to learn to discern where and how much to relax.
Relationship between hand and arm	If hand structure is structurally sound the elbow "naturally relaxes" (p .155). Arm is "as loose and relaxed as possible" (p. 156).	Looseness Passive mode Naturally Gently	P	Structural integrity of hand produces positive relaxation in elbow and arm.

Forearm working as lever for leaps	Beautiful tone production not necessarily related to relaxation.		N	Questions common belief that beautiful tone is related to relaxation.
Role of wrist in playing	If wrist is too relaxed forces of arm never get through the wrist joint due to "total lack of connection" (p. 177).	Hyper-relaxed Looseness	N	Over relaxed wrist causes forces of arm to be displaced—does not get into the keys.
Rotation	"Relaxing your fifth metacarpophalangeal (MCP) joint…increases the distance between your two fingertips" (p. 195).		P	Relaxation of MCP joint increases span between fingers.
Exercise to instill feeling of fluttering in rotation for freedom of movement	Loose and flopping "triceps muscle flapping and shaking, completely relaxed" (p. 202).	Loose muscle tonus Flopping Flapping Shaking Completely Relaxed	P	Completely relaxed triceps muscle flops, shakes: facilitates freedom of movement. (Instructions to encourage appropriate relaxation for rotation).
Feeling the weight of the hammer	"It should feel distinctively heavy" (p. 272) when the arm is totally relaxed.	Limp Release Loose Totally relaxed	P	A state of total relaxation for sensation of arm weight and weight of key.
Playing forte chords	"Let everything higher up (above fingers) release" (p. 278).	Release	P	Release to relax.
Playing with pulse	"Mentally, physically relax prior to the pulse note" (p. 315).	Free Mentally Physically	P	Speaks of a mental and physical relaxation.

Gesture in phrasing	Questions common practice of elbow movements as a means to relax.	N	Excessive elbow movements disturb skeletal organization and undermine the goal of relaxing, causing tension instead. Implies that the opposite of relaxation is tension.

Table A.2.5.2 Fraser (2010)

Context	Definition	Terms	Role	Summary
Hand structure	Over-relaxation causes collapse of the hand arch.	Over-relaxation	N	Relaxing too much causes collapse of the skeletal structure of the hand.
Awareness of skeletal structure	Reducing the body's effort allows for more accurate and sensitivity to skeletal structure. Relax to "help you better feel" (p. 10).	Reduce effort	P	Relaxation described as the antithesis of 'effort'. End product of relaxation is increased sensitivity to skeletal structure.
Concepts related to sensory awareness	"Many of classical piano's relaxation movements inadvertently bring bones out of alignment, thereby damping their power instead of enhancing it" (p. 15).	Damping Relaxation movements	N	Relaxation can have negative consequences: bones can become misaligned and reduce the inherent power of a well-aligned skeletal structure.
Concepts related to sensory awareness	"In Feldenkrais Method, relaxation is not an end in itself but merely a learning tool in the rediscovery of a more potent skeletal structure" (p. 15).	Empowering relaxation	P	Relaxation in Feldenkrais Method is used as a learning strategy for the body to find its alignment, empowering the whole structure.
Individuation of metacarpals/phalanges	Describes state of student's hand with sensation of wrist tightening but no "wild relaxation" (p. 91).	Loose Wild relaxation	N	To make the hand like an oilrig platform of hand, wrist is loose but there is no "wild relaxation" (p. 91). Infers that too much relaxation can produce uncontrolled results.

Hand and arm organization	"Stay relaxed without becoming flaccid or phlegmatic, maintain precise, empowered alignments. It's easier said than done, it actually takes a very high state of attention" (p. 93).		P	Finding the appropriate degree of relaxation demands great attentiveness. An optimal degree of relaxation is not too relaxed, but relaxed enough to facilitate alignment.
Hand and arm organization	"Full looseness facilitates lightening-quick finger attacks whose impulse feels more neurological than muscular" (p. 94).	Full looseness	P	Refers to a state of 'full looseness' that allows for more neurological sensation of extremely rapid finger movement.
Finding the fourth fingers structure	"Relax the muscles around the metacarpophalangeal joint and you'll make a startling discovery: the fourth's bones are just as strong as the other fingers" (p. 102).	Relax the muscles	P	Relaxing muscles around the MCP joint of 4th finger allows for sensation of the natural strength and structure of bones.
Relaxation habits	"We are so habituated to the chronic over-relaxation that has somehow developed over the generations that we simply don't perceive its detrimental effects" (p. 232).	Chronic over-relaxation	N	Over- relaxation in piano playing is so common, we are immune to its negative consequences.
Relaxation	Relaxation can result in tension because extra muscular effort is needed to compensate for a compromised structural integrity. Relaxation results in destabilization, extra muscular effort: this constrains freedom.	Destabilizes	N	Describes the pitfalls of relaxation and its chain effects leading to instability and more muscular effort to compensate for weak links.

Glossary of terms	Glossary of terms: “ Relaxed, slack, flaccid: over-relaxed. In this state, movement cannot happen because the muscles aren’t ready to make it happen. The bones have often fallen out of alignment. For all intents and purposes, dead” (p. 241).	Flaccid Slack Dead	N	Defines too much relaxation as a dead state, putting bones out of alignment, in glossary of terms.
Glossary of terms	“If we avoid indiscriminate relaxation but maintain an alive, skeletal relaxation, it works for us not against us” (p. 241).	Skeletal relaxation Alive relaxation	P	Discern an optimal skeletal relaxation that contributes positively to piano technique.

A.3 Co-contraction

Table A.3.1 Lister-Sink (Wingsound, 1996, 2008)

Context	Definition/Description	Terms	Role	Summary
Free fall	Simultaneous contraction of muscles to stabilize joints	Tension Fixate	N	No specific references to co-contraction, but describes muscular contraction (tension) needed to stabilize joints at the moment the finger makes contact with the key. Must release muscular contraction the instant the muscles contract. If contraction is not released, this will impede movement and cause pain and injury.
Efficient muscle use	Need just enough muscle tension at impact of finger with key to stabilize joints. "Significant muscle contraction is needed for only a split second at the moment of impact in order to stabilize the joints so that the weight can be transferred to the keys" (chap. 1).	Stabilize	P	Joints do need to be stabilized, but just for a fraction of a second. Must release muscle contraction immediately after finger makes contact with key.

Table A.3.2 Taubman (Bloomfield et al., 2001)

Context	Definition/Description	Terms	Role	Summary
Principles and concept	Fixating uses contrary muscles (flexors and extensors) at the same time	Fixating Dual muscular pull Tension	N	Fixating uses contrary muscles (flexors and extensors) at the same time—cause of tension.
Principles and concepts	Flexors and extensors have to work at the same time to move thumb under hand and down.	Dual muscular pull Antagon-istic move-ments	N	Common teaching to put thumb under the hand can cause injury because there is a flexing and extending at the same time: creating dual muscular pull. A cause of injury.
Principles and concepts	Flexors and extensors are activated when lifting and curling fingers, resulting in a dual muscular pull. Fingers need to lift and come down together.	Dual muscular pull	N	Lifting and curling fingers a cause of dual-muscular pull—pulling flexors and extensors in two directions. Very harmful. Wasted efforts to pull up fingers-they should all go down together.
Principles and concepts	"The extensors are pulling, the flexors are pushing…such a battle for your fingers to move" (Taubman, chap. 12).	A battle for your fingers	N	Muscular pull: extensors pull; flexors push.

Table A.3.3 Mark (2003)

Context	Definition/Description	Terms	Role	Summary
Basic Concepts	Refers to Taubman's definition: "dual muscular pull" (p. 3), to define co-contraction.	Co-contraction Dual muscular pull	N	Refers to Taubman's observation of harmful effects of co-contraction.
Mapping muscles	"If the opposing muscles do not release, then the two muscle groups are working against each other. This is called co-contraction. Excessive co-contraction makes movement more difficult and can be a cause of injury" (p. 105).	Limiting Injurious	N	Co-contraction clearly defined as two muscle groups working against each other when opposing muscles fail to release. Too much (excessive) co-contraction impedes movement and is a source of potential injury.
Mapping muscles	"Co-contraction is one of the causes of injury….and there are pianists who have suffered injury from playing with tightly curled fingers" (p. 107).	Co-contraction	N	Does concede that there are situations when music may demand curling fingers, but these should largely be avoided as this is a major cause of injury and impediment to movement.
Injuries and retraining	"In short, pianists' stress injuries are caused by: 1) co-contraction 2) awkward positions 3) static muscular activity 4) excessive force" (p. 142).	Co-contraction Excessive force Static muscular activity	N	Co-contraction listed as a primary cause of playing-related injuries.

Table A.3.4 Karpoff (2009)

Context	Definition/description	Terms	Role	Summary
Foundations	Does not use the word co-contraction but describes a situation where extensor and flexor muscles contract simultaneously: "stability is increased but at the expense of flexibility and speed, therefore this antagonistic relationship must be respected. Learning to use opposable muscles in alteration will result in maximum freedom at the piano" (Unit 1, chap. 17).	Antagonistic relationship Opposable muscles	N/P	Though Karpoff never says the word 'co-contraction,' he describes a muscular state of opposing muscles contracting simultaneously leading to both positive and negative outcomes: stability but reduced flexibility and speed. Must learn how to "use opposable muscles in alternation" (Unit 1, chap. 17) for free movement.
Common Hand positions	Does not use word co-contraction, but states "simultaneous use of opposable muscles" (Unit 1, chap. 17) occurs when there is too much lateral movement in thumb, thus inhibits free movement.	Simultaneous use of opposable muscles	N	If thumb moves laterally too much then opposable muscles are used at the same time, thus will inhibit movement.

Table A.3.5.1 Fraser (2003)

Context	Definition/description	Terms	Role	Summary
Curling/curving fingers	Opposing forces create tension. Flexors and extensors work together: extensor is a brake so that flexor does not overextend.	Opposing forces Tension Optimal Effortless Easy	P	Optimal balance of opposing forces between flexors and extensors for finger shape.
Necessary tension	Dual muscular pull Must always be present	Dual muscular pull	P	A degree of dual muscular pull is always present.
Overdone co-contraction	A type of anti-movement	Dual muscular pull Anti-movement	N	Unbalanced dual muscular pull becomes anti-movement.
Opposing forces	"…two opposing muscle groups working purposefully one against the other, to achieve musical ends" (p. 38).	Effortful fixation Crucial Effortful Working purposefully	P	Two muscle groups working against each other, crucial for some musical effects.
Cantabile quality	"Balance of opposing qualities of force that creates a symbiosis" (p. 39) describing the hand stiffening and the arm plasticizing "arm movement counterbalances the effect of your stiffened hand" (p. 39).	Stiffening Plasticizing Counterbalances Flexible fixation	P	The two opposing forces of muscles contracting and lengthening produces opposing qualities of arm plasticizing while the hand is stiffening.
Stability	Must find a way to stabilize without impeding movement.	Rigidify Functional	N/P	Stability can facilitate or impede movement. Important to find a stability that is functional for piano technique.

Table A.3.5.2 Fraser (2010)

Context	Definition	Terms	Role	Summary
Joint stabilization	"The proximal joints will be stable relative to the greater movement of the distal joints. But even the proximal joints are not fixed, they are in unstable equilibrium. They stay aligned because no forces are at work to dis-align them" (p. 227). Note: Fraser spells 'dis-align'in this way to emphasize this quality. "The paradox: some joint stabilization is present in unstable equilibrium" (p. 228).	Unstable equilibrium Dual muscular pull Fixation Fluid stability	N/P	Proximal joints are more stable than distal, but he says these are not fixed. They are able to stay aligned because muscles are not contracting to take bones out of alignment. Points to limitations in belief that we need stability to move, that even though joints behave as fulcrums, they can still move in space. Describes this place from which to move as 'unstable equilibrium'—a paradoxical state due to contrasting duality of fixation and mobility.
Antagonism	Makes distinction between healthy and unhealthy dual muscular pull. Healthy: necessity in all movement. Unhealthy: "a co-contraction that results from a cross-motivation where the degree of antagonism rises too high. Dual muscular pull becomes dysfunctional only when it works against movement instead of fine-tuning it" (p. 238).	Agonist Antagonist Antagonism Dual muscular pull Co-contraction Healthy Unhealthy	N/P	Describes healthy and unhealthy dual muscular pull. In healthy dual muscular pull there will be some muscle tonus that allows for stability but mobility in joints. This is how co-contraction plays a positive, healthy role. However, the perception should be of not of stabilizing—if it is perceived this is a signal that muscles are overworking. This is unhealthy dual muscular pull.

Glossary definitions of muscle contractions	Classifies four types of muscle contraction: 1. "Agonism which acts 2. Antagonism and muscle tonus which controls 3. Tension which inhibits. …When your movement possesses the first three qualities and is free for the fourth, it will feel effortless—an almost 'non-movement' where the skeleton does most of the work" (p. 238).	Agonism Antagonism Muscle tonus	N/P	Editorial error: states that there are four kinds of muscle contractions but only lists three. Contractions serve to produce motion, control motion, and inhibit motion. Says the fourth type is most desirable and effortless but this is the important information that is missing.
Glossary definitions of muscle contractions	"Tension: overly high tonus—muscular effort that blocks movement. Almost all co-contractions fall into this category" (p. 241).	Overly high muscle tonus Tension Co-contraction	N	Describes co-contraction as tension with too much muscle tonus as almost always blocking movement.
Alignment of skeletal structure	"Two bones so perfectly aligned that all forces pass through the joint with no shearing have no need for fixation—simply staying in the position in a fluid state suffices, and better suits our purposes" (p. 229).	Fluid No fixation	P	If bones are aligned, they will not need to be fixated.

Definition of terms	Defines 'unstable equilibrium' when "a certain amount of tonus in a joint maintains its fluid stability (unstable equilibrium) without hindering movement" (p. 228).	Unstable equilibrium Fluid stability Healthy dual muscular pull Certain amount of muscle tonus	P	'Unstable equilibrium' means there is healthy dual muscular pull allows a fine degree of stability but offers mobility at the same time. A degree of muscle tonus will be present.

A.4 Arm Weight

Table A.4.1 Lister-Sink (Wingsound, 1996, 2008)

Context	Definition/Description	Terms	Role	Summary
Exploring the piano and body mechanisms	Design of keyboard and mechanism works with gravity requiring least amount of effort.	Gravity	P	The piano's mechanism works with gravity and is the optimal way to set a key in action.
Exploring the piano and body mechanisms	Bones can absorb "the dynamic shock of weight-bearing" (chap. 1).		P	The bones absorb arm weight.
The body's lever system	Levers of the keyboard "are activated by the falling weight of the arms" (chap.1).	Falling weight of the arms	P	Falling weight of the arms activates the keys.
The body's lever system	Sitting further back from the keys provides a mechanical advantage for torso to lend power: "Allows for weight support, weight shift, and mobility of the arms" (chap. 1).	Weight shift Weight support	P	Seating position will affect the amount and quality of arm weight. A further distance from the keyboard allows arm weight to produce more volume.
The body's lever system	Weight of the falling forearms appropriate for more refined repertoire.	Weight of falling forearms	P	Must consider the relationship between repertoire and location of the weight from different levers of the torso, shoulder, and forearms. Just forearm weight for refined repertoire.
The natural arches of the arm and hand	Bony arches support the "ever changing weight of the arm as we play" (chap. 1).	Ever- changing weight of the arm	P	Weight of arm always changing as we play. Weight of arm supported by the bony arches arm and hand.

A step-by-step training program for developing good coordination at the piano	Exercises lying on the floor encourage a shifting of the arm weight from one finger to the next.	Shift Arm weight	P	Arm weight can be shifted from one finger to the next. Teach first away from piano.
Explanation of free fall	Experience 'free fall' by allowing forearm to fall with completely relaxed arm. "Actual time of significant muscle contraction to support the weight of the arm as it is transferred to the key bed is also a fraction of a second" (chap. 2).	Free fall Completely relaxed	P	Free fall of arm associated with completely relaxed arm muscles. Muscles only contract for a split second to support weight.
Step-by-step training program for developing good coordination at the piano	"One of the most important components of piano technique is the ability to transfer weight from the body through the arm levers to the key and back to the torso" (chap. 1). This transfer of weight assists in controlling dynamic range.	Transfer weight	P	Transferring the weight from body to arm levers to key and then back to the torso a central aspect of piano technique. Crucial to control of dynamic gradation.
Free fall of arms	Explores alternative feeling of weightlessness and heaviness in arms.	Give and take weight	P	Weight can be given and taken in an instant. Feels heavy and suddenly light and buoyant.
Free fall of arms	Arm acts as a falling weight on to keyboard.	Falling weight	P	First steps for learning 'basic stroke': an easy lift of forearm and then arm acts as a falling weight on to keys.
Free fall of arms	Arm weight falls on to thigh (later to keys). Muscles contract at instant of making contact. Muscles of forearm released for the weight to be transferred back to the torso. Arm will feel buoyant and light. Important to have "optimal alignment of the arm and hand bones for transmitting the weight to the key bed" (chap. 1).	Light Buoyant	P	Forearm drops into lap, muscles contract. Muscles release and weight is transferred back to torso. This will feel light and buoyant. Goal is to make that transfer instantaneous. Alignment of arm and hand bones crucial for weight to be transmitted.

Regulation of arm weight	Arm weight is regulated from the torso allowing for more freedom in joints.	Regulated	P	Regulation of arm weight from torso contributes to freedom in joints.
High, curved fingers	Weight is transferred through arm to key. Arm serves as a bridge to transfer weight into the key.	Transfer weight	P	Important to maintain arm arch for weight to be transferred into key. "Arm regulates the weight of the whole arm" (chap 2).
Holding fingers high	Transfer weight to individual fingers, but allow arm to be supported by torso.	Weight transferred	P	Arm weight is transferred into the fingers, with the torso providing support for the arm.
Excessive key pressure and motion	Pressing into key differs from weight transfer from one finger to the other. "While feeling the continuity of graduated arm weight isn't actually necessary for a percussive instrument like the piano, as it is on a sustaining instrument like the violin, it still helps us to remember the sensations felt on one note and to match them more subtly with the next" (chap. 2).	Pressing Kneading into key Sophisticated Well coordinated Regulated	P	Do not confuse pressing into key with arm weight. Arm weight is continuous regulated from torso to finger and back: this continuous transfer of weight provides physical connection to previous notes.
Excessive key pressure and motion	Sensation of arm weight similar to what an artist feels "creating the lights and darks of a line drawing" (chap. 2).	Arm weight	P	Graduation of arm weight illustrated as the movements of artist creating continuous line that becomes light and dark.
Heavy, relaxed arms	Equating relaxed arms with perpetually heavy arms can mislead. Important to discern that split second of tone production and allow weight of falling arm to go back to torso. Free fall to produce tone with arm weight "is sort of like a falling brick transforming into a ping-pong ball on contact" (chap. 2).	Relaxed arms Heavy arms Like a falling brick transforming into a ping-pong ball.	P	Relaxing arms does not mean constantly heavy arms. Important to discern the moment of sound production to put weight of arms back to torso. Comparison of heavy bricks turning to ping- pong balls.

Table A.4.2.Taubman (Bloomfield et al., 2001)

Context	Definition/Description	Terms	Role	Summary
Principles and concepts	Golandsky states: "When we talk about weight, we talk about the correct amount of weight that will allow us to feel like we are resting down without holding up" (chap. 4).	Resting down	P	Amount of weight is important to discern so that it feels like 'resting down.' Clearly states that this does not mean 'holding up.'
Principles and concepts	A low wrist will displace arm weight into wrist. Fails to get through to the fingers.	Arm weight	N	If wrist breaks (lower than the forearm) arm weight falls into the wrist and does not get to the fingers. Causes pain and injury.
Principles and concepts	The shoulder often drops to put forearm weight behind finger.	Forearm weight	N	Dropping shoulder to facilitate forearm weight behind finger results in neck pain.
Principles and concepts	Dropping shoulders causes upper arm to relax, weight of arm goes to fingers, finger can't move.	Weight of arm	N	Negative consequences of chain effect of dropping shoulders resulting in relaxed upper arm; this causes arm weight to fall into fingers; fingers have difficulty moving.
Principles and concepts	If elbow too low, the weight of arm falls into elbow.	Weight falls	N	If elbow is low the weight falls there, fingers compensate by trying to hang on to the keys.
Playing large intervals	If fingers too stretched the weight of the arm cannot be behind each finger to provide tonal variety.	Hanging on	P/N	Stretching fingers to reach large intervals results in less arm weight behind fingers. Better to use pedal for legato effect in passages where fingers have to reach large intervals to ensure arm weight is behind each finger.

Principles and concepts	Golandsky states: "When the fingers rest closer to the keys they bring the weight of the hand and the forearm behind them. This part—these limp parts are heavier—they can provide us with the weight to overcome surface resistance very easily-the finger can control the hammer at the point of sound and put it down slowly" (chap. 9).	Limp Heavy Weight of the hand and forearm	P	Need weight from hand and forearm to overcome resistance of the key.
Tone production and voicing chords	Dropping hand into keys, Golandsky states: "allowing the arm to fall freely behind it….drop a little bit….free a little bit of arm weight behind the finger you want to bring out….I feel no effort in the finger" (chap. 10).	Arm weight	P	Arm weight can be freed to go behind the fingers. Connection of arm to fingers is vital to how arm weight is directed. Golandsky states: "Once the arm is connected to the finger…you can tell it whatever it is you want" (chap. 10).

Table A.4.3 Mark (2003)

Context	Definition/Description	Terms	Role	Summary
Mapping the arm and hand.	"Unlike the forelimbs of other vertebrates, our arms play no weight-bearing role in locomotion and are free to function primarily as manipulating structures" (p. 65).	Weight-bearing role	N	States that arms do not play weight-bearing role in playing the piano.
Mapping the piano.	Speed not weight determines volume and quality of sound. Opposes notion that "the force or weight used to depress a key could affect the sound" (p. 128).		N	States that velocity is the only determinant in sound production.
Mapping the piano.	"Fantasies of 'dropping weight' can be dangerous" (p. 130).	Dropping weight Excessive force	N	Does not discuss arm weight but insinuates that this practice (dropping weight) has inherent dangers.

Table A.4.4 Karpoff (2009)

Context	Definition/Description	Terms	Role	Summary
Foundations: Free fall	Arm weight is aided by gravity. Encourages a free fall of the arm by tossing students' arms into the keys. "Arm weight is aided by gravity…Don't do anything" (Unit 1: chap. 7). To experience the free fall you must "give up control to gain control" (Unit 1: chap. 7).	Free fall Let go Be loose	P	A free arm is tossed onto the keys for feeling of arm weight aided by gravity. Equated with a free fall. To control arm weight you have to give up control, not do anything.
Foundations: Free fall	Hand and wrist must be loose and supple to use gravity well. Describes a 'rebound' once the finger drops through the point of sound: "Go through the sweet spot and decelerate." "Leave only enough weight on key to leave it down" (Unit 1, chap. 7).	Utilize gravity	P	There is a free fall of the arm that uses gravity to drop into the keys. Decelerate once the point of sound is reached, leaving only enough weight on key that will keep it down.
Height and distance from the piano	Leaning back away from the piano will take weight off the arms to allow for pianissimo playing. "Take the arm weight out by leaning backward" (Unit 1, chap.5).	Weight off the arms	P	Infers that weight can be removed and added to the arms depending on the body position: less arm weight results in playing at softer dynamic levels.
Foundations: Point of sound	Allow arm to freely fall and use gravity. There is a rebound of hand and arm off the bottom of the "elastic key bed" (Unit 1, chap. 9).	Free fall Utilize gravity Rebound	P	Arm falls freely, using gravity. A slight deceleration and rebound after the point of sound is reached. A rebound with the hand and wrist "cushions the attack" (Unit 1, chap. 9).
Height and distance from the piano	Forearm parallel to floor "allows effective use of arm weight aided by gravity" (Unit 1, chap.5).	Arm weight Gravity	P	Position of forearm important to optimize gravity assistance.

Foundations: Free fall	Demonstrates forearm lifting, hand dropping into key for a free fall.	"Lift and drop" Arm weight	P	Forearm lifts, hand drops into keys for sensation of falling freely.
Two-note slurs	Asks student to "give me some of your arm weight" in demonstrating slurs. Demonstrates an "integrative motion" that "uses gravity to allow the arm to float," (Unit 2, chap. 4).	Arm weight Integrative motion Gravity Float	P	Suggests arm weight is something that can be taken and given. Gravity lets arm float.
Two-note slurs	"Follow-through utilizes gravity" (Unit 2, chap. 4).	Follow-through Gravity	P	Last stage of slur is a follow-through that "utilizes gravity" (Unit 2, chap. 4).
Vibrato technique	Fingers fix to "absorb the kinetic energy of the arm weight" (Unit 5, chap. 2).	Kinetic energy of arm weight	P	Arm weight associated with kinetic energy that is absorbed by fingers.
Review two-note slurs	Integrative movement allows arm weight to transfer from finger to finger	Transfer arm weight	P	Integrative movement allows arm weight to transfer from finger to finger for more legato tone, no extra effort.
Chord ensemble and sound quality	Playing chords come from the upper arm, "happen to absorb that deceleration of the weight into the bony structure of the fingertips" (Unit 3, chap. 1) then rebound.	Weight from upper arm absorbed into fingers.	P	Instruct students when playing chord ensemble to play the chords from the upper arm let the slowing down of the weight be absorbed into fingers.
Arpeggios	Transference of arm weight important aspect of playing arpeggios (along with released fingers and alignment)	Transference of arm weight	P	Weight is transferred to execute arpeggios.
Isolating the thumb in two octave arpeggios	Continuous drop, "gradually transferring the arm weight" (Unit 3, chap. 11) from one note to another in arpeggio. "Avoid a sudden drop" (Unit 3, chap. 11).	Continuous drop Transfer arm weight	P	A continuous drop facilitates the gradual transference of arm weight from note to note. Demonstrates arpeggio exercises by isolating a few notes, falling into key and then allowing the arm to drop on to the leg (finger slides off key, arm drops on to leg).

Trills	Continuous cycling with forearm rotation, moving in and out, up and down, "feel continuously connected to your arm weight and to your proximal muscles" (Unit 6, chap. 16).	Connected to arm weight and proximal muscles	P	When using three dimensional movement patterns there is a constant connection to arm weight from proximal muscles.
Scales: 3-dimensional shaping	"Transfer the weight" (Unit 7, chap. 1) continuously for 3-dimensional shaping: don't drop all weight into first note, otherwise there is no momentum left for shaping.		P	The key to the 3-dimensional shaping in scales is a constinuous transfer of weight. 'Under motion' helps to transfer the weight.

Table A.5.4.1 Fraser (2003)

Context	Definition	Terms	Role	Summary
Role of arm weight and tone production	"Allowing the arm's mass to be transmitted through the finger into the key…widely held tenet rife with pianisitic dangers… and incomplete understanding of human movement" (p. 40).	Arm's mass	N	Arm weight is a poorly defined and misunderstood concept in practice and literature and can result in 'dangerous' habits.
The nature of freedom in arm weight	Free fall feels like "uncontrolled freedom…but it is almost dead… like jumping out of a plane without a parachute is free" (p. 40).	Free fall (dead) Uncontrolled Like jumping out of a plane without a parachute	N	Dangers of equating arm weight with free fall: can deaden and impede movement.
Role of arm weight in tone production	Arm weight "does play a crucial role in tone production" (p. 40). But this is not a dead weight.	Intelligent mass Crucial Not dead	P	Arm weight plays a crucial role in tone production, but is not a dead weight.
Freedom in arm weight	Arm weight can provide "capable freedom" (p. 40).	Capable freedom	P	Distinguish between uncontrolled and capable freedom that comes from arm weight.

Role in tone production	The muscles help to provide momentum but they must also direct the action. "Active, intelligent mass, flexible in its actions" (p .41).	Active, intelligent, flexible mass Not dead	P	The muscles move with intent to provide momentum and direct action—not a free fall.
Balance of relaxation and tension	"Symbiotic relationship between the muscles' activity and their physical mass" (p. 42). "Inner activity" (p. 43) in upper arm, to forearm guides the mass.	Flowing weightlessness Inner activity	P	Arm weight alone cannot produce tone, must have 'inner activity' to initiate and generate movement. "You act with gravity" (p. 42).
Role in tone production	Arm: internal function not external. Arm weight warms up the tone.	Internal function	P/N	Internal function of arm contributing to tone production.
Thumb and finger differentiation	"Momentum is not from arm weight but the result of ongoing internal activity higher up your arm" (p. 258).	Internal activity	P/N	Distinguishes between momentum from arm weight and internal activity.
Exercise to feel weight of hammer and weight of arm	"It [arm] should feel distinctly heavy" (p. 272). Release to experience your own arm weight.	Totally relaxed Limp Loose	P	Arm weight feels heavy. Must release arm to feel loose, totally relaxed.

Table A.5.4.2 Fraser (2010)

Context	Definition	Terms	Role	Summary
Feeling bones to produce tone	"Arm weight can help you feel 'bones,'" (p. 118). Distinction between 'arm-thunk' and 'let-go' feeling: "The falling arm shows you the exact skeletality available when you free yourself from unnecessary contractions. It stimulates your hand-skeleton into a richer sense of itself" (p.118).	Arm-thunk Let go Bone-whips	P/N	Discern between 'arm-thunk' and 'let go' to allow arm weight to feel skeletal structure that is free of unnecessary muscle contraction. Falling arm instills a heightened kinesthetic sensitivity to hand structure.
Playing with 'lightening strikes'	Allow fingers to move freely and rapidly: "The feeling is not that you're using any kind of weight to produce your sound, but structure supporting gradations of finger velocity" (p. 138).	Lightening strikes	N	Fingers playing freely and rapidly in what he coins as 'lightening strikes.' The feeling is of a supporting structure not weight.
Role of arm weight in how joints behave as levers	"Arm weight doesn't actually move the key, it relaxes the musculature to help this series of levers align precisely and maintain a fluid state—done well, arm weight allows these levers to function at their best" (p. 160).	Arm weight	P	Arm weight does not move the keys. Arm weight allows muscles to relax so that joints serve as levers to produce sound. Arm weight important to allowing the levers to work well.
Arm weight's role in 'attacks'	"You won't collapse if your muscular effort takes precedence over the sense of arm weight in an attack. The equation looks like this: Muscular effort + structural integrity›the sense of arm weight + pressing" (p. 170).	Muscular effort Structural integrity	N/P	Arm weight is secondary to muscular effort and structural integrity, or the other way round: Muscular effort and structural integrity more important than arm weight. Necessary that all bones align to stand up like a "house-of-cards" (p. 170) when arm weight is used.

Arm weight in context of what we know today	Critical of approaches advocating arm weight as remedy for stiffness. "But arm weight can overlook one crucial cause of stiff playing: a lack of structural functionality in the hand and arm" (p. 206).		N/P	Need to diagnose stiffness problems before prescribing arm weight. Often, poor skeletal structure and support is the cause of stiffness. Adding arm weight to the equation only serves to exacerbate the problem.
Timing in application of arm weight	"Exact timing is crucial: If your finger plays too soon, you used more effort than needed; a 'certain contraction' effort in the finger impedes the free and exact control of the note sounding" (p. 208).	Free fall	P	Discusses the importance of the timing between the free fall of the arm and finger manipulating the key: "In the instant your arm is in 'free fall,' your finger has the opportunity to manipulate the key with such precision and tiny effort, it really seems your arm did it all, not your finger" (p. 208).
Arm weight and muscle effort	Relaxing important to feeling skeletal alignment, facilitating arm weight. "There is a complex relationship of arm weight to muscular effort, and there is an art in employing it to best effect" (p. 213).	Muscular effort/ arm weight	P	Complex relationship between arm weight and muscular effort.
ATM exercise	Describes sensation of arm weight and neutrality: By relaxing shoulder "so completely it feels like even your torso's weight is resting on your finger. Your bones line up to bear this not inconsiderable weight, everything falls into balance, and a strange phenomenon occurs: your arms seem to disappear—its weight becomes imperceptible. This is true neutrality, the point from which all efficient movement originates" (p. 211-12).	True neutrality	P	Describes the paradoxical feeling of arm weight when used with skeletal alignment. Affords a feeling of balance and 'neutrality'. All movement should be initiated from this state of neutrality.

Pros and cons of arm weight	Pros: Richer tone, "arm weight facilitates ease and agility in all fingerwork…One's playing becomes more human" (p. 213). Cons: Creates loss of structural integrity of hand—too much softening, loss of momentum. Can replace finger activity, impeding free movement, hand and fingers do not work well. "The arm doesn't really move the key. The arm weighs much more than the finger: if it did really move the key, such an awkward mass couldn't possibly have as fine control as the tiny, precise finger. The arm doesn't produce tone—bones make your tone" (p. 215). "Weight is unwieldy; movement is manageable!" (p. 217).		P/N	Discussion of pros and cons of arm weight: pros include improved facility and sound and almost 'magical' connection to keys; cons include loss of structural integrity of hand. If the arm weight generates motion the movement is not efficient, fingers do not activate. Important to distinguish between arm and finger and know that the fingers move the key, not the weight of the arm.
How to teach arm weight	Well coordinated arm weight technique combines arm weight with muscular activity. Maintain hand's natural structural integrity. Effortless movement resulting from a very complex coordination of muscles. Muscles have to be involved in arm weight although the illusion may seems the opposite: "To achieve finer control over your tone, you still may think you are letting the arm fall, but in reality your muscles are controlling that fall every step of the way" (p. 218).	Arm weight	P	Detailed analysis of what constitutes good arm weight, when and how to teach. Argues that hand needs to be structurally secure before introducing arm weight—like teaching a baby to walk before spine is strong. Many other steps to learn before arm weight. The feeling belies what is really happening. Muscles are activating even though it does not feel thus.

Arm weight and joint stabilization	Argues that muscles contract primarily to move, "holding a joint in place is subsidiary to the key role of muscular activation" (p. 224). If muscles only contracted to fix joints we would not move. Use alignment of bones for stability: "A well-aligned finger needs no stabilizing muscular activity" (p. 225), but then does state that muscles do contract to stabilize joints in the next paragraphs and that joint alignment is not the same as joint fixation. The subjective nature of arm weight does not accurately reflect muscular activity.		P/N	Challenges Lister-Sink's statement that the only purpose of muscle contraction to stabilize joints. Muscles stabilize joints but they also are the prime movers. Points to the subjective experience of arm weight can belie what is really happening, (one may feel like there is no muscle activation but there is). Complex explanation differentiating between joint alignment and joint fixation and muscular activity.
Summary of principles	"Arm weight: sensing the weight of your arm frees your musculature to completely sense your skeletal alignments and establish precise, absolute key contact" (p. 249).	Arm weight	P	Arm weight helps to heighten awareness of skeletal alignment for optimal contact with keys.

A.5 Hand and Finger Shape

Table A.5.1.1 Hand shape: Lister-Sink (Wingsound, 1996, 2008)

Context	Definition/Description	Terms	Role	Summary
Learning basic stroke	"Beautiful and natural alignment of the curves of the arm as it hangs by the side" (chap. 1). Places hand over oranges and balls to feel the natural arch of the hand.	Natural arch Curves	P	Best hand shape comes from natural curves when arm hangs by side. Recommends use of oranges and balls to cultivate kinesthetic sense of natural curve in hand.
Learning basic stroke	"Arch span bridge from the elbow to the tips of the fingers" (chap. 1). Apex of arm arch is at the inside of the wrist.	Arm arch Apex	P	Arch reaches from elbow to tips of fingers. Describes the apex of arm arch at inside of wrist. Arm arch created by lifting wrist, natural arch of hand forms.
Artificially formed hand arch	Tightening hand muscles to form hand arch incorrect. "We don't need to form an arch, we already have one built into our skeletal structure—we simply need to maintain it" (chap. 2).	Hand muscles Natural, built-in arch	N/P	Tightening hand muscles to form hand arch incorrect but commonly taught to remedy 'wobbly fingers' (chap. 2). Not necessary to form an arch as it already exists as part of the skeletal structure. There is a minimal amount of tension that supports arch but there will be no feeling of any tension if assuming the natural arch of the hand.

Table A.5.1.2 Finger shape: Lister-Sink (Wingsound, 1996, 2008)

Context	Definition/Description	Terms	Role	Summary
Basic stroke	"Fingers rest lightly on the keys. When not in use they are supple and released" (chap. 1).	Supple Released	P	Non-playing fingers rest on keys, are supple and released.
High, flat fingers	Articulating with high and flat fingers cuts off coordination of fingers from rest of arm. Describes this as: "just like lonely, little children working without the support of mama—the arm" (chap. 2). "If we ride the keys we don't overwork our finger-lifting muscles" (chap. 2).	High, flat fingers Finger-lifting muscles Ride the keys	N	Good coordination includes entire arm, hand, and fingers. High, flat fingers divorces fingers from arm resulting in poor coordination. Allowing fingers to ride on the keys means less work for extensors.
High, curved fingers	High, curved fingers accompanied by low wrist—leading to collapsed arm arch—leading to tension in hand muscles—leading to "paralysis in the joints" (chap. 2).	High, curved	N	High, curved fingers can lead to serious injury and locked joints. They cause wrist to be excessively low, hyper-extended, compromising the arm arch's function.
High, curved fingers	Let fingers "hang from the apex of the arch" (chap. 2).	Hang	P	Fingers "hang from the apex of the arch" (This is not clear as she repeatedly refers to the wrist as the apex of the arm-hand arch. However, the appearance is of the fingers hanging from the MCP joint).
Holding fingers high	Do not hold non-playing fingers off keys. If weight is directed into individual fingers and if the arm is supported by torso, then hand and fingers can rest on the keys without tension. Saves muscular energy.	Rest	P	Resting fingers on key related to how arm weight is directed and how arm is supported. If arm weight is correctly directed to fingers, arm is supported by torso and fingers can rest on keys, resulting in less muscular work for moving fingers.

Table A.5.2.1 Hand shape: Taubman (Bloomfield et al., 2001)

Context	Definition/Description	Terms	Role	Summary
Principles and concepts	Elbow must be level (on a straight plane) with the top part of the keyboard for unified hand, arm, and fingers. Should feel as if the fingers are "resting down" (chap. 3). Fingers are holding lightly with slight contact with the key. Not hovering, not relaxing.	Unity Resting down Holding Lightly curled	P	Hand considered in context of fingers, hand, and arm unit. Describes fingers as 'resting down.'
Principles and concepts	Seating position important to hand position, including elbow working as a stable fulcrum for the hand in motion.	Stable fulcrum (elbow)	P	Hand position considered in context of position of whole body, the upper arm, elbow position.
Principles and concepts	Hand position with hands hanging at sides in standing position, tilted towards the 5th finger. "When we go to the keyboard, clearly we have to turn to be straight over the keys" (Golandsky, chap. 5).	Straightness (alignment of finger to forearm)	P	Hand naturally orients towards 5th finger side when standing: the hand needs to turn to be straight over the keys, however, many people do not turn enough and tilts too much towards 5th and do not receive support from hand and forearm. Always start movement from the hand in a straight position.
Principles and concepts	If knuckles are high to create strong bridge, movement down is difficult because fingers are at their extreme range of movement, creating a pull on the muscles at top of hand, forearm (causing pain). Describes finger going down, knuckle up as creating pull. Better to have knuckle in natural position as hanging from side. "The main knuckle is a little bit higher than the main knuckle" (chap. 6). (The repetition of 'main knuckle' is probably not intentional, likely due to a careless error.)	Knuckles Main knuckle Natural position Resting down	P/N	Examines pros and cons of different levels of knuckle positions. Criticizes a high knuckle and moving the knuckle and finger in opposite directions as this creates pull, thus tension. Better to move everything in same direction at same time. Recommends a natural position, feeling of being balanced, a 'resting down' position.

Table A.5.2.2 Finger shape: Taubman (Bloomfield et al., 2001)

Context	Definition/Description	Terms	Role	Summary
Concepts and principles	"The long flexors tighten over the wrist only when the fingers are curled" (Goldandsky, chap. 3).	Curled Long flexors	N	Curling fingers results in long flexors tightening over the wrist.
Concepts and principles	"Give the fingers the support of the hand and the forearms" (Golandsky, chap. 4).	Support Resting down	P	Fingers support hand and forearm in 'resting down' position. Resting down allows for unity between arm, hand, and fingers
Concepts and principles	If fingers feel like they are falling off the keyboard they clench to keys, creating tightness.	Clench Grab Hang on	N	Fingers compensate by tightening if they do not feel balanced on the keyboard.
Concepts and principles	Correcting student's low wrist position, "the hand and the arm is like a road going on to a bridge….pretend that the road has to be perfectly straight… you don't want the car to fall off" (Taubman, chap. 4).	Hand and arm like a perfectly straight road to the fingers	N	Likens the hand and arm to a road. If it is not straight the car will fall off.
Concepts and principles	Sitting position impacts where weight is distributed and fingers compensate by clenching.	Clenching Holding	N	If elbow too low, the weight of arm falls into elbow. Fingers clench because they feel like they are falling off the keys.
Concepts and principles	"Arm and hand are available to support the finger in key descent" (Golandsky, chap. 4). Do not bring hand up as the arm, hand, finger are no longer unified.		N	Arm and hand support the finger for key descent. If there is a break in the playing apparatus, something compensates for lack of unity. Not an efficient way to move. Important that whole playing apparatus is unified.

Concepts and principles	Curling fingers is a basic position that is universally taught. Often as a response to weak "nail joint" (chap. 6). Restricts movement because long flexors are used. Curving fingers moved by short flexors that do not cross over wrist resulting in free movement. "Move in one piece from the knuckle-it is the freest way to do it" (Golandsky, chap. 6).	Curving Curling Phalange Nail joint Knuckle	N P	Explains why moving with curved fingers is preferable to curling fingers. Difference is the use of long and short flexors. Curved fingers move from the knuckle with short flexors. Curling fingers impedes movement because long flexors are used.
Concepts and principles	Extensors thrust fingers out; playing down into key uses flexors, thus use two opposing muscles at same time: "Very tense, in-coordinate way to use the muscles" (Golandsky, chap. 6).	Straightening motion Thrusting	N	Thrusting fingers from the knuckle engages flexors and extensors simultaneously; muscles tense and impede motion.
Concepts and principles	Nail joint is mostly flat—"not bulging out or breaking in" (Golandsky, chap. 6). "Hold the joints (DIP, PIP) perfectly straight" (Taubman, chap. 6).	Natural curve	P	Describes best finger shape with emphasis on holding DIP and PIP joint straight.

Table A.5.3.1 Hand shape: Mark (2003)

Context	Definition/Description	Terms	Role	Summary
Ulnar and radial deviation	"The position of the hand is not what is dangerous, it is the quality of movement used to assume the position that may or may not be dangerous" (p. 85).	Ulnar deviation	P/N	If deviation is free, it is not harmful. Therefore, the quality of movement is what is important when considering injurious habits.
Mapping the Hand and Arm	Open hand from the CMC joints. "let the piano open your hand" open the hand "like an umbrella" (p. 94).	CMC joints	P	Best to conceive the hand as opening from the CMC joint, in this manner the whole hand is used.
Mapping muscles	Hand is turned sideways in ulnar deviation. If hand positioned in ulnar deviation without thumb orientation, "the position is benign" (p. 108). But harmful if oriented towards thumb.	Ulnar deviation Thumb orientation	N/P	If ulnar deviation is accompanied by thumb orientation, this produces tension and is injurious.
Mapping muscles	Orientating hand towards little finger is preferable with arm movements to accommodate the different lengths of the fingers.	Little finger orientation Ulnar deviation	P	Orientating hand towards little finger preferable.

The forearm arch	Mechanical advantage with arch formed by forearm and hand. "When its keystone is in place, the arch is self-supporting" (p. 110).	Arch of the forearm and hand Keystone Self-supporting Metacarpal bone Forearm arch Strong Stable Efficient Not rigid	P	Arch end points are elbow and fingertips, keystone is the metacarpal bone (does not say which metacarpal bone). If arch is in place the feeling is one of the finger depressing the key "with no muscular effort" (p. 111).
The forearm arch	"The forearm arch goes from the elbow to the fingertip, but it is part of a whole arm that includes the humerus, collarbone, and shoulder blade in addition to the arch" (p. 112).	Bony structure Forearm arch Sense of support Not fixed or rigid	P	Holistic consideration of the arch includes fingertips, whole arm, humerus, collarbone, and shoulder blade.

Table A.5.3.2 Finger shape: Mark (2003)

Context	Definition/Description	Terms	Role	Summary
Mapping the Hand and Arm	Bending and unbending movement of PIP and DIP joints. Avoid habitual curling. "Pianists need to be aware of the dangers of habitually curling these joints (PIP, DIP) without proper release. Notice that though the curling movements are very strong they are not very fast or easy compared to the up-and-down movements at the MCP joint" (p. 99).	Bending Unbending Curling Uncurling	N	Inherent dangers from curling fingers. Must release curling fingers; though strong, they are not as fast as the movement available at the MCP joints.
Mapping muscles	Natural curve in fingers: "this is the position in which muscles are not working either to straighten the fingers or to curl them" (p. 107).	Natural curve Neutral	P	Clearly defines the optimal finger position as natural curve requiring no muscular effort.
Mapping muscles	Curled fingers: "Sometimes pianists bend the two end joints of the fingers more acutely, producing a more pronounced curve than the natural one. I shall call this 'curled' fingers, and if it is chronic it is potentially injurious" (p. 107).	Chronically curled	N	Curled fingers clearly defined as a curving of the two end joints of the fingers. Chronically curled fingers can be injurious. Also causes shortening and tightening of the wrist.
Mapping the piano	"Note the optimum point of contact is not the fingertip but slightly further back, more on the pad" (p.130). More sensitive and a source of feedback.	Fingertips Pad	P	Best to play on the finger pad, not tip. The finger pad provides more sensory feedback.

Table A.5.4.1 Hand shape: Karpoff (2009)

Context	Definition	Terms	Role	Summary
Bench height and distance from the piano	Shows how to determine hand position. Bring hand to keys in a karate chop position with radius over the ulna, and then rotate into playing position.	Radius Ulna Playing position Rotate	P	There is a rotation to bring hand into playing position.
Opposable muscles	Opposable muscles engaged when fingers are held in a position so that they are the same length (a practice recommended in some piano methods).	Opposable muscles	N	Traditional hand position of fingers held so they are same length engages opposable muscles, inhibits free movement.
The quiet hand and alignment	When one finger plays the others rest on the surface of the keys. Thumb can hang away from piano. Align fingers behind forearms so tendons align with fingers.	Quiet hand Fingers rest Align fingers and forearm	P	Describes quiet hand as non-playing fingers resting on the surface of the keys. Thumb can hang away from piano. Align fingers behind forearms so tendons align with fingers. This is a position that should be used in all types of movement whenever possible.
Common hand positions	Cluster position: created with "stable bridge or arch" (Unit 1, chap. 17) but encourages thumb to have too much lateral movement, simultaneous use of opposable muscles.	Cluster position Stable bridge Arch	P	Stable arch or bridge in hand creates 'cluster' position, but too much lateral movement in thumb can inhibit free movement with "simultaneous use of opposable muscles" (Unit 1, chap. 17).
Common hand positions	Common hand position of holding imaginary apple results in a cup shaped hand with bent and rounded fingers. While this position has some merits, people often do not let go of the 'apple' and hold the position, "not the sensation of letting it go" thus inhibiting movement (Unit 1, chap. 17).	Cup shaped hand Letting go	N	Common practice of encouraging students to hold apple/orange to cultivate rounded hand shape may cause holding and restrict movement.

Common hand positions	When hand rests down at the side there is a natural curvature. Instructs pianist to "draw relaxed hand up to keyboard….honours the structure of the hand" (Unit 1, chap. 17).	Natural curvature Relaxed hand MCP joint	P	The natural curvature of the hand (when resting at side of the body) is the best hand structure for playing: The arch is maintained and fingers are free to move uninhibited from the MCP joint.
Common hand positions	"Whenever possible, maintain quiet hand in all movements at the piano" (Unit 1, chap. 17).	Quiet hand	P	Quiet hand for all movements is preferable.
Two-note Slurs	"Maintain good bridge support" (Unit 2, chap. 3).	Bridge support	P	Bridge support important for proper hand and finger shape in slurs.
Arpeggios	Breaks the movements down for playing arpeggios. Important to all fingers to instantaneously release for a quiet hand, should allow the hand be small after each note is played.	Small hand Quiet hand	P	Alignment and released fingers important to creating a quiet and small hand.
Arpeggios	After 'thumb throw' in executing arpeggio, must release hand.	Release hand Quiet, released hand	P	Hand needs to release after thumb throw in arpeggios.
Arpeggios	Common to fix hand while playing arpeggios.	Fixing hand	N	Problems from fixing hand (does not specify, but infers movement is not free and easy).
Arpeggios	Swiveling takes hand out of alignment.	Swiveling	N	Hand alignment paramount; swiveling takes hand out of alignment.
Vibrato technique	Hand size and span important to how large intervals are played. More important to release notes early if hand is small or play on 7/8 size keyboard.		P/N	Hand size and span a consideration in how large intervals are played.

Scales	"Keep the hand open and respect the natural structure of the hand" (Unit 7, chap. 2).	Open hand Natural structure	P	The natural structure of the hand is the best structure. Instructs student to "respect the natural structure of the hand" (Unit 7, chap. 2).
Scales	"Conflict within the hand" (Unit 7, chap. 3) results from common way of teaching thumb under in scales.	Conflict within the hand	N	The common practice of reaching the thumb under hand to play scales result in hand and thumb not working together efficiently.

Table A.5.4.2 Finger shape: Karpoff (2009)

Context	Definition	Terms	Role	Summary
Slurs	Release fingers to play slurs; keep hand quiet.	Release fingers Quiet hand	P	Release fingers when playing slurs.
Quiet hand	Demonstrates fingers' relationship in sharing tendons between fingers 3, 4.		P	Know the natural structure and relationship between fingers to understand the importance of maintaining a quiet hand.
Free fall	Fingers gently curved, supported, landing on the "fleshy part of the first digit" (Unit 1, chap. 7).	Gently curved First digit Supported fingers	P	Gently curved fingers, land on fleshy part of first digit. Let fingers rest on keys after playing.
Quiet hand	Pulling back finger engages opposable muscles.	Opposable muscles	N	Pulling fingers back results in simultaneous contraction of opposable muscles.
Supported fingers	Introduces an exercise of allowing fingers to passively hang off a pencil from the DIP joints—serves to support and stabilize fingers.	Stabilized Support fingers	P	Suggests that exercises (allowing fingers to passively hang off a pencil from the DIP joints) can strengthen and stabilize fingers.

Common Hand positions	Gently curved fingers moving from the MCP joint "allow muscles to be continuously rejuvenated…Opposable muscles do not contract simultaneously allowing for interdependent 3-dimensional movement" (Unit 1, chap. 17).	Gently curved MCP joint	P	Fingers are gently curved, moving freely from the MCP joint when a natural curvature of hand position is used.
Common Hand positions	Even with good alignment, pianists may play with "excess tension in fingers" (Unit 1, chap. 17). Need to allow fingers to rest on the surface of the keys.		P/N	Fingers must rest on surface of keys to avoid excess tension. Correct alignment does not necessarily mean there is no tension in the fingers.
Common Hand positions	"Stable fingers enable nice rhythmic response"(Unit, 1 chap. 17). Each finger joint is stabilized with gently curved fingers (bridge to fingertips).	Stable joints Gently curved from bridge to fingertip	P	Gently curved fingers from bridge to fingertips results in stability in all finger joints.
Common Hand positions	Need to stabilize over-flexible joints (shows supporting hand from beneath with teacher's hand).	Stabilize	P	Joints of fingers should be stabilized.
Common Hand positions	Gentle passive stretching exercises can help to "strengthen finger joint and further facilitate stability" (Unit 1, chap. 17).	Finger joint Stabilize Strengthen	P	Demonstrates exercise of hanging fingers from DIP on a pen; beneficial for developing strength and stability in "finger joint" (Unit 1, chap. 17).
Two-Note Slurs	Hyper-extended equated with flat fingers Preferable to have slight curve, supported bridge.	Hyper-extended Slight curve Release finger into quiet position	P/N	Best finger shape for two note slurs is slightly curved from supported bridge, not flat.
Two-Note Slurs	Non-playing fingers are inactive, dragged on surface of keys.	Inactive (non-playing fingers)	P	Non-playing fingers should be quiet and inactive on surface of keys.

Hanon exercises	Many harmful effects from lifting fingers high off keys when playing Hanon exercises: flexors and extensors contract simultaneously, leads to fixed wrist, thin tone, and digital sound. Instead, apply 3-D principles to Hanon. These can be useful "problem-solving opportunities" (Unit 2, chap. 15). Discourages any curling— (shortens forearm tendon and can lead to injury) looking for instantaneous natural release of fingers, arm floats.	Activated high fingers Not released Curl First phalanx	N	Original Hanon instructions to lift fingers high limits motion, musical responses. Leads to fixed wrist, simultaneously contracts opposing muscles, flexors and extension continuously contracted, not released. Activated fingers above key surface, not released. However, these situations can be avoided if 3-D principles of movement applied to Hanon exercises.
Arpeggios	Shows example of student playing arpeggios. Fingers played in "claw-like fashion" (Unit 3, chap. 5) results in engaging opposable muscles simultaneously.	Claw like	N	Claw-like fingers engage opposable muscles simultaneously.
Vibrato technique	Non-playing fingers rest on surface of keys. If there is a "sympathetic contraction" (Unit 5, chap. 8), allow fingers to release instantaneously.	Sympathetic contraction	P/N	Non-playing fingers may contract as others play, but these must be released at once.
Vibrato technique	Well-supported arch with gently curved fingers. Do not curl fingers under the hand or up in the air. Maintain a quiet hand in all movements.	Supported arch Gently curved fingers	P	Describes the desirable hand and finger shape for all movements: quiet hand, well-supported arch, gently curved fingers. Do not continuously curl or lift fingers.
Scales	Fingers release naturally, on their own: prepare with preparatory motion for momentum.	Released fingers		Allow fingers to release on their own, naturally with quiet hand. Incorporates multiple notes in one motion, using little effort.
Scales	Fingers must "activate in all three planes" (Unit 7, chap. 10).	Activate	P	Fingers move to make vertical and horizontal adjustments when playing scales.

Table A.5.5.1 Hand shape: Fraser (2003)

Context	Definition/Description	Terms	Role	Summary
Empower hand structure	"Remedial work in basic strength" (p. 6) needed to strive for a stronger hand structure.	Strength Empower Strong	P	Strength needed to maintain hand structure that is empowered.
Legato touch key to orchestral colour	"…hand must be galvanized into action so that it becomes a functional entity, a structure that is maintained by the very activity it supports" (p. 21).	Activated, galvanized Strength Functional entity	P	Activated hand structure central to functional piano playing.
Hand shape not forced	Strength must not negate the suppleness and sensitivity" (p. 26). "…it must be derived from functionality, not brute force" (p. 26). Feels like a drumstick and is free to vibrate.	Activation Strength Suppleness	P	Distinguishes between forced and inherent strength that comes from aligned structure. Strong but supple.
Strong hand remedies poor tone	Poor tone quality often due to a lack of integrity and of flexible solidity in hand structure" (p. 43).	Flexible solidity	P	Without solid, flexible structure of hand there is harsh tone.
Fixation for function	Stiffen hand "to the point of cement-like rigidity" (p. 38) to achieve musical results.	Stiffen Rigidity	P	Stiff, rigid hand achieves specific musical effects.
Form and function	Stiffen hand form for function, "flexible hand fixation…opposing forces that creates a symbiosis" (p. 39).	Flexible Fixed Stiffened hand	P	Opposing concepts of flexibility and fixation important to form and function.

ATM exercise	Describes sensation of bones and muscles in hand: “sense of the bones of the hand swimming in a sort of ‘muscle soup’ ” (p. 45).		P	Describes the heightened sensations of bones and muscle structure from ATM exercise.
Over-holding notes	Differentiate hand and finger function. Strong hand facilitates freedom in arm: “Arm free to move, supported by the standing base of your fingers and hands” (p. 65) “feels like standing on the keyboard” (p. 65).	Standing base Stable structure	P	Hand shape provides stable base for free arm movement.
Grasping	Grasping function instills important strength in hand.	Grasping	P	Grasping a key component of strength in hand shape.
Thumb pushups	Push up on thumb to activate hand structure.	Stable platform	P	Emphasizes activity and strength in thumb. Describes exercise of “thumb push-ups” for stable hand.
Cantabile playing	Banded fingers form a secure hand structure for cantabile sound.	Active Strength Banded fingers	P	Banding fingers provides strength and structure, produces cantabile effects.
Rotation	“Bipartite nature of hand structure” (p. 190) felt in rotational movement.	Bipartite nature	P	Rotational movement cultivates a feeling of the duality of strength and suppleness in the hand. Contributes to brilliant tone.
Rotation	Strength and flexibility=functionality	Strong Flexible Functional	P	Relationship between flexibility, strength, and functionality. The hand must be strong and flexible to function well.

Hand and finger shape	Equilibrated muscle tonus rather than superfluous tension. Neutrality is free of tension, holding, and effort. "Make the soft" (p. 210). Opposite is deformed and distorted.	Capable Natural Neutral	P	Natural shape is free of tension, holding and effort. Minimal muscle tonus.
Maintaining hand shape in scales	Describes the hand as the platform to allow: "centered effort-free point from which the fingers drop" (p. 233).	Hand-platform Neutrality Neutral manner	P	Minimum muscular effort to maintain neutral "hand-platform" (p. 233).
Synthesis of hand-finger relationship	Dramatic power found in the opposing action of metacarpals/phalanges.	Secure base Opposive-supportive	P	Opposive-supportive function of hand and fingers provides secure base structure, thus power.

Table A.5.5.2 Hand shape: Fraser (2010)

Context	Definition/Description	Terms	Role	Summary
Introduction to key concepts	MCP joint "the keystone of the hand's arch" (p. 3) often the 'weak link' in piano playing.	Keystone of the Fully potent Strong	P	MCP joints serves as the keystone of the hand's arch, however this is commonly the weak link in piano playing.
Introduction to key concepts	Hand function presented "in the context of unstable equilibrium" (p. 4), and includes wide range of capabilities. Advice will change depending on musical outcomes and personal needs.	Firm Flexible Unstable equilibrium Skeletally conscious Hand functionality	P	Hand capable of a wide range of functions that may seem contradictory——from standing to floating— "unstable equilibrium" (p. 4) permeates all of these functions.
The role of the metacarpals	Hyper-extended MCP joints weaken the hand structure.	MCP	N	Stability and function of hand compromised by hyper-extended MCP joint.
The role of the metacarpals in hand shape	Making the wrist the keystone of the hand's natural arch takes the whole hand out of alignment.	Hand's natural arch	N	Compensating to find stability in the hand by making the wrist the keystone of the hand's natural arch takes the whole hand out of alignment.
The role of the metacarpals	Hand's relationship to forearm: "All the hand's grasping energy can become kinetic energy, freed from the need of maintain stability" (p. 41).	Grasping energy Kinetic energy	P	Forearm orientation empowers hand to transform 'grasping energy' to kinetic energy.
Hand shape	Uses imagery to convey the sense of buoyancy and stability of hand.	Helium balloon buoying the top knuckles	P	Imagery of " helium balloon buoying the top knuckles" (p. 41) used to convey buoyancy and stability in hand.
The role of the metacarpals	"Your oilrig platform has detached from its moorings, so to speak, as if a helicopter had hoisted one side up into the air slightly so the whole thing tilts" (p. 46).	Primed Up and back Primed metacarpal Oilrig platform	P	Describes relationship of metacarpals to phalanges. A paradox of stability and instability.

The role of the metacarpals	Second knuckle acts as the apex of the entire hand structure—"Your second knuckle is now the peak of the entire structure, the apex of not one, not two, but three arches" (p. 47).	Second knuckle acts as apex	P	Uses exploratory approach to differentiate between metacarpals/phalanges eventually arriving at a hand position with the second knuckle as the apex of the entire structure. The collapse of the second metacarpal-phalangeal joint "is the most insidious and consistent cause of skeletal hand alignment loss" (p. 47). This is also injurious.
Arch structures of the hand	Demonstrates that more weight directed to the arch of the hand will strengthen the arched structure. Describes arches as "combining the Russian arch with this lesser-known transverse arch makes a four-ribbed structure similar to the vault of a Gothic cathedral" (p. 51).	Russian arch Multiple arches of the hand Potency Transverse arch	P	Explores how delivering weight to the arches of the 'Russian hand' will strengthen its functionality. Superimposes diagram of a transverse arch to illustrate shape of hand like a cupola and vault of a Gothic cathedral.
The three interlocking arch structures of the hand	To find a functional natural hand position: Bring natural hand shape (as hanging by side) to lie flat on table—there is not much space under the fifth finger—can't move well. Draw forearm forward to create some space. Thumb and fifth finger serve as two sides of the arch, 2nd finger as keystone. Commonly taught position of 'natural' curve often results in hand too flat: "this hand shape exerts an insidious, perhaps unnoticeable strain on your system" (p. 69).	Functional	P	Describes how to find a potent hand structure. Suggests that if the hand is empowered, tension will be released from the shoulders.
Arch structure	Explores the thumb-forefinger structure and compares to the structure of a doorframe.	Thumb and forefinger form doorframe 2^{nd} metacarpal bone acts as lintel	P	Uses metaphor of doorframe and lintel to describe the thumb and forefinger assembly.

Hand shape	Encourages hand shape with one hand passive, the other helping lift MCPs to form arches. Cultivate a sense of the "arch that floats on its own" (p. 71).	Arch floats Cocked hand	P	No muscular effort needed to maintain the arches of the hand, rather there is a feeling of arch floating.
Sensations in fingers controlling the key descent	"The hand needs an element of structurally secure instability as it plays, like the body's instability in walking or running" (p. 84). Discourages describing the hand as being in a position. I hesitate even to use the word 'position', as it implies something fixed in space. No, this 'position' is simply the place in space where your fingers hang out if you just let them go" (p. 84).	Structurally secure instability	P	Describes the dual properties of 'secure instability' that the hands need to experience. Hand is not in a position but in a space.
Moveable fingers	"The image of an 'oilrig platform' helped us define our hand structure in a sensorily rich way. But often at the piano the hand-platform must float in space, not stand on its pylons" (p. 86).	Oilrig platform floating in space Balanced	P	Describes dual properties of stability and floating of hand as oilrig floating in space.
Differentiating finger/hand	"Moveable stability really comes into its own when finger and hand functions differently. The platform floats, the finger manipulates the key be dropping in from the platform" (p. 88).	Moveable stability	P	Continues to explore stability/instability; floating platform.
Description of finger manipulating key	"The directions of the force vectors for each bone of the hand and arm are precise and specific, creating movements in which no energy is lost and dissipated: they are all focused towards the sole goal of effective manipulation of the key" (p. 93).	Force vectors	P	Describes organization of hand and arm that allows for efforts to be entirely directed to finger playing the key.

Using bone to produce tone	Encourages feeling of bones playing with no "superfluous effort, parasitic contractions" (p. 117).		P	Cultivate a feeling of bones in hand playing the piano, no extra muscular effort.
Sensing bones in the hands	"Maximize bone involvement, minimize muscular involvement" (p. 130).	Bones swimming in liquid hands	P	Important to have a mental image of bones playing.
ATMs for discovering thumb differentiation	Hand stands on four fingers (no thumb), knuckle ridge fairly level.	Harpsichordist's hand	P	Exploration of how the 'harpsichordist's hand' (no thumb) can facilitate a differentiation of thumb.

Table A.5.5.3 Finger Shape: Fraser (2003)

Context	Definition/Description	Terms	Role	Summary
Thumb/forefinger assembly	Thumb and forefinger are two legs and "Second finger's top knuckle is a pelvis…Stand up on your thumb-forefinger assembly" (p. 155).	Finger's knuckle Thumb-forefinger assembly	P	Thumb and forefinger likened to two legs, and 2nd MCP as pelvis.
Finger/arm/hand relationship	Activity comes from the fingers "it is pianistic suicide to let them [wrist, arm] take over the finger's work" (p. 156).	Activity from fingers	P	Active fingers play primary role in piano technique. Not wrist and arm.
Cantabile playing	Your fingertip becomes like the tip of a whip" (p. 164).	Whole banded finger group	P	Banded fingers provide functional strong structure and support. Compares fingertips to tip of a whip.
Activating finger	Banded fingers will allow arm to be "free and functional" (p. 165) assists in enhancing tone. Feels as if the "finger that reaches all up to our shoulder… whole arm functioning as one giant finger" (p. 165).	Stiffen Strength Properly Absolute security	P	Banded fingers important to functionality of loose arm.

Arm-swing exercise	Strong, active fingers free up arm from "unnecessary and residual contractions of your arm" (p.168-9).	Galvanize Vital Active Strong	P	Freedom and functionality in arm comes from strong, active fingers.
Phrasing with the wrist	Finger movement reduced "to an absolute minimum" (p. 177) for generating phrases from wrist. "…as if you put two or more fingers into one hole, rather than different holes" (p. 177).	Immobile Absolute minimum of movement	P	Legato and phrasing from wrist involves minimal movement from fingers. Feel unity in fingers, not individuated.
Feather legato	Recommends a feather touch to address over-pressing to find alignment.	Natural Floating	P	"Feather legato" (p. 185) tactic to find joint alignment if there is too much pressing down.
Fingers in passage-work	"Natural finger shape allows us to explore the exact distribution of this strength" (p. 208).	Natural	P	A natural finger shape accentuates the positive use of strength.
Fingers in passage-work	Natural finger shape results when hanging by sides. Natural curve from length of ligaments—"maintained not by muscle tonus" (p. 208). "Natural shape means naturally soft muscles" (p. 209).	Natural curve Not straight Vital Moveable Soft Free	P	Definition of natural shape: muscle tonus does not maintain it, but describes muscles as naturally soft. The curve comes from length of ligaments.
Finger and hand shape	Like an "alive statue: still, yet not stiff" (p. 211).	Natural Pleasant neutrality Absolute quietness (non-playing fingers) Like an alive statue	P	Describes how to lift finger keeping natural shape. Uses simile "like an alive statue" (p. 211) to convey a feeling of activity but stillness.
Finger/arm relationship	Standing fingers acts "as a stabilizing fulcrum" (p. 214).	Playing digit Standing finger	P	Cultivates sensitivity to finger function with proper alignment. Finger stands to provide the fulcrum to arm.

Finger shape	Natural finger shape allows strength without muscular effort.	Natural Neutral	P	Strength and neutrality come from natural shape, no muscular effort.
Relationship between playing and non-playing fingers	Differentiating between playing fingers and non-playing fingers provides freedom. Playing finger described as: "fourth finger pillar of strength" (p. 215).	Pylon Natural shape	P	Playing and non-playing fingers distinct from each other. Describes a strength that comes from proper alignment.
Natural finger shape for orchestration	Yin finger is structurally sound "not rigid" (p. 219). Yan fingers "free from extra tonus or effort" (p. 224).	Yin and Yan fingers	P	Compares playing and non-playing fingers as yin and yan, effort and non-effort.
Natural finger shape	A natural finger shape with naturally soft muscle tonus allows for musical results.	Softer More sensitive Flexible	P	Softer, sensitive, and flexible fingers contribute to a broader spectrum of articulation possibilities.
Articulations	Describes a wide range of finger shapes to achieve musical effects: but always "maintain the relationship to the feeling of natural shape" (p. 226).	Hammer action Cat scratches Flat fingers Moderately curved	P	A variety of finger shapes serves many different musical articulation and effects: but encourages a return to natural shape.
Quality of flexibility	"Your finger cannot have internal movement if it is stiff…flexibility that is functional, not so loose as to become non-functional" (p. 227).	Internal movement Independence Looseness Natural state of soft tonus Moderately curved Fleshy Relaxed	P	Natural muscle tonus crucial to sensitivity. Must not feel internal stiffness: flexible but not too flexible. A balance is needed.
Natural finger shape	There is a quality of activity but stillness in a natural finger shape. Natural equated with "soft aliveness" (p. 240).	Free Natural Loose curved-ness Soft aliveness	P	Describes the dual qualities of stillness and activity felt in a natural finger shape.
Finger shape in arpeggios	Describes a feeling of neutrality that is simply the absence of over-involvement.	Neutrality Over-involvement	P	Emphasizes lack of effort for neutrality.

Fingers in legato	Fingers feel like T'ai Chi walking to achieve legato articulation.	Firm implantedness Secure state of standing	P	Transfer of weight through hip joints to legs compared to hand/finger arrangement.
Comparison of walking and legato playing	Illustrates "smooth transmission of weight from one leg to another" (p. 244) similar to what is needed to achieve legato touch.	MCP compared to the hip	P	Transfer of weight through hip joints to legs compared to hand/finger arrangement.
Symbiotic relationship between fingers and hand	"Maximum finger activity (some external but even more internal) contributes a great deal to maintenance of hand/finger structure" (p. 267). Provides full orchestral tone.	Agility Power Activity Maximum activity Opposive-supportive function	P	Active fingers important to lending stability in structure of hand. Important to achieving tonal range.
Playing stacattismos in Chopin Etude	"Try curling your fingers in a special way: curl only the bottom two joints, as if you want to pull the tips back and up" (p. 276).	Curling in a special way Cat scratch	P	Curling of bottom two joints effective for some musical effects.
Different finger shapes	Flat fingers "opposite of curled fingers, "fuses the three phalanges" (p. 285) to work as one, but the power of grasping is present.	Flat Grasp	P	Flat fingers with underlying power that comes from curling and grasping. "The intention to curl is still present in a flat finger attack" (p. 285).
Flat fingers	Flat fingers allows for an "area of contract fifteen times greater" (p. 228).	Flat Powerful	P	Flat fingers much more powerful than curled fingers due to greater surface area.
Natural finger shape	"Do not use effort or tension to keep your fingers shaped naturally" (p. 210).	Natural Minimum muscle tonus	P	Natural finger shape requires no effort, holding, or tension, only a minimum of muscle tonus.

Table A.5.5.4 Finger shape: Fraser (2010)

Context	Definition/Description	Terms	Role	Summary
The role of the metacarpals	"Each finger actually possesses its own individual 'platform' " (p. 38). Argues that because the fourth finger has fewer tendons it has greater individuation.	Metacarpals Strength Support	P	Bone structure of metacarpals gives each finger its own platform, providing strength and support. The fourth finger has greater support from metacarpal due to fewer tendons.
The role of the metacarpals	Metacarpals move up "in an equal and opposite direction" (p. 38) as the phalanges move down. Feel metacarpals as 'ultra-proximal phalanges' (p. 38).	Ultra-proximal phalanges Metacarals Phalanges	P	Metacarpals function differently than phalanges. Important to 'differentiate' between metacarpals and phalanages. This is paramount in determining hand and finger function.
The role of the metacarpals	"Cocking the metacarpals allows the fingers to move powerfully and remain free for the next equally lithe, powerful attack. It cultivates natural finger shape but empowers their looseness, avoiding the associated tendency towards flaccidity" (p. 43).	Natural finger shape Empowers looseness	P	Demonstrates this differentiation with instructions to 'cock' the metacarpals, thus allowing natural shape, freedom, looseness, and power in fingers.
The potency of the hand arches	Fingers move as a unit. Explains how the lumbricals move the fingers; "the tendons and the muscles along the inside of each finger act like the cable under the arch" (p. 78).		P	Clearly demonstrates how to use lumbricals to move fingers— they must move as a unit—not at the DIP or PIP.

Potency in hand shape	"The finger possesses the tensile strength of a geodesic structure, or an eggshell—able to bear considerable stress, but only along a certain path… intention to 'curve' generates the finger's movement as it manipulates the key, but your finger doesn't actually curl" (p. 82).	Tensile strength	P	Describes the tensile strength in finger coming from an intention to curve, but does not curl.
Differentiating metacarpals/phalanges	Manipulating the key with the fingertip is a 'poking' one-dimensional playing (pushing). Often compensate by curling the fingertip, "But the curl risks deforming natural finger shape and the movement becomes a spasm, if it's not directly related precisely to the object it aims to move" (p. 91). Flat of the finger allows for more three-dimensional movement: combine this with metacarpal-phalanges differentiation.	Flat of the finger Three dimensional movement Hammer stroke	N/P	Presents the disadvantages of playing on fingertip—fingers curl, less efficient movement. Better to play on the flat of the finger, differentiating metacarpal from phalanges.
Individualization of metacarpals and phalanges	"In standing or hovering, oil rig or hummingbird, always maintain a sense of the finger manipulating the key" (p. 93). Description of hand/finger organization: "The looseness we seek is not generic but possesses a sophisticated, highly intentional organization" (p. 93).	Looseness is highly intentional organization. Force vectors	P	Finger manipulates the key. Standing properties of hand and fingers likened to oilrigs and hummingbirds. The hand and finger organization is complex.

ATM for fingers	ATM exercise to feel skeletal nature of hand and fingers: "It's as if your fingers were the spokes of a rimless bicycle wheel. Your hand is the hub, your fingers the spokes, and if there were a rim to the wheel, it would connect your five fingertips in a smooth curve" (p. 113).	Uncooked spaghetti bicycle spoke finger. Hand-hub Fingers-spokes	P	ATM exercise to cultivate feeling of finger bones resulting from reduction of muscle tonus. Likens phalanges to uncooked spaghetti bicycle spokes and the hand to the hub of wheel.
Finger action	"Hooking is the thwarted intention to curl. It combines action and stabilization" (p. 155). In making the finger hook on to the key a grasping motion is used, imparting "flexibility and suppleness" (p. 155) in finger, forearm, shoulder blade, whole body.	Medial phalange Distal phalange Finger hook	P	Describes a finger action as 'hooking' — an action that provides power but great flexibility. Hook on the part of finger between the tip and pad.
Arm weight and finger-hand-arm unit	Don't use curled fingers in trying to achieve forte sound, but play on fingerpad for a "relatively flat finger-lever" (p. 163).	Finger-lever	N/P	Curled fingers not an effective way to achieve forte sound. More power and fullness when using flat of fingerpad.
Different advantages of curled, curved, flat fingers	"You need to either curl, curve, or flatten your finger depending on the context. The more it's curled, the more the work of the lumbricals is usurped by skeletal structure (in the 'hammer), or the long and short flexors (in the 'hook' or the 'cat-scratch'), each variation giving a specific articulation and colour. The more it's flattened, the more your lumbricals activate, creating really juicy sound and enhancing the potency of the metacarpal-phalangeal joints, consolidating their prominent position" (p. 169).	Curl Curve Flatten	P	Clearly outlines different shapes of finger, which muscles work to make this happen, and musical outcomes.

Appendix B: Summary of data

B.1 Tension

Table B.1.1 Lister-Sink (1996, 2008)

Role	Terms	Summary
Positive	Significant tension Minimal tension	Definition/description: A muscular property associated with contraction of muscles, tension only occurs at moment of impact of the finger with the key at point of sound. This tension must be instantly and continuously released. Though a small amount of tension is needed to play, pianists commonly play with excess tension. A minimal degree of tension is needed to maintain the hand arch, however pianist should not feel this: "It is a question of finding just the right amount of tension—no more, no less" (chap. 2). The hand and arm will feel buoyant and weightless when tension-free. Causes: Muscular contraction. Effects: Stabilizes joints at the moment of impact of finger with key. How to address: Brain must cut off signals to contract muscles in order to release. Tension must be instantly and continuously released.
Negative	Stresses Muscular tension Resistance Locks, paralyzes joints Body tension Let go Chronic tension Dangerous tension Excess tension Unnecessary tension Harmful tension	Definition/description: Tension is a muscular property associated with contraction of muscles. Chronic tension results from continuous signals from the brain to the muscle to contract. Infers that the opposite of tense is relaxed (chap. 1). If not completely relaxed, resistance and "a loss of suppleness" (chap. 1) in movement patterns is a sign of tension. Tension can accumulate and release. Any necessary tension to stabilize joints must be instantly released. Frequent instructions for movements to be free of tension, including let go of all muscle tension throughout the arm and let arms fall freely. Causes: Many people have become desensitized to tension. Can be caused by unnatural, forced movements including jutting elbows, raising shoulder blades, highly curved fingers, collapsed arm and hand arch. Effects: Blocks power from torso and shoulder levers (chap. 1), diminished mobility which can eventually "paralyze and lock joints in place" (chap. 2), impedes flow of energy and arm weight into the keys. A principle cause of stresses, playing-related injury, pain, and discomfort. Diverts mental and physical attention and compromises physical sensitivity and ability to hear. How to address: Outlines steps to eliminate chronic muscle tension: 1.Awareness of the state of the tensed muscles 2. Regain conscious control of the tensed muscles. 3. Learn and apply the principles and sensations of efficient muscle use. Releasing tension paramount to mastering the basic stroke—the foundation of this method. Teacher's physical

	touch of hand to tensed area can help student to release. Playing short fragments with one gesture.

Table B.1.2 Taubman (2001)

Role	Terms	Summary
Positive		Does not discuss tension as playing a positive role.
Negative	Dual muscular pull Clenching Fixating Tighten Holding up Hovering up Finger individualization Slightest tension Tremendous tension	Definition/description: Muscles pulling in opposite directions at the same time results in dual muscular pulls, "which is another name for tension" (Golandsky, chap. 3). Anytime that you move in a way that activates those two muscles at the same time you will end up with tension"(Golandsky, chap. 3). Equates tension with too much muscular effort. Tension can also be found in joints when moving in their extreme range of motion. An undesirable quality: "even a little bit would be wrong" (Taubman lecture, chap. 5). Causes: Opposing muscles pulling at the same time. Refers often to the flexors and extensors moving the fingers simultaneously as a cause of tension: Moving fingers by themselves without help of forearm; clenching fingers to hold on to the keyboard; lifting and curling fingers; thrusting fingers; fixating and tightening fingers to mold them into unnatural positions; twisting motions; motion in the extreme range of motion; pushing into the bottom of the key bed after the point of sound; efforts to play softly by holding arms, hand, fingers up away from the keys; movement at the joints' extreme range of motion; moving the thumb under hand so that it is extending and flexing at the same time; initiating movement from the upper arm. Feeling musical intensity in the body can create unwanted tension. "Tension can come from tension" (Golandsky, chap. 10). Tension can also come from relaxation: A great deal of muscular effort needed to move from a state of relaxation. Effects: Limits motion. Movement feels labored and compromises coordination of muscles. Impedes fast and free movement. Can cause injury. Weakens power and ability to play quickly. How to address: It is not a matter of telling muscles to activate or relax, but using a quality of movement that does not create tension. Move the forearm, hand, and fingers as a unit with the upper arm following behind. Let the forearm be directly behind the fingers.

Table B.1.3 Mark (2003)

Role	Terms	Summary
Positive		Tension is never mentioned as a positive attribute, only that which is to be avoided.
Negative	Excessive muscular work Stiff Tense Fixed joints Stabilizing joints Muscular effort Downward pull Chronically shortened, narrow, stretched muscles Gripping muscles Chronically tight muscles Strain Static muscular activity Holding Fixed Squeezed Constant Underlying Upward tension Small amount Excessive tension Chronic tension Continual tension Restrictive tension Compensatory tension Any tension Damaging tension Repeated tension Unnecessary tension	Definition/description: Clearly defines tension as meaning "excessive muscular work—work in excess of what is needed to accomplish the task at hand" (p. 1). Later, equates tension with static muscular activity (p. 53) and an isometric muscular contraction. Describes tension as a muscular property resulting in shortened, narrow, or stretched muscles. Infers that tension is the opposite of free. Location of tension referred to in general and specific terms. Specific locations include tension found in jaw, neck, shoulder area, arm, back, butt, knee, and ankle—joints that play a role in determining balance. Causes: Causes of tension include muscles compensating and counteracting for poor body mapping, imbalance of skeletal structure. Tension often results from habits of moving poorly. We have become so habituated to moving with tension it is common for people to be unaware of the presence of tension. Pianists' attention is focused on the movement, not necessarily the muscles that make the movement. Adhering to traditional teaching methods including stabilizing joints, focusing on finger action also cultivate tension. Mismapped hand positions including ulnar deviation, thumb orientation, and poorly understood mechanics of rotation. Other causes include holding, fixing, and stabilizing joints. These terms mean the same thing. Mark even allows that semantics do not change the meaning—any stability is harmful as this creates tension. Collapsed joints cause one to grip, which in turn causes tension. Breathing from an incorrect map of the lungs can cause tension in the back, and in turn, the arms. Effects: The term 'tension' is overwhelmingly undesirable and negative quality that restricts and impedes movement. While tension is closely associated with poor body mapping, it is not clear if tension is a cause or a result of mismapping. Constant tension associated with pain, injury, and "permanent damage" (p. 144). Tension is the primary cause of injury and creates the following conditions for injury: "co-contraction, awkward positions, static muscular activity, or excessive force" (p. 145). Tension in the neck and face negatively impacts the quality of listening. How to address: Because tension infiltrates all aspects of life, we must acquire "new habits of movement [that] will inform all life activities" (p. 109). If movement is organized around the "bony structure, stability is achieved without tension. The muscles can release" (p. 112). Do not stabilize joints, instead move from the core to eliminate tension. Cultivating an awareness of tension by developing "kinesthesia" and a balanced body through accurate body mapping facilitates a heightened awareness of tension —in turn, this allows for a release of tension. A hand position with the metacarpals acting as the keystone of arch "can be a basis of playing without tension, yet with ease, control, and power" (p. 111). Releasing tension is key to eliminating its ill effects. Releasing tension allows muscles to widen and lengthen. Moving in accordance with the body's structure allows movement without tension.

Table B.1.4 Karpoff (2009)

Role	Terms	Summary
Positive	Expressive	Definition/description: Emotional tension and release created with two-note slur. (Unit 2: chap. 2). Causes: The gesture for a two-note slur creates a sense of expectation on first note of slur, release on the second. Effects: Musical expression.
Negative	Cramped hand position Held Locking joints Extra tension	Definition/description: Opposable muscles contract to hold hand and fingers in undesirable positions, creating tension at the forearm, wrist, and fingers, particularly in non-playing fingers. A quality that can 'accumulate' (Unit 6, chap. 9) and be released. Playing without tension is associated with playing with "no extra muscular effort" (Unit 6, chap. 13). Causes: Cramped hand position, curling fingers in attempts to align fingers in a straight line, holding fingers up, poor breathing patterns, engaging abductor muscles in hand to span large intervals, locking wrist, habitual patterns of movement. Effects: Tension in fingers causes an imbalance in the hand and can lead to injury. Other than imbalance and injury, Karpoff does not state other specific effects of tension, but shows examples of students playing with tension as undesirable and suggests that this limits technical facility. How to address: Stretch during breaks and after practice to reduce tension. Release tension, especially release non-playing fingers and hand. Keeping the hand quiet with loose joints and fingers helps to release tension. Play slowly to bring awareness to any tension in habitual patterns of movement.

Table B.1.5 Fraser (2003, 2010)

Role	Terms	Summary
Positive	Tensile strength Tensile wires Co-contractions Muscle tonus Muscle tone Stabilizing muscular activity Muscular effort Necessary tension Appropriate tension Minimum tension Reduced tension	Definition/description: The words 'muscle tonus' or 'muscle tone' describe the positive aspect of muscular tension. Muscular tonus defined as "appropriate muscular effort needed to hold bones in place" (2010, p. 241). Defines necessary tension as " stabilizing muscular activity" (2010, p. 237) Tension can be felt by touching the flesh (2003, p. 256), and is dynamic in that it can be transformed into activity. Causes: Natural muscular property that comes from holding bones in place. Tension comes from stabilizing joints to control movement. External downward forces create tensile activity that allows fingers to bear stress, "but only along a certain path" (2010, p. 53). Effects: "Without tension there is no life" (2003, p. 38). Holds bones in place, maintains "optimal skeletal alignment" (2010, p. 237), controls movement. External downward forces create tensile activity and improve strength and potency of hand arch. Infers that tension can be transformed into finger and hand activity: "hand and finger activity replace residual wrist tension" (2010, p. 216). Appropriate degree of tension (not excessive) facilitates greater kinesthetic sensitivity: "The lower your arm's overall muscle tension, the more clearly you can feel of the details of inner movement" (2010, p. 95). How to address: Establish structural integrity of hand arch. Develop kinesthetic sensitivity to optimal skeletal alignment and place of 'unstable equilibrium' from which movement is perceived as effortless.
Negative	Immobility Extra tension Counterproductive tension Unwanted tension Undesired tension Excess tension Overly tense Any tension Too much tension Undue tension Increased tension Useless tension Superfluous tension Inner tension	Definition/description: Excessive muscular tonus. "Contraction with no movement results in tension, not kinetic energy…reserving the word 'tension' for its negative manifestations where movement is blocked" (2010, p. 237). Unbalanced muscular contractions from opposing forces resulting in excessive muscular effort. Tension often found in wrist, hand, and fingers. Causes: Tension a result of excessive muscular contraction—often habitual patterns stemming from poor skeletal alignment. "Contraction with no movement" (2010, p. 237), efforts to over-relax, leaping to play large intervals, ulnar deviation, extraneous movements that weaken skeletal structure in the elbow, wrist, hand. If fingers are not individuated from hand, tension results from extra muscular effort to support the hand. Effects: Excessive, useless, undesired, counterproductive tension can limit, impede, and inhibit movement, cause immobility, disturb the "equilibration of overall muscle tonus" (2010, p. 12). However, "complete release of tension leads to collapse" (2010, p. 215). How to address: Reduce, release, soften, and minimize excess, unwanted, useless tension by bringing full attention to skeletal alignment, awareness-through-movement (ATM) exercises based on Feldenkrais principles. Finding the structural integrity of the hand arches reduces tension in other places of the body such as the shoulder, arm, and neck. Allow the arm to be still with a "feeling of inner activity" (2010, p. 95). Use arm weight to realize skeletal alignment and reduce undue muscular tension. Cultivate heightened kinesthetic sensitivity to skeletal alignment and amount of muscular effort needed to move.

B.2 Relaxation

B.2.1 Lister-Sink (Wingsound, 1996, 2008)

Role	Terms	Summary
Positive	Contraction Release, relax, refresh muscles No tension Heavy Effortless Completely relax	Definition/description: A muscular state resulting from brain not sending signals for muscles to contract. Infers that the opposite of relaxed muscles are tense muscles, muscle effort is the opposite of muscle relaxation. As an action, it is equated with total release of muscle contraction. Frequent instructions to relax muscles between contractions: "Relax the muscles completely, a state of release to which the pianist must always return" (chap. 1: Part II). Causes: Messages from brain to muscles to contract cease. Effects: A feeling of heaviness in arms. Joints are mobile and loose. Playing feels effortless. If arms are completely relaxed they will freely fall—an important component of the fundamental basic stroke. How to address: Take frequent breaks while playing to refresh and relax muscles. Learn to control rapid contraction and relaxation of arm muscles.
Negative	Heavy Harmful relaxation	Definition/description: Muscles deactivate from state of contraction. Though mostly a positive state, cautions of pitfalls of the 'relaxation school' focusing on wrist and hand supporting arm weight. If release of contraction is too quick the point of optimal alignment is missed: joints are not stabilized and the pianist lands on a low, extended wrist putting hand/wrist/arm unit out of alignment. Causes: Efforts to relax arms with unnatural, forced movements results in opposite effect of tension. Adhering to the 'relaxation school' of piano technique by cultivating a constant sensation of heaviness in arms misleading. Effects: Injuries often stem from "inability to contract and release muscles appropriately" (chap. 1, Part II). How to address: Important to learn to contract and relax muscles, continuously releasing tension from muscles. Must discern the slit second of tone production to allow weight of falling arm to return arms to the support of the torso.

Table B.2.2 Taubman (2001)

Role	Terms	Summary
Positive		No positive aspects of relaxation
Negative	Sagging	Definition/ Description: Both active and passive muscles are relaxed: "To move freely, one muscle is active and one muscle is passive. When we relax, we relax both" (Golandsky, chap. 10). More than the opposite of tension: "Relaxation is going beyond the lack of tension point. Relaxation is an activity" (Goldandsky, chap. 10). Distinction between being relaxed with no feeling of tension and a state of extreme tension that results in body 'sagging' (chap. 10). Causes: Common instructions to tell people to relax for a freer technique. Effects: Makes movement difficult. Tremendous muscular effort needed to overcome state of relaxation. Too much relaxation at the wrist breaks unity with hand and arm and can cause pain, injury, and carpal tunnel syndrome. Too much relaxation in shoulders can result in neck pain. How to address: "Our philosophy is that we should move in a way that there is nothing to relax from" (Goldandsky, chap. 6).

Table B.3.3 Mark (2003)

Role	Terms	Summary
Negative	None	None
Positive	None	Only one reference to relaxation in the context of questioning the meaning of the 'posture myth': "we should be relaxed, balanced, poised" (p .33).

Table B.3.4 Karpoff (2009)

Role	Terms	Summary
Positive	Release Very relaxed	Definition/Description: Described as a desirable state associated with a natural hand position (the natural curve when hand is hanging at side of body), released non-playing fingers, and free forearm rotation. Gives no detailed explanation of what relaxation is other then its association with releasing fingers and hand. Describes a "very relaxed hand" (Unit 3, chap. 12) and "relaxed motion" (Unit 6, chap. 16) as desirable. Causes: Infers that 'release' results in relaxation. Effects: Desirable hand shape, musical execution of slurs, allows for free under and over shaping gestures found in 3-dimensional shaping, good forearm rotation, and less effort required for continuous cycling motions. How to address: Gives frequent instructions to release the hand and non-playing fingers.
Negative	None	None

Table B.3.5 Fraser (2003, 2010)

Role	Terms	Summary
Positive	Full looseness Loose Skeletal relaxation Supple Opposite of tight Intentionally active Alive stability Limp Soften Empowered relaxation Wild relaxation Completely relaxation Totally relaxation Sensitive relaxation Gently relax Free relaxation Passive relaxation Extraordinary relaxation	Definition/Description: Infers that relaxation is free of counter-productive muscular effort, contraction, and tonus. Opposite of tight, contracted, and tense muscles A muscular and skeletal quality— refers to relaxation of muscles and 'skeletal relaxation' (2010, p. 241). Discerning the amount of relaxation crucial. Cannot be totally relaxed. "Stay relaxed without becoming flaccid or phlegmatic, maintain precise, empowered alignments" (2010, p. 93). Alludes to a mental and physical relaxation (2003, p. 213). Causes: Reduced muscular effort. Effects: As a learning tool, relaxation heightens kinesthetic sensitivity and can lead to the "rediscovery of a more potent skeletal structure" (2010, p.15). Fine-tuning the appropriate degree of relaxation allows for a state referred to as 'full looseness.' Improves muscle function for freer, more effortless movement. "Full looseness facilitates lightening-quick finger attacks whose impulse feels more neurological than muscular" (p.94, 2010). Improved enervation of the finger muscles (2003, p. 41). Allows for greater feeling of arm weight. How to address: Must be attentive to kinesthetic sensations: "It's easier said than done, it actually takes a very high state of attention" (2010, p. 93). "If we avoid indiscriminate relaxation but maintain an alive, skeletal relaxation, it works for us not against us" (2010, p. 241). Relaxing the appropriate degree is crucial—neither too much nor too little, but "enough so your muscles work well" (2003, p. 41). Relax. Release. Soften.
Negative	Flaccid Slack Inactivity Flapping Floppy Limp Total relaxation Too much relaxation Contagious relaxation Over relaxation Total relaxation Automatic relaxation Exceptionally relaxed	Definition/Description: " Relaxed, slack, flaccid: over-relaxed. In this state, movement cannot happen because the muscles aren't ready to make it happen. The bones have often fallen out of alignment. For all intents and purposes, dead" (2010, p. 241). "Total relaxation, which equals total inactivity" (2003, p. 42). Causes: Relaxation movements and ubiquitous directives to completely relax found in many traditional teaching. Effects: Relaxation can result in tension because extra muscular effort is needed to compensate for a compromised structural integrity (particularly in the hands) from relaxing too much. Results in destabilization requiring extra muscular effort. Restricts freedom and takes alignment out of place of balance. Bones can loose their skeletal alignment thus reducing the power and control that comes with structural integrity. Limits tonal range. How to address: Must be attentive to kinesthetic sensations to discern appropriate degree of relaxation: "It's easier said than done, it actually takes a very high state of attention" (2010, p. 93). "If we avoid indiscriminate relaxation but maintain an alive, skeletal relaxation, it works for us not against us" (2010, p. 241).

B.3 Co-contraction

Table B.3.1 Lister-Sink (1996, 2008)

Role	Terms	Summary
Positive	Stabilize	Definition/description: No references at all to the term co-contraction, but refers to muscular contraction needed to stabilize joints at the moment the finger makes contact with the key. Effects: Stabilizes joints at moment of finger's contact with key. How to address: Must instantaneously and continuously release muscular contraction on impact of finger with key.
Negative	Fixating	Definition/Description: Muscular contraction to stabilize joints that lasts longer than necessary. Causes: Holding on to muscular contraction to stabilize joints longer than necessary. Effects: Tension. Playing-related-injury and pain. How to address: Release muscular tension at moment of contact with key.

Table B.3.2 Taubman (2001)

Role	Terms	Summary
Positive	Fulcrum	Does not define co-contraction specifically but does state that the joints act as fulcrums and suggests there has to be a relatively stable fulcrum for movement.
Negative	Fixation Dual muscular pull Antagonistic movement Harmful Injurious	Definition/description: Two opposing muscles activate creating antagonistic movement. Describes co-contraction as 'dual muscular pulls' to fixate joints. Mainly describes muscles in conflict: Muscles are "pulling against each other" (Goldandsky, Chap. 1) to fixate joints and curl fingers. In describing a students' fingers that are lifting and curling, Taubman states: " The extensors are pulling, the flexors are pushing….such a battle for your fingers to move" (Chap. 12). Causes: Flexors and extensors working at the same time to curl and lift fingers, to move thumb down "In fixating the arm while trying to move the fingers quickly, it could be compared to five racing horse pulling along a train without an engine" (Taubman lectures, Chap. 3). Effects: Tension. Limits motion. Movement feels labored and compromises coordination of muscles. Impedes fast and free movement. Can cause injury. Weakens power and ability to play quickly. How to address: Fingers should all move together as a unit in same direction—down, not up. Unity with hand, forearm, and fingers crucial to avoiding dual muscular pulls.

Table B.3.3 Mark (2003)

Role	Terms	Summary
Positive		No positive attributes for co-contraction.
Negative	Dual muscular pull Tense Limiting Injurious Excessive Chronic	Definition/description: Describes this by referring to Taubman's definition as 'dual muscular pull' (p. 3). In order to move at joints, one muscle group contracts while the other lengthens; but when the opposing group contracts instead of lengthening, then this is co-contraction "If the opposing muscles do not release, then the two muscle groups are working against each other. This is called co-contraction" (p.105). Causes: Gives example of lifting and curling fingers as a chief cause of co-contraction. In order to lift and curl fingers, extensors and flexors are activated at the same time. It is "the absence of release" (p.108) in the opposing muscle group that creates co-contraction. Effects: Chronic co-contraction can be one of the causes of injury and pain. Co-contraction can severely interfere and limit movement. How to address: Must release muscles. Avoid chronically curling fingers.

Table B.3.4 Karpoff (2009)

Role	Terms	Summary
Positive	Opposable muscles Antagonistic relationship	Definition/Description: Does not use the term 'co-contraction' but describes opposing muscles contracting simultaneously (Unit 1: Chap. 16). Causes: Contracting opposing muscles simultaneously for stability (Unit 1: Chap. 16). Effects: Increased stability (Unit 1, Chap. 16). How to address: Discern the appropriate degree of muscle activity. "Respect the antagonistic relationship" and "learn to use opposable muscles in alteration" (Unit 1: Chap. 16).
Negative	Antagonistic relationship	Definition/Description: Does not use the term "co-contraction" but describes opposing muscles contracting simultaneously for stability (Unit 1: Chap. 16). Causes: Contracting opposing muscles simultaneously for stability (Unit 1: Chap. 16), too much lateral movement from thumb (Unit 1: Chap. 17). Effects: Impedes flexibility and speed and inhibits free movement. How to address: Same as addressing positive co-contraction. Must learn to use an appropriate degree of muscular activity. He states that we must "respect the antagonistic relationship" and "learn to use opposable muscles in alternation" (Unit 1: Chap. 16).

Table B.3.5 Fraser (2003, 2010)

Role	Terms	Summary
Positive	Healthy Always present Effortless Easy Crucial Purposeful Functional	Definition/Description: A necessary and healthy dual muscular pull allows joints to move fluidly from a point of "unstable equilibrium" (2010, p. 226). A necessity "in virtually any movement" (2010, p. 238). Defines 'unstable equilibrium' as "a certain amount of tonus in a joint maintains its fluid stability (unstable equilibrium) without hindering movement" (2010, p. 228). Causes: Antagonism: Muscle contraction of antagonists against agonists to control movement. An optimal balance between the opposing forces. Effects: "Healthy dual muscular pull also plays its crucial role in fine tuning the degree of stability offered by any given joint" (2010, p. 228). Controls movement, provides 'fluid stability' for free and effortless movement: "two opposing muscle groups working purposefully against each other, to achieve musical ends" (p. 38, 2003), How to address: Heightened kinesthetic sensitivity to skeletal alignment and balance of opposing muscular forces. Even though the muscles provide stability to the joints, it is not perceived thus—if stability is felt, this is a signal that muscles are overworking. Muscular contraction provides fluid stability, however we don't feel that contraction if movement is effortless. Makes an important distinction— feeling these contractions serve a purpose when learning a new skill.
Negative	Tension Fixation Stability Effortful contraction Over-try Anti-movement Cross-motivation Unhealthy Detrimental Unbalanced	Definition/Description: Unhealthy: "A co-contraction that results from a cross-motivation where the degree of antagonism rises too high. Dual muscular pull becomes dysfunctional only when it works against movement instead of fine-tuning it" (2010, p. 238). "Overly high muscle tonus—muscular effort that blocks movement" (p. 237). Describes 'cross-motivation' as some muscles working to pull up while others simultaneously pull down, working against skeletal structure (2010, p. 288). Causes: Too much muscular effort that blocks movement in efforts to fix and stabilize joints. Misalignment of skeletal structure, weak links in the skeletal structure. Effects: Blocks and impedes movement. Overly high muscle tonus (tension). How to address: Stabilize without impeding movement. Even though joints behave as fulcrums they can still move in space. Move with optimal skeletal alignment by developing kinesthetic sensitivity. Even though the muscles provide stability to the joints, it is not perceived thus—if stability is felt, this is a signal that muscles are overworking.

B.4 Arm Weight

Table B.4.1 Lister-Sink (Wingsound, 1996, 2008)

Role	Terms	Summary
Positive	Gravity Weight-bearing Free fall Weight shift Weight support Transfer weight Regulated Falling weight Completely relaxed Continuity of graduated arm weight Ever-changing Sophisticated Well-coordinated	Definition/description: Considered one of the most significant aspects of her method, the weight is continuously transferred from the torso to the arm levers and back again to the torso. Free falling weight of the arms activates the keys. Optimal alignment of the bony arches of the arm and hand support the weight and absorb "the dynamic shock of weight bearing" (Chap. 1). The arm serves as a bridge to transfer weight into keys. Muscles contract to support the weight of the arm but this contraction lasts only "a fraction of a second" (chap. 1). Modulating arm weight crucial for dynamic shading: adding weight for louder dynamics, less for softer dynamics. Causes: Free fall, alignment or arm and hand structure, relaxation, an awareness and control over muscle contraction and release. Effects: Freedom in joints. Full compass of tonal and dynamic range. Mastery of the basic stroke. How to address: Master all components of the basic stroke: "easy efficient lift of the forearm; free fall of the forearm; optimal skeletal alignment; and instantaneous muscle contraction and release at moment of impact of finger with key" (chap. 1).
Negative	Pressing Kneading into the key Heavy	Definition/description: Arm weight is sometimes confused with constantly heavy arm and continuous pressing into key after the point of sound. Causes: Confusion of how to apply arm weight, 'relaxation school' approaches. Effects: Does not specify, but implies this impedes movement. Avoid pressing into key. Release muscle contraction at the instant muscle contracts to produce sound. Do not release muscles too soon or too late.

Table B.4.2 Taubman (Bloomfield et al., 2001)

Role	Terms	Summary
Positive	Resting down Weight of the arm Drop Fall Limp Free arm weight	Definition/description: Weight from the arm and hand is what overcomes the resistance of the key. A quantitative aspect, different amounts of weight can be directed from the arm to the finger: "free a little bit of arm weight behind the finger you want to bring out." (Golandsky, chap. 10). Important to discern the right amount of weight to feel resting down—a state from which movement is initiated: "When we talk about weight, we talk about the correct amount of weight that will allow us to feel like we are resting down without holding up" (Golandsky, chap. 4). Causes: Resting down allowing the weight of the keys to support finger, hands, and arms—but do not 'hold up.' Drop hand into the keys, "allowing the arm to fall freely behind it" (Golandsky, chap. 10). Effects: Tonal control and variety. No effort for fingers as the forearm is assisting in producing tone. How to address: The relationship between the arm and finger is paramount in learning to direct arm weight: "Once the arm is connected to the finger….you can tell it whatever it is you want" (Golandsky, chap. 10).
Negative		Definition/Description: Altering the position of shoulders, upper arm, forearm, hand, and wrist can impact where the arm weight is directed. Causes: Breaking wrist (allowing it to drop below the MCP joint), low level of elbow, dropping shoulders, hanging on to keys while attempting to create legato effect between large intervals). Effects: If wrist breaks (drops below the MCP joints) weight falls into the wrist, not into the fingers. Dropping shoulders causes upper arm to relax, arm weight goes to the fingers, fingers cannot move. If elbow is too low, the weight falls into the elbow and fingers feel like they are falling off the keys. Fingers compensate by clenching to keys and thus cause tension. How to address: Find the optimal alignment between upper arm, forearm, hand, and fingers so that there is unity in the playing apparatus.

Table B.4.3 Mark (2003)

Role	Terms	Summary
Negative	Dropping weight Excessive force Dangerous	Definition/description: Scarce reference to this concept with no use of the term 'arm weight,' but links "dropping weight" with "excessive force" (p.130). States that it is not weight but velocity that is the sole determinant in tone production. Mark explains, "our arms play no weight-bearing role in locomotion and are free to function primarily as manipulating structures" (p.65). Causes: Traditional practices. Effects: "Dropping weight" is a dangerous practice, produces harsh tone and can lead to injury. How to address: Arms should not bear weight but should be "free to function primarily as manipulating structures" (p.65). Bring awareness to the tactile quality of fingers on keys and listen to the sound.
Positive	None	

Table B.4.4 Karpoff (2003)

Role	Terms	Summary
Positive	Gravity Free fall Let go Loose Float Integrative motion Lift and drop Kinetic energy	Definition/description: A foundational principle of his method, arm weight is experienced by letting the arm fall freely into the keys with the help of gravity. Gives special attention to letting go and feeling loose by taking the student's arm and tossing it on to the keyboard. Infers that weight can be removed and added to the arms, instructing students to "take the arm weight out" (Unit 1, chap. 5) for softer dynamic levels and "give arm weight" (Unit 2, chap. 4) while dropping arm into his hand. Most of the focus is on feeling of free fall, however, he demonstrates two note slurs that "uses gravity to allow the arm to float" (Unit 1, chap. 7). Arm weight associated with a feeling of connection to the proximal muscles (does not specify which proximal muscles). Causes: Lifting and dropping at the forearm, allowing arm to fall freely with the help of gravity. Forearm should be parallel to the ground with a loose and supple wrist. To cultivate the sensation of freely falling one must "give up control to gain control" (Unit 1, chap. 17). Once the finger goes through the point of sound there is a slight rebound which "cushions the attack" (Unit 1, chap. 9). Instructs student to "go through the sweet spot and decelerate…and then leave only enough weight on the key to leave it down" (Unit 1, chap. 7). Effects: Arm weight can affect dynamics. Instructions to student to play softly: "Take the arm weight out by leaning backward" (Unit 1, chap. 5). Allows for legato playing and provides momentum for one gesture to shape groups of notes.
Negative	Sudden drop	Definition/description: Arm dropping suddenly into the first key. Causes: Dropping suddenly into the keys expends all of the kinetic energy, leaving no energy left to provide momentum for cycling and shaping motions. How to address: Drop gradually into the keys to allow for a gradual transfer of arm weight.

Table B.4.5 Fraser (2003, 2010)

Role	Terms	Summary
Positive	Falling arm Let go Arm's mass Intelligent mass Active mass Flowing weightlessness Bone whips	Definition/description: Arm weight is secondary to muscular effort and structural integrity: "Muscular effort + structural integrity›the sense of arm weight + pressing" (2010, p. 170). Points to the subjective experience of arm weight can belie what is really happening, (one may feel like there is no muscle activation but there is). Arm weight does not move the keys, the fingers do. Timing of coordination with finger is crucial: "In the instant your arm is in 'free fall,' your finger has the opportunity to manipulate the key with such precision and tiny effort, it really seems your arm did it all, not your finger" (p.208). Causes: Letting go. Relax the shoulder "so completely it feels like even your torso's weight is resting on your finger. Effects: Arm weight helps to feel alignment of skeleton, gets rid of excess muscular contractions by relaxing the musculature: "The falling arm shows you the exact skeletality available when you free yourself from unnecessary contractions. It stimulates your hand-skeleton into a richer sense of itself" (2010, p. 118.). "Done well, arm weight allows these levers to function at their best" (2010, p. 16). In addition, arm weight results in richer tone, heightened sense of connection to the keys, increased facility and ease in fingerwork. Moreover, "One's playing becomes more human" (2010, p. 213). How to address: Ensure that skeletal structure is in place before introducing arm weight. Muscles have to be involved although the perception may be the opposite. "To achieve finer control over your tone, you still may think you are letting the arm fall, but in reality your muscles are controlling that fall every step of the way" (2010, p. 218). Nonetheless, he provides directives to 'let go' to feel arm weight.
Negative	Arm thunk	Definition/description: Describes poorly understood arm weight as an 'arm thunk.' Causes: Can cause hands' structure to collapse, loss of control from too much mass. Effects: Loss of momentum, replaces finger activity thus compromising facility and control. Impedes movement. How to address: Muscular effort and structural integrity must take precedence over arm weight.

B.5 Hand and Finger Shape

Table B.5.1.1 Hand Shape: Lister-Sink (Wingsound, 1996, 2008)

Role	Terms	Summary
Positive	Curves Arm arch Apex Bridge Natural curve	Definition/description: Natural curve of arm and hand occurs when arm hangs at side. Looks and serves as a bridge from elbow to fingertips with the underside of wrist acting as apex. Hand hangs from the wrist joint: "Relax the wrist muscles so that the hand is hanging from the wrist joint" (chap. 1). Causes: Natural state. Lifting the wrist allows the natural arch of hand to form. Forearm, wrist, hand, and fingers are aligned. A minimal amount of tension will support arch, but will not be felt. Effects: Serves as a bridge to effectively transfer arm weight to fingers and back to torso. How to address: Can encourage this sort of shape by placing hand over a small ball or piece of fruit.
Negative	Hand muscles	Definition/description: Hand muscles tighten to form an arch. Causes: "Wobbly fingers" (chap. 2). Effects: Hand muscles tighten. How to address: Do not try to impose an arch structure, but use naturally occurring structure.

Table B.5.1.2 Finger Shape: Lister-Sink (Wingsound, 1996, 2008)

Role	Terms	Summary
Positive	Supple Released Ride the keys Apex	Definition/description: Non-playing fingers release and rest on keys without tension. Fingers hang from the apex (not entirely clear as the underside of the wrist is referred to as the apex earlier, but the appearance is that fingers are hanging from the MCP joint). Causes: Fingers can rest on surface of keys if arm weight is correctly directed to fingers and released back to arm. Effects: Organization of arm, hand, and fingers results in good coordination. Saves muscular energy. How to address: Allow fingers to release and rest on keys. Ride the key to avoid overworking 'finger-lifting' muscles (chap. 2: Part III).
Negative	High flat fingers High curved fingers	Definition/description: Fingers are held high in a flat shape or in a high curved shape. Causes: Fingers are not released. Effects: Flat fingers are divorced from the arm resulting in poor coordination. High, curved fingers usually accompanied by a low wrist compromising arm arch. This in turn leads to tension in hand muscles, "paralysis in the joints" (chap. 2: Part III), and injury. How to address: Do not hold non-playing fingers off the keys. Ride the keys.

Table B.5.2.1 Hand Shape: Taubman (Bloomfield et al., 2001)

Role	Terms	Summary
Positive	Unity Resting down Unified	Definition/description: Natural curve of hand shape as it hangs at side of body. Hand is considered in context of arm, hand, and fingers. Unified arm, hand, and finger position and movement is central to the whole approach. In a lesson with a young student, Taubman describes the hand and arm to a road that must be straight—if it is not straight the car will fall off. The hand position depends on seated position with elbow in line with the top of the surface of keys. Always start movement with the hand in a straight position over the keys. Causes: Unified arm, hand, fingers. Elbow acts as a fulcrum for hand in motion. Effects: Movement with least amount of effort. How to address: Unify arm, hand, fingers and cultivate feeling of balance in a 'resting down'—not hovering, not relaxing—but feeling weight of keys holding fingers, hand, and arm up.
Negative		Definition/description: Knuckles in extreme range of motion, positioned high to create a bridge. Causes: Commonly taught. Effects: Creates a pull with the muscles on the top of the hand and forearm. Cannot support the finger. A cause of pain. How to address: Move hand and fingers in same direction.

Table B.5.2.2 Finger Shape: Taubman (Bloomfield et al., 2001)

Role	Terms	Summary
Positive	Curving Phalange Nail joint Natural curve Unified	Definition/description: Fingers supported by hand and forearm in 'resting down' position. Curving fingers with perfectly flat nail joint: "Hold the joints [pointing to DIP and PIP joints] perfectly straight" (Taubman, chap. 6). Fingers unified with forearm; do not move fingers by themselves but with the help of the forearm. Causes: Short flexors move curved fingers. Effects: Because short flexor muscles do not cross over the wrist movement is free. How to address: "Move in one piece from the knuckle—it is the freest way to do it" (Golandsky, chap. 6).
Negative	Curled Long flexors Clench Grab Hand on	Definition/description: Curled fingers, clenching fingers grabbing to hold on to keys, thrusting fingers out. Moving thumb down and snapping fingers up. Causes: Long flexors tighten over the wrist to curl fingers. If arm weight is misdirected to the elbow, fingers will feel like they are falling off the keyboard and respond by clenching. Thrusting fingers uses flexors and extensors at same time. Low wrist position will break unity of hand and forearm. Any break in the playing apparatus compromises unity. Effects: Using flexors and extensors to curl or thrust fingers at same time causes tension. Any break in the playing apparatus triggers the body to compensate and unity is compromised. How to address: Find a position where whole playing apparatus is unified.

Table B.5.3.1 Hand Shape: Mark (2003)

Role	Terms	Summary
Negative	Ulnar deviation Thumb orientation	Description/definition: A sideways hand position deviating towards the ulna—a result of thumb orientation—creates tension. Causes: Orienting hand towards thumb, stabilizing thumb when rotating creates conditions for ulnar deviation. Effects: Restricts movement, a cause of carpal tunnel syndrome. How to address: Know the mechanics of supination and pronation in forearm rotation so that the forearm and hand moves around the ulnar as axis. Free the shoulder joints to counter effects of ulnar orientation.
Positive	Opening from the CMC joints Little finger orientation Bony structure Forearm arch Strong Stable Not rigid Efficient Not fixed	Description/definition: Provides scarce details on specific hand position or shape, but it is the quality of movement that determines the hand shape. Opening the hand at the carpometacarpal (CMC) joint allows the hand to attain a wide span with ease. A stable, strong and efficient arch structure is created the fingers and elbows acting as end points of the bridge, and the MCP joints acting as the keystone. The hand structure is not considered in isolation, rather the integration of forearm, humerus, collarbone, and shoulder blade must be considered when forming the arch structure. Causes: Arch structure is created with all parts of the arm and hand—from shoulder joint to fingertips. Movement is well organized, using the ulnar as axis in rotation. Effects: The structure is not rigid, not fixed, but stable and strong. How to address: Incorporate a holistic approach in considering the hand shape— including forearm, humerus, collarbone, and shoulder blade.

Table B.5.3.2 Finger Shape: Mark (2003)

Role	Terms	Summary
Negative	Curling DIP joints PIP joint Habitually curled Chronic curling	Description/definition: Curving of the two end joints of the fingers create a curled finger. Causes: Habitual, often taught in method books. Effects: Injurious. Causes shortening and tightening at the wrist. Movements are not fast or easy. How to address: Finger joints must release properly. Avoid a chronically curled position. Mark does allow that curling can be effective at times, as long as it is not chronic and fingers release.
Positive	Curve Finger pad MCP joints Natural Neutral	Description/definition: Clearly defines the natural curve of the fingers as "the position in which the muscles are not working either to straighten the fingers or to curl them" (p. 107). Movement takes place at the MCP joint. Best place of contact with the key is on the finger pad, thus allowing for more sensory feedback. Causes: Muscles are not working to straighten or curl. Effects: Playing is fast and easy at the MCP joint. How to address: Allow fingers to assume their natural curve.

Table B.5.4.1 Hand Shape: Karpoff (2009)

Role	Terms	Summary
Positive	Quiet, released hand Small hand Bridge support Natural curvature Relaxed hand Aligned	Definition/description: The natural curvature of the hand (when hanging at rest beside the body) provides best playing structure. There is a rotation to bring hand into playing position. Imperative to align fingers behind forearm for tendons to line up. Describes the hand as relaxed and quiet with particular focus on a quiet hand with non-playing fingers resting on the surface of the keys: "Whenever possible, maintain a quiet hand in all movements at the piano" (Unit 1, chap. 17). Keeping the arch is desirable for free movement of fingers at MCP joint. Instructs students to "draw relaxed hand up to the keyboard….and honour the structure of the hand" (Unit 1: chap. 17). Causes: Natural position and curvature as found when resting hand by side of body. Effects: Allows for free, uninhibited movement of fingers and assists in playing with speed. How to address: Always allow hand to release and return to a quiet position after playing.
Negative	Fixing hand Swiveling Conflict within the hand Cup shaped	Definition/description: Commonly taught hand positions of aligning fingertips into a straight line, maintaining a "cup-shaped" rounded position as in holding an apple. Other poor positions include fixing the hand and swiveling to play arpeggios. There can be "conflict within the hand" (Unit 7, chap. 3) if one or more non-playing fingers are activated. Causes: Common and traditional positions taught to young students causes simultaneous contraction of opposable muscles to hold unnatural positions. Activating one or more non-playing fingers, rather than allowing them to rest quietly on the surface of the keys. Common practice of preparing thumb under hand to play scales. Effects: Limits free movement. Swiveling movements take the hands out of alignment. Infers that this makes movement impaired, not free or easy. How to address: Release fingers. If hand is small, consider playing on a 7/8" size keyboard. Use a throwing motion to take thumb under hand in arpeggios and scales. "Respect the natural structure of the hand" (Unit 7, chap. 2).

Table B.5.4.2 Finger shape (Karpoff, 2009)

Role	Terms	Summary
Positive	Released fingers Quiet hand Curved Supported First digit Strengthen Stabilize Curvature Bridge Fingertips Inactive (Non-playing fingers) Activate Gently Natural	Definition/description: Fingers should be gently curved from the bridge to fingertips, playing on "the fleshy part of the first digit" (Unit 1: chap. 7). Release fingers, moving from the MCP joint with a quiet hand. Awareness of shared tendons between fingers 3 and 4 important in acknowledging sympathetic contraction and release (Unit 5: chap. 8). Non-playing fingers should release and rest quietly on the surface of the keys. To accommodate different levels of black and white keys, fingers "activate in all three planes" (Unit 7: chap. 10). Causes: Moving fingers from the MCP joint and a quiet hand with a gently, curved and supported finger. Important to "release fingers instantaneously" (Unit 5: chap. 8), and to rest quietly on surface of keys, Effects: Stable fingers "enhance nice rhythmic response" (Unit 1, chap. 17), facilitate movement with "minimal effort" (Unit 7: chap. 8). How to address: Cultivate strength and stability in the DIP joints by passively hanging from a pencil by the DIP joints. Allow fingers to release on their own, "naturally" (Unit 5, Chap. 8) with non-playing fingers resting on surface of the keys. Maintain a quiet hand.
Negative	Over-flexible Hyper-extended Activated high fingers Curled First phalanx Not released	Definition/description: Pulling fingers back out of their natural position engages opposable muscles. Continuously lifting fingers high, curling fingers, and "claw-like" fingers (Unit 3, chap. 5) result in simultaneous contraction of flexors and extensors. At the other end of spectrum, finger joints may be too flexible. Causes: Lifting fingers, not releasing fingers, trying to align fingers into a straight line. Overly flexible joints may be due to a lack of strength and support in joints. Effects: Shortens forearm tendons. Limits movement, fixes the wrist, produces thin tone and a digital sound (Unit 2: chap. 15). How to address: If fingers are lifted and curled, allow non-playing fingers to release, be inactive and rest on surface of the key. Over-flexible joints can be strengthened for stability with exercises that involve passively hanging off a pencil from DIP joints.

Table B.5.5.1 Hand Shape: Fraser (2003, 2010)

Role	Terms	Summary
Positive	Oil rig platform Metacarpals Russian arch Secure instability Moveable stability Bones swimming in liquid hands Harpsichordist hand Flexible solidity Stable platform Secure base Functional entity Forefinger-thumb assembly Unstable equilibrium Firm Flexible Fully potent Functional Active Strong Buoyant Empowered Stiff Stable Secure Neutral Natural Balanced	Definition/description: Skeletal structure of hand is the centerpiece of Fraser's approaches. Contrasting concepts of extreme strength and suppleness: "flexible fixation" (2003, p. 39),"flexible solidity" (2003, p. 43) derived from skeletal alignment with minimal muscle tonus. The 2nd MCP joint serves as keystone to transverse arch structure of the hand with thumb and 5th finger as two sides of the arch. Forefinger and 2nd MCP form additional 'Russian' arch. Metacarpals serve as a platform for each finger. Platform provides stability—likened to oilrig platform and hummingbird. The hand "is stable relative to the vigorously moving finger" (2010, p. 87). Distance of the hand from keys is important—it floats neither too far nor too close to keys so that fingers can drop into keys unimpeded. Causes: External downward forces create tensile activity that allows fingers to bear stress, "but only along a certain path" (2010, p. 53). Maintaining hand arches, 2nd MCP is apex of entire structure. Differentiating metacarpals and phalanges. Cultivate a feeling of bones playing with "no parasitic contraction" (2010, p.117). Effects: Skeletally secure hand serves a broad range of capable functions: from floating to standing, from firmness to flexibility, from buoyancy to stability. Imparts a sense of power. 'Unstable equilibrium' permeates all of these functions and qualities, describes this as "secure instability" (2010, p. 84). Imparts a feeling of looseness and fluidity in finger, forearm, and shoulder blade. How to address: ATM exercises to cultivate differentiation between phalanges and metacarpals. External downward forces create tensile activity in phalanges, activate the arches in the hand. Use natural curve of hand as hanging by side, but then draw up the forearm to create more space under the 5th finger. Make a mental image of the "bones swimming in liquid hands" (2010, p. 132). Suggests that mental imagery is just as effective as physically imposing the structure.

Negative	Phlegmatic Collapsed	Definition/description: The MCP joint is often the weak link of the skeletal structure. Hand is too flat. Causes: Hyper-extended MCP joint, flat hand that is often a result of the 'natural' curve of hand commonly taught. Making the wrist rather than the MCP joint the keystone will take the hand out of alignment. Effects: Unnecessary tension to compensate for weak links in the structure. Counter-productive tension and fixation in other parts of the body. How to address: Cultivate skeletal structure discussed in positive attributes.

Table B.5.5.2 Finger Shape: Fraser (2003, 2010)

Role	Terms	Summary
Positive	Tensile strength of a geodesic eggshell Loose Lumbricals Finger-lever Finger hook Dangling Standing legs Relatively flat finger-lever Active Banded Stabilizing fulcrum Firm implantedness Ying/Yang, Active Passive, Softer Sensitive, Flexible Strong, Healthy Useful, Secure Curled, Curved Soft, Free Loose, Firm, Bipartite	Definition/description: Common to all shapes and movement is skeletal alignment and the relationship of the MCP joints to the phalanges. Metacarpals serve as a platform from which the fingers move. Metacarpals move in opposite and equal direction from the phalanges. The concepts of differentiating and 'cocking' metacarpals central to providing facility, freedom, and power in fingers. A variety of finger shapes (flattened, curled, curved, hooked) and a variety of movements (cat scratch, hooking) opens up diverse musical results. Describes a 'tensile strength' in the fingers: "intention to 'curve' generates the finger's movement as it manipulates the key, but your finger doesn't actually curl" (2010, p. 82). Even though there is a sense of strength in the structure, this is accompanied by a sense of 'looseness'. Contrasting concepts of stiffness and aliveness, firmness and flexibility. *The Craft of Piano Playing* focuses primarily on strength and power, likening fingers to pylons and pillars. *Honing the Pianistic Self-Image* sheds more light of looseness quality: The looseness we seek in not generic but possesses a sophisticated, highly intentional organization" (2010, p. 93). Best to move fingers with the lumbricals. Fingers are active. Causes: Differentiating phalanges and metacarpals, using the power of the lumbricals to move the fingers. Finger manipulates the key, (not arm weight). Effects: Power, facility, freedom, three-dimensional movement, a wide palette of sounds and musical effects. Freedom and functionality in whole arm. How to address: Use ATM exercises to cultivate skeletally secure hand arches, differentiate metacarpals and phalanges.

Negative	Curl	Definition/description: Curled fingers not an effective way to achieve forte sound, although curling may be suitable for other musical effects and an important function in 'grasping'. Collapsed fingers. Inactive fingers. Causes: Curled: Curling fingers at medial and distal phalanges. A commonly taught position. Collapsed: flattened MCP joint stemming from commonly taught 'natural' position. Inactive fingers caused by trying to phrase at the wrist. Effects: Curled fingers bypass the work of the lumbricals and uses long and short flexors instead. Sound is not as full. Collapsed and inactive fingers results in loss of control, facility. How to address: Use a more flattened fingers playing to play with a "relatively flat finger-lever" (2010, p.163). Maintain the forefinger-thumb assembly to avoid collapsing. Activate fingers from MCP joint with lumbricals.

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