HEALTHY PIANO TECHNIQUE AND THE PREVENTION OF PROFESSIONAL INJURIES: AN EXPLORATION OF THE SCHMIDT-SHKLOVSKAYA-MINSKER METHOD AND ITS IMPLEMENTATION IN PIANO PEDAGOGY

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ABSTRACT

Modern scientific experiments explore the positive effects of music on many aspects of human life such as cognitive development, learning skills, and geriatric wellness to name only a few. Scientists have emphasized the connections between active music making, specifically learning to play a musical instrument, and personal development, such as improvements in children's academic achievements. In contrast to the benefits, one negative effect of playing a musical instrument -- professional injuries -- has been understudied. In the early 19th century, the mechanical development of the piano posed new technical and physical challenges for players. While pianists and pedagogues have been concerned with these challenges since then, researchers started gathering information on the subject of pianists' professional injuries only a few decades ago. Moreover, most studies involve professional musicians, whereas the need to address a healthy body-instrument relationship exists at all levels of learning and teaching. As one of the most popular musical instruments in Western culture, piano remains a pathway into the world of classical music for many people -- professionals and non-professionals alike. A pedagogical focus on efficient and comfortable piano technique is therefore imperative both musically and physically, and would go a long way to promoting life-long enjoyment of music making and the many benefits associated with it.

In this work, I explore a teaching approach developed by Soviet pianist and pedagogue Anna Schmidt-Shklovskaya that has been further promoted and extended by her student Galina Minsker. Schmidt-Shklovskaya based her system on the views and practical work of Ivan Kryzhanovsky, a musician and medical doctor who, in the beginning of the 20th century, worked with pianists' professional injuries. Minsker, who is a highly respected pianist and

pedagogue in the field of playing-related injuries, has brought a new perspective to the Schmidt-Shklovskaya method. In particular, she has explored the theory of multi-levelled motor control, as authored by Russian scientist Nicolai Bernstein, and applied it to her practical work with piano students.

I met Galina Minsker when I was 13 years old. My parents were looking for a professional who could help me with a wrist problem I was experiencing. Although the problem was a result of activities other than playing piano, it was the right moment for me to be introduced to her physiologically informed technique as my musical and technical skills were not developing correctly. I was lucky to spend an initial period of one year learning with Minsker, during which my whole understanding of music, the piano, and my own playing changed significantly. A few years later, I became a student of Professor Minsker at the University of Culture and Arts in Saint Petersburg. During my formative years, other teachers also influenced my musical and technical development, as well as the formation of my pedagogical views. Nevertheless, after spending more than 25 years in piano pedagogy, my search for the best ways of playing and teaching constantly brings me back to the principles of Schmidt-Shklovskaya and Minsker. The development and practical application of these principles have guided my current research of what I call "The Schmidt-Shklovskaya-Minsker Method," as well as my interest in professional injuries of pianists.

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Chapter 1

A Review of Some Past and Current Studies of Piano Technique and Prevention of Professional Injuries

In this chapter, I look at piano technique from a historical perspective. I describe some of the approaches to piano playing and teaching beginning from the dawn of the piano in the early 18th century to the present. By observing old and new pedagogical methods I demonstrate the cause and effect of their practical applications. Further, I analyze these approaches from the point of view of modern knowledge in piano pedagogy, including some scientific data from the fields of physiology and biomechanics. I look at the dynamics and changes toward a healthier and more balanced piano technique. Finally, I observe how some older methods such as the "finger school" or the "school of natural weight" have influenced piano pedagogy over time and whether these methods resonate with modern theoretical thought and research.

Due to the vast range of ideas and literature on the subject, I chose to focus on sources that are significant to the central theme of my research, namely the Schmidt-Shklovskaya-Minsker approach. Whenever possible, I studied primary sources, such as C. P. E. Bach's *Essay on the True Art of Playing Keyboard Instruments*, Breithaupt's *School of Weight-Touch*, and Ortmann's *The Physiological Mechanics of Piano Technique*, among others. In addition, I examined secondary literature, such as Gerig's *Famous Pianists and Their Technique* and Kochevitsky's *The Art of Piano Playing: a scientific approach* and found them very informative, especially when these authors retrieve the material from older sources that otherwise may be difficult to access.

Early History

The piano is the "youngest" acoustic keyboard instrument[1]. When Bartolomeo Christophori introduced his new invention, the pianoforte, in 1709, older keyboard instruments -- the harpsichord and clavichord -- had already existed for a few centuries. Since their techniques were well developed, refined, and widely accepted, it is no wonder that composers applied the old ways of playing to the new keyboard instrument. Kochevitsky believes that for this reason, "performers, and especially teachers, became guilty of certain fallacies in their outlook on the fundamental relationship of performer and instrument" (Kochevitsky 1967, 2). A study of performance styles and teaching methods of the composers of the 18th and early 19th centuries will help clarify which mistakes in the "performer-instrument" relationship occurred during the transition and why they continued into the piano pedagogy of later times.

J. S. Bach, C. P. E. Bach, F. Couperin

Forkel[2] writes that J. S. Bach played with curved fingers, keeping them close to the keys, and gliding the fingertip off the key and into the palm when transitioning to the next key (Gerig 2007, 20). He explains the advantages of such a technique, the most important of which were "the highest degree of clearness in the expression of the single tones" and a

[1] The oldest keyboard instrument, the organ, was known since the 3rd century B.C.; it reached the height of its mechanical development by the early 18th century. The clavichord and harpsichord were in use since the 14th century. Their builders had continuously searched to improve mechanics and sound of these instruments, hence the emergence of a new keyboard instrument, the hammerclavier, in the beginning of the 18th century. "Hammerclavier" was one of the early names of the piano. The hammers caused a heavier action in the piano compared to the tangents used in the clavichord and the plucks in the harpsichord. (Grove Music online; also, Schweitzer 1966, 200-201).

[2] Johann Nicholaus Forkel (1749-1818) was the earliest known researcher of J.S. Bach. He knew Bach's sons personally and gathered information from them.

prolonged tone allowing for a singing style (Gerig 2007, 21). Further, Forkel notes that many advantages of Bach's hand position were well applicable not only to the clavichord, so favoured by Bach, but also to the pianoforte and organ (ibid). In this connection, it is important to distinguish that earlier pianofortes had much lighter mechanics and action than those that were developed and improved later. Therefore, Forkel's viewpoint about the application of Bach's technique to the pianoforte had to be adapted to his time. In particular, curved fingers were capable of sufficient power for the tone production on the clavichord and harpsichord, as well as for certain styles on the piano, but would be of little help for the chordal texture or sonorous cantabile tone of Romantic and post-Romantic music.

Likewise, another feature of Bach's performing style -- the limited participation of any body parts except fingers -- is equivocal in light of today's understanding of a healthy and effective performer-instrument relationship. While some teachers nowadays still insist on developing the fingers as a separate unit from the rest of the body, the later development of pianistic thought proves that this approach is an attribute of the past. On the other hand, the limitation of extraneous movements at the piano could be seen as one of the ways to build a more efficient technique if interpreted as avoiding "all waste of strength by useless exertion" (Forkel cited in Gerig, 21).

Continuing with other aspects of Bach's performing and teaching heritage, the following comparison made by Forkel is significant: "a person may...possess all these [technical] advantages, and yet be a very indifferent performer on the clavier, in the same manner as a man may have a very clear and fine pronunciation, and yet be a bad declaimer or orator" (ibid). In other words, the technique (how) is not a substitution for the content of the

music (what). In spite of the fact that Bach was extremely persistent in teaching students "his peculiar mode of touching the instrument," his work on technique did not obscure the ultimate goal of training -- the expression of the musical content of a composition (Gerig 2007, 23).

Johann Sebastian's son and one of his most remarkable students, Carl Philipp Emanuel Bach (1714-1788), echoes his great father in the treatise *Essay on the True Art of Playing Keyboard Instruments*:

> Keyboardists whose chief asset is mere technique are clearly at a disadvantage... Most technicians do nothing than play the notes. And how the continuity and flow of the melody suffer, even when the harmony remains unmolested! It is to advantage of the keyboard that dexterity can be developed beyond the limits of other instruments. But finger velocity must never be misused (Bach 1949, 147).

Like his father and other contemporaries, the cornerstone of C.P.E. Bach's performing and teaching philosophy was an understanding of technique as the means to serve a higher purpose, "[an] ability through singing or playing to make the ear conscious of the true content and affect of a composition" (Bach 1949, 148). On the contrary, we will see how later in the 19th century, piano teachers would turn their attention to the pure mechanics of playing, making mechanical perfection their leading principle.

Famous French harpsichordists also left some evidence of how they played and taught. For instance, François Couperin (1668-1733) paid close attention to the position of the body at the harpsichord, including the height of the chair, and even mentioned the step stool for children's feet (a detail which many teachers nowadays tend to neglect). Interestingly, even though Couperin warns against fatigue of the fingers and hands, he and his contemporaries did not refer to pain or injuries resulting from the wrong technique or overuse. We can only assume that even if there were such cases, they were rare and therefore did not deserve

mentioning in the written works of the time. This could be due to the much lighter mechanics/action of the harpsichord and clavichord, as well as the early pianoforte, compared to the modern piano.

One of the scarce examples of reference to bad habits can be found in Couperin's advice for students who were late beginners or "were taught badly" (Couperin 1983, 3-4). He recommended the students to pull their fingers or "get somebody else to pull their fingers in all directions" to make them more flexible prior to playing (ibid). Even though, as Savage rightly notes, this advice is questionable and "would benefit from more clarity and greater specificity," Couperin was aware of and put a great emphasis on the freedom of movement of the fingers (Savage in Berenson 2002, 15). This idea that "dexterity in execution depends much more on suppleness and great freedom of the fingers than on force" does not lose its viability nowadays (Couperin 1983, 12). However, some of Couperin's other advice -- such as to use a small flexible stick to lock the wrist into the right position -- seems to be even more questionable than pulling of the fingers. Couperin's stick might as well be the earliest mentioning of an auxiliary object or device to assist with hand position, a predecessor of "pedagogical" inventions of the 19th century, such as the *Chiroplast*[3], or a cup of hot coffee on the wrist to keep it immovable, or a ruler under a wristband to hold the wrist at a level height (the last one is still in use by some teachers today). Even though, as Couperin noted, his stick "must not absolutely hinder the freedom of the player", it does, as any of the above mentioned devices, "hinder" the ability of the mind to connect a musical idea to physical

[3] *Chiroplast* consisted of a wooden board and aided in keeping the wrists in levelled position to the keyboard. It was invented by German pianist J. B. Logier (1777-1846).

sensations. Instead, these devices provide a mechanical surrogate for making this connection, a fixed position rather than allowing the body to adjust flexibly.

Wolfgang Amadeus Mozart, Johann Nepomuk Hummel

In his time, Mozart was highly regarded as a virtuoso of the pianoforte, in part for his manner of even and *leggiero non-legato* touch in fast passages. Paul and Eva Badura-Skoda wrote, "For whatever instrument, he [Mozart] almost always wanted ... virtuoso passage-work played 'non-legato'" (Gerig 2007, 52). Gerig believes that by this manner of playing, Mozart defined an ideal style of Viennese keyboard technique, including "a physical approach that ruled out all affectations and unnecessary movement -- still largely the finger and hand technique of the harpsichord" (ibid).

Mozart's most prominent student, Johann Nepomuk Hummel (1778-1837), furthered this understanding of piano technique as mainly finger work and wrote in his pedagogical treatise, *A Complete Theoretical and Practical Course of Instruction on the Art of Playing the Piano Forte,* that hands should be held in a light and quiet position with fingers always bent. He insisted that the "quickness of motion lies only in the joints of the fingers which should move with lightness and freedom, and not to be lifted up too high from the keys"(Gerig 2007, 73). For the highly cultivated musical taste which he demonstrated in his compositions, Hummel received much respect from his contemporaries, and later, from Romantic composers, including Schumann and Chopin. However, in his pedagogical principles, Hummel focused mainly on the mechanical side of playing. In particular, he pointed out that musicality as a talent is either given or not, therefore there is not much use in

putting a lot of teaching effort into developing it. Rather, working on the pure mechanical side of students' development would be more fruitful and would result in making a decent piano player (Gerig 2007, 76). As will be seen, this perspective received further advancement in the 19th century.

Ludwig van Beethoven

While the technique of Mozart and Hummel belonged to the harpsichord past, Beethoven's compositional style was inseparable from the new potential of the piano with its range of dynamics, deep tone, and pedals. *Legato* playing was one of the main principles of his pianism and according to Schindler[4], Beethoven wrote that the player should "learn to *generate* the tone, and, as it were, to make the instrument sing" (Gerig 2007, 91). Two other prominent pianists and pedagogues of the time, whom Beethoven highly respected, Muzio Clementi (1752-1832) and his pupil Johann Baptist Cramer (1771-1858), also cultivated the *legato* touch in their pedagogy. They contributed remarkably to the development of such technical formulas as double notes, octaves and arpeggios (Gerig 2007, 60). However, when it comes to the description of hand position in their writings, it was still "penny-on-the-wrist" and the finger technique, which later on many researchers held responsible for repetitive injuries. Thomas Mark argues, "Musicians' injuries are almost always of somatic origin [and result] from inefficient or stressful habits of movement." He particularly stresses that many harmful movements come from such stereotypical teaching techniques as cultivation of independence and isolation of fingers (Mark 1999, 4, 7). As for Beethoven, at the end of his life, he began putting together exercises that demonstrated a different approach to the

[4] Anton Felix Schindler (1795- 1864), Beethoven's secretary and early biographer.

relationship of the pianist and the instrument. In these exercises, Beethoven prioritised work on achieving fullness of the piano tone, control of subtle dynamic changes, pedal work, and the power of arm support (Gerig 2007, 91).

Nineteenth and Early Twentieth Century

In the 19th century, there was the growing need for different playing approaches in order to meet the new demands of the instrumental and compositional styles. However, as we saw from the above historical references, pianists and pedagogues inherited older principles of clavichord and harpsichord techniques, which continued to be in great use throughout the 19th century.

As a result of this contradiction, two distinctive directions in piano teaching evolved in the 19th to early 20th centuries: the "finger school," and later, as a response to it, the "school of natural weight." The former became later associated with the harpsichord technique from the previous centuries, whereas the "school of natural weight" pioneered the new (for that time) direction in piano pedagogy, that later became known as the "anatomic-physiological approach" (the term belongs to the Soviet pianist and pedagogue Grigori Kogan (1901-1979)). While there were sensible seeds in both approaches, when taken to the extremes each of them was accountable for many misunderstandings, inefficient technique, and teaching methods that led to injuries.

The Finger School

The "finger school" emerged in response to the new challenges that piano playing presented compared to the harpsichord and clavichord. Even though the mechanical action of the early pianoforte was still light, keyboardists were already complaining that playing was fatiguing their fingers (Kochevitsky 1966, 2). The problem increased when in the early 1780s English piano makers *Broadwood and Sons* introduced their version of the piano, which had a deeper tone but heavier action. To solve the problem of greater resistance of the keys, piano teachers continued to employ the old harpsichord technique, which consisted of mainly isolated finger work. Instructors insisted on the development of finger strength to the utmost degree. In order to generate a greater force that the above-mentioned heavier action of the piano required, many exercises for the fingers were invented and written down (those by Hummel, Czerny,[5] as well as the notoriously famous ones by Hanon[6] are among a vast literature of finger exercises). Students were required to spend hours practicing them, which often spilled into pure mechanical drills. Supposedly, this type of practicing would help to build a necessary technical foundation for further musical development. Frederick Kalkbrenner (1785- 1849), a famous pedagogue of his time, suggested that students read some books while practicing five-finger exercises for hours. He supported the usefulness of this activity by insisting that it would save musicians' precious time and drew parallels with Rafael who had books read to him while painting and Voltaire who dictated to his secretary while getting dressed (Gerig 2007, 134). Kalkbrenner was also famous for the invention of the Hand-guide, a device that promoted isolated work of fingers and prevented the

[5] Carl Czerny (1791-1857), a German pianist and teacher, student of L.-V. Beethoven.
[6] Hanon (1819-1900), French piano pedagogue, best known for his collection of finger exercises.

participation of the arm in playing. The Hand-guide was "an adjustable horizontal rail, parallel to the keyboard, on which the forearm rested. Its purpose was to rid the playing of any arm action and develop the independence of the fingers, the basic principle of Kalkbrenner's technique" (Grove Music online 2007-2016). As mentioned before, he was not the first one to advocate for an external device to assist with the development of finger independence. Similar devices, such as the Logier's *Chiroplast* and Henry Herz's *Dactylion* were very popular among the teachers and students in the 19th century. Despite their popularity, use of these auxiliary devices raised concerns among piano pedagogues. Czerny, for instance, warned that the devices could fetter "all freedom of movement, and reduce the player to mere Automaton" (Gerig 2007, 129). However, the idea of the mechanical development of equal strength of all fingers seemed to have become firmly rooted in the minds of pianists and teachers.

The mechanical approach of the "finger school" culminated in the establishment of the Stuttgart school. Even though its founders, German pedagogues Sigismund Lebert (1822-1884) and Ludwig Stark (1831-1884), proposed the priority of artistic goals such as beauty of tone and melodious *legato*, in practice they focused exclusively on mechanical training of the fingers. In their approach they required to curve and lift fingers high in order to strike each key with force to produce loud sound. Kochevitsky recalls Heinrich Ehrlich's comparison of high bent fingers to soldiers marching in goose step (Kochevitsky 1967, 4). Amy Fay (1844 - 1928), an American pianist who studied in Europe, described the way Louis Ehlert (1825-1884) taught her at the Tausig's conservatory: "Ehlert makes me play them [Cramer's

Studies] tremendously *forte*, and as fast as I can go. My hand gets so tired that it is ready to break, and then I say I cannot go on. 'But you *must* go on,' he will say" (Fay 1888, 21-22).

It took a few decades and a number of injured pianists to unwind the wrongdoing of the "finger school" approach, in particular its chief beliefs that a) all fingers should be developed to become mechanically equal, b) the curved fingers were the prescribed position once and for all, and c) the participation of the rest of the body in the playing process should be limited as much as possible so that the fingers can work in isolation. Beginning from the second half of the 19th century to the present days, pianists, pedagogues, and physiologists who have studied the coordination required for piano playing have proved the inefficiency and harm of the finger approach. Breithaupt[7] wrote:

> It is wrong to start training the fingers from a strictly curved position. A free, natural style of movement or action can only be acquired from a free, natural pose (exempt from any strain) of the hand, and from a natural curve of the naturally straightened fingers. Long, flexible fingers having the natural swing in extension and flexion may with impunity be "curved" in playing, but not the other way about. [...] the curved pose paralyzes the fingers and prevents their free co-oscillation (Breithaupt 1909, 66).

One of Breithaupt's followers, Ivan Kryzhanovsky, a Russian physiologist and musician (1867- 1924), mentioned that the injuries, which resulted from misuse or overuse of the groups of muscles and tendons associated with a curved high position of the fingers, became so common in European music schools in the second half of the 19th century that they received a special term -- the "pianists' spasm." He further referred to the famous surgeon of the time, Theodore Billroth, who called "pianists' spasm" the newest disease of the 19th century (Kryzhanovsky 1922, 54-55).

[7] Rudolf Maria Breithaupt (1873-1945), a German pianist and teacher, in piano pedagogy -- founder of "the natural weight" approach.

Regarding the main requirement of the "finger school" to develop equal strength and independence of the fingers, Kryzhanovsky explains that the physiology of the hand assumes different degrees of independent movement between different fingers, with the thumb and index finger having the greatest range of mobility, while the middle and ring fingers have the least (Kryzhanovsky 1922, 45). Among other limitations in developing independence of the fingers, Watson observes partial fusion of the flexors and extensors of the forearm, and synchronization between the activities of motor neurons, which control the parts of the muscle responsible for the movements of different fingers (Watson 2009, 61).

However, Watson refers to studies that show that with practice it is possible for pianists and instrumentalists to reduce the level of synchronization between the activities of motor neurons to allow for better control of independent movements of the fingers (ibid). As the development of the smaller muscles of the palm and fingers is necessary for pianists for the fine control of tone production and velocity, the key point is then not to abandon the whole idea of training the fingers, but to train them the correct way in accordance with the physiological and biomechanical laws of the human body. Csurgai-Schmitt describes the training process in which a piano student first learns to coordinate larger playing units of the body, such as the shoulders and arms, so when it comes to smaller units, that is fingers, their work is backed up by the support of the upper body. At the same time, Csurgai-Schmitt insists that without proper coordination and development of the corresponding smaller muscles of the palm and fingers, a dysfunction of the fingers can occur, as well as some limitation of speed (Csurgai-Schmitt in Berenson 2002, 261).

In spite of the scientific evidence of the ineffectiveness and harm of "finger school" methods, the approach had come to be so firmly instilled in the minds of teachers that it continues to be passed on from generation to generation. Gerig writes that "it is difficult to understand how so many instructors of the period [19th century] could be so blinded to the physical and musical evils of their [Lebert-Stark] system and so little influenced by the freedom and abandon of a Liszt or Rubinstein performance" (Gerig 2007, 230). One of the reasons might be, as C. J. Haake pointed out, that "percussion touch was [and *is*]... of more definite substance and form than a vague pressure playing, and method will always thrive on that that can be definitely projected and prescribed" (ibid).

Another reason for the tendency to cling to the old harpsichord finger approach could be the difficulty of passing the intuitive pianistic knowledge from the great virtuosi of the 19th century to others. What comes naturally to the few genuinely talented may not be so evident to the rest. Gifted pianists sometimes could not explain the magic of their mastery. Moreover, teachers observing the great Romantic pianists often found it challenging to break down their virtuosity into pedagogical tools (Gerig 2007, 4). Nevertheless, the gap between the ease and comfort of the performance of great pianists and the dry mechanical drills of the European music schools triggered the search for new ways of piano playing and teaching. Rogers notes that even though the technique did not always keep up with the development of the instrument and the Romantic compositional style, there were pedagogues who worked toward a better understanding of “how the physical act of playing the piano could be achieved with ease through a more coordinated use of the body as a whole unit" (Rogers 1999, 26).

The School of Natural Weight

Despite the leading role that the supporters of the "finger school" had maintained in the 19th century, progressive teachers such as Germans Adolph Bernard Marx, Ludwig Deppe, and American William Mason opposed finger approach on many points. Marx was against the striking and pushing of the key, but taught that the key has to be felt and "seized with feeling" (cited in Gerig 2007, 248). Unlike the mechanical training of the "finger school", he insisted on the inherency of musical conception and its realisation through touch.

Marx's student, Ludwig Deppe (1828-1890), whom Novara regards as "one of a handful of truly great 19th century piano pedagogues that are responsible for the cultivation and evolution of a modern piano technique" (Novara 2015, 1), went further in his search for more comfortable and musical playing. Not only did Deppe cherish sensitive tone production, but he connected it to the proper functioning of the whole body as a unified playing system, making "the technique and the conception *identical*, as of course they ought to be" (Fay 1888, 319). Deppe insisted on shifting the focus from excessive finger activity to the upper arm, supported by the muscles of the back. One of his students, Elisabeth Caland, used the expression *muscular synergy* to describe the coordinated work of muscle groups of the torso that Deppe taught (Gerig 2007, 256). Kochevitsky believes that representatives of the "anatomic-physiological" direction, which began after Deppe with the launch of the "school of natural weight", distorted his ideas of a perfect blend of musical and technical goals by focusing mainly on the physical side of the movement (Kochevitsky 1967, 9).

Rudolf Maria Breithaupt (1873-1945)

In 1906-1912, Rudolf Maria Breithaupt published pedagogical series of *Natural Piano Technique*, the second volume of which was entitled *School of Weight-Touch.* The "school of natural weight" thus became the new direction in piano pedagogy. Breithaupt considered a completely relaxed, loose and heavy arm, with its natural weight applied to the key, to be the cardinal principle for acquiring a healthy and effective piano technique. In his writings, he assertively described the benefits of his natural weight approach over the old method of excessive finger work. In particular, Breithaupt objected to the permanent curved position and high lifts of the fingers, a main tenet of the old school. He insisted that the position created over-tension in the fingers and wrists and prevented the transmission of the free weight of the arm into the fingertips (Breithaupt 1909, 8). Breithaupt suggested a different position of the hand, an "arch-set hand" or the "hand-bridge," in which the fingers are straight or slightly bent, and metacarpal joints form a line of humps. In this way, "the fingers become 'stilts', 'props' supporting the weight borne by the palm of the hand, arched to form a bridge" (Breithaupt 1909, 3). Having stated the importance of the hand-bridge, Breithaupt contradicted himself by noting in the same paragraph that this position should not be rigid, and as the students' technical abilities develop, the hand should freely adapt itself to the instrument according to its [the hand's] physical proportions (ibid). This is one example of the many contradictory postulates that Breithaupt proposed but did not fully explain. From his writing, it follows that mastery of the technique of natural weight requires a student to acquire a keen sense of the balance between "normal muscular action and muscular relaxation" (Breithaupt 1909, 18). He does not explain what "normal muscular action" is and

which groups of muscles are involved. Quite to the contrary, he insists that "normal" everyday activities are actually in contrast with piano playing because the actions that we are accustomed to in our daily lives, such as holding or grasping, do not promote suspending and relaxing of the arm as required for his weight-technique (Breithaupt 1909, 14).

Responses to Breithaupt's theory and teaching were widely varied from highly favourable to entirely negative. In spite of the initial popularity of his ideas, the many contradictions in his writing raised concerns and misunderstandings among pianists and teachers. Apart from the lack of scientific basis of his physiological descriptions, the biggest flaw in the ideas of the "school of natural weight" was the missing connection between movement and its purpose -- the musical expression, because Breithaupt focused almost entirely on the physiology of the movement (hence the umbrella title for similar approaches -- "anatomic-physiologic school"). His priorities become clear from the description of tone gradations and aesthetics of musical expression at the end of *School of Weight-Touch.* In Chapter 10, Breithaupt briefly outlines the leading role of the mind in the conception of musical expression and connects it to his theory "of training and refining muscular sense and sense of touch" (Breithaupt 1909, 66). Yet, from further explanations, it follows that "the aesthetics of tone...largely resolve into a question of weighting. Beauty of tone results as a natural, inevitable consequence from the faculty to transfer and roll the weight... wherever, and whenever, it is needed" (ibid). In other words, his writing demonstrates that for Breithaupt, physical training comes before mental and aural preparation.

Artur Schnabel, who found Breithaupt to be an interesting and fascinating figure, nevertheless seemed to be quite sceptical of Breithaupt's method, especially when he

discovered that Breithaupt observed and used his (Schnabel's) playing for the sake of developing the theory of natural weight, rather than in appreciation of his musical art. Schnabel strongly believed that "one should never make any music, not even sound one musical tone, without a musical intention preceding it" (Schnabel 1970, 162). Reflecting on Breithaupt's enthusiastic comment after one of Schnabel's recitals that the latter played with shoulder-participation, Schnabel exclaimed in his writing that he "had never speculated how much shoulder-participation is required, how much "fall," "weight," wrist-rolling, what elbow angles -- and endlessly on" (Schnabel 1970, 163).

Nonetheless, those pianists who worked with or alongside Breithaupt found many valuable applications in his teaching. One of his students, Florence Leonard, wrote that in the lessons, Breithaupt inexhaustibly tried to convey his new approach to the students by both appealing to the student's mind, i.e. by describing an arm motion as well as by producing the motion physically. Thus, Leonard insisted, Breithaupt pursued the goal of teaching a "perfectly free, natural set of movements, movements which are to the purpose and waste no energy" (Gerig 2007, 336-337). Likewise, Claudio Arrau, who taught piano at the Stern Conservatory at the same time that Breithaupt worked there (1926-1930), promoted many ideas that resonated with Breithaupt's. Like Breithaupt, Arrau insisted on the work of the whole arm and upper body in coordination with the fingers, the balance of relaxation and exertion; he, too, denied the "cocked-gun" position of tensely curved fingers (Von Arx 2014, 59, 62, 67). In terms of the influence of Breithaupt theory, the work of Ivan Kryzhanovsky is of particular interest for the present work as will be discussed in Chapter 2.

Twentieth and Twenty First Century

Experimental Approaches to Piano Technique

In the 20th century, theorists of piano technique, including Otto Ortmann, Arnold Schultz, and Josef Gat among others, proved scientifically that in building a strong "performer-instrument" relationship, piano players could not rely on natural weight alone.

American Otto Ortmann (1889-1979) and Hungarian József Gát (1913-1967) used their observations of famous pianists as foundations and evidence for their theories. They subjected piano technique to detailed and thorough scientific analysis. The goal was to prove that any piano player is physically capable of acquiring a comfortable and efficient technique if trained according to the laws of physics and mechanics.

Otto Ortmann

Otto Ortmann established a laboratory at Peabody University and invited famous pianists to participate in his experiments. He used pantograph[8], photography, and roentgenography to measure, record, and analyze the directions and intensity of arm, hand, and finger movements in specific technical formulas. Ortmann described his findings in *The Physiological Mechanics of Piano Technique.* In 1929, this book was revolutionary in a number of ways.

One of Ortmann's innovative ideas was his view of piano playing as a process, in which the human body is subject to the same laws of physics and mechanics as any machine. He believed that all physical concepts, such as action and reaction, acceleration, force, and mass

[8] "Pantograph, an instrument for copying a plan or drawing on a different scale by a system of hinged and jointed rods" (Oxford Dictionary online).

"apply to physiological motion as well as to mechanical motion in general" (Ortmann 1962, 3). Ortmann considered the pianists' fingers, hands, and arms to be like levers, with the joints of the hands, elbows, and shoulders acting as fulcrums or stabilizers (Ortmann 1962, 6-7). One of the most important conclusions that Ortmann drew from his studies and that he emphasised repeatedly throughout the book, is that piano playing involves all body parts (Ortmann 1962, 71). Ortmann looked for the middle ground between the "finger" and "weight" schools and found it in what he called "coordinated movement" -- the balanced and efficient work of all joints and muscles involved in piano playing, that does not use unnecessary energy, but contributes to smooth and effortless technique. Ortmann opposed the chief pedagogical belief of the "school of natural weight" that complete relaxation is the most desirable muscle condition for piano playing. Rather, he insisted, efficient movement depends on the coordinated work of muscles and joints, the kind of work that balances relaxation and contraction and results in sufficient muscle-tone (Ortmann 1962, 60-61).

As mentioned earlier, Ortmann was one of the first piano theorists who supported his conclusions by measurements, which he conducted using equipment available at that time. While his method of exploration of piano technique was unusual for his time, at the end of the 20th and now in the 21st century, it received more attention and practical application. Piano researchers have taken an increased interest in this type of studying pianists' movements using more advanced equipment and measuring systems. One example is the work by Dr. Kathleen Riley, who uses a variety of tools to analyze and correct pianists' technical problems. The equipment includes MIDI-connected pianos, digital video recording,

and electromyography[9]. These biofeedback tools provide a means to record and evaluate information on the timing and velocity of finger movements as well as on muscle conditions, i.e. contraction and relaxation. Riley et al. argue that the benefits of such multimodal feedback are two-fold; it helps pianists and pedagogues "to become [more] aware of body alignment, muscle movement and muscle tension," and it provides "feedback on the sounds resulting from these [movements] and any changes in them, particularly changes leading to sought-for improvements in the muscle outcomes" (Riley et al. 2005, 87).

A different example of scientific exploration of healthy piano technique is the biomechanical analysis conducted by Dr. Brenda G. Wristen. She designed a procedure for observation and quantitative analysis of pianists' movements, which include pre- and post-observation questionnaires and lists of movements involved in the execution of specific technical elements such as scales, arpeggios, trills, etc. Wristen warns that it is important to understand that visual observation can provide feedback only on an outward sign of the movement and cannot give information about "how the production of a certain motion feels to the player" (Wristen 2000, 57). Besides, she notes that many individual factors, which were not considered in the research such as age, gender, anthropometry, level, learning style, stress, as well as environmental conditions, affect the performance of a movement. Nevertheless, Wristen believes that further studies with a biomechanical approach will help "to develop conclusive strategies for injury prevention" (Wristen 2000, 63).

It is questionable how much the above-described types of work with movements can help pianists find a genuine connection between musical content and technical form, because

[9] "Electromyography, the recording of the electrical activity of muscle tissue, or its representation as a visual display or audible signal, using electrodes attached to the skin or inserted into the muscle (Oxford Dictionary online).

like Ortmann's, these experiments also fall into the category of the "anatomic-physiological" approach. Despite Ortmann's explicit negation of the principles of the "school of natural weight," he, too, focused on the mechanical side of playing as a starting point for piano technique.

This does not diminish Ortmann's contribution to the ever-lasting search for a link between empirical and analytical approaches to piano technique, the proponents of which have often opposed one another, but "failed to see that both are valid and even complementary" (Gerig 2007, 4). Although other pedagogues before Ortmann, for example Deppe and Matthay,[10] promoted similar concepts in piano technique, such as coordination, involvement of the whole body, balance of lightness and steadiness, their discoveries were guided by intuitive knowledge and personal practical experience. Ortmann, on the other hand, explained the mechanics of piano technique in a concise and convincing way based on the results of hundreds of measurements, thus eliminating subjectivity as much as possible (Schultz in Introduction to Ortmann 1962, xvii).

The Physiological Mechanics of Piano Technique cannot serve as a ready-to-use practical guide for piano teachers, because Ortmann did not link the theoretical postulates and conclusions from his experiments with their practical applications. Rather, the book is a "raw" resource that pianists and teachers can use as a foundation for building their own approaches to piano technique, which some teachers do. For example, Csurgai-Schmitt considers Ortmann's theory of third-class levers to be fundamental for the understanding of pianists' movements. Taking Ortmann's principles of stabilization, i.e. fixation at the base of the movement (fulcrum) -- be it a shoulder joint or the metacarpal joints of the hand -- as the

[10] Tobias Matthay (1858-1945), an English pianist, pedagogue, and composer, author of *The Act of Touch.*

foundation, she developed her own system of teaching coordinated movements to piano students (Csurgai-Schmitt in Berenson 2002, 32 and 254-255). Her method includes attention to piano bench height, arms warm-up, and finger exercises.

Psycho-technical School

A new turn in the understanding of piano technique, which became known as the "psycho-technical school," appealed to the "brain-ear-movement" connection. The proponents of this direction -- F. Busoni, G. Prokofiev, L. Bonpassier, G. Kogan, K. A. Martienssen, W. Giesiking, H. Neuhaus -- emphasised the primary role of the mind in piano activity. They believed that it is the musical purpose that defines and promotes pianists' movements, i.e. "the more our consciousness is diverted from the movement, and the stronger it is concentrated on the *purpose* of this movement, the more vividly do artistic idea and tonal conception persist in the mind" (Kochevitsky 1967, 17).

Kochevitsky notes that the idea of the importance of the mind in technical development was not new and mentions such 19th century pianists as I. Moscheles and Nikolai Rubinstein, who focused on attention to musical problems in solving technical difficulties (Kochevitsky 1967, 15). We can trace this idea even further back in time, to the pre-piano era when J. S. Bach and his son C. P. E. Bach insisted that technique is only a means to express musical content.

However, in the 20th century, pianists and pedagogues became particularly aware of the leading role of the mind in order to respond and confront the lopsidedness of the "anatomic-physiological" approach with its focus on the physical side of playing. While the "anatomic-

physiological" approach and the old "finger school" both thrived on the principle of going from "outward inward" (Kogan 1966, 7) with technique playing the leading role in achieving artistic results, the theorists of new direction saw their concept "from within outward" to be the undeniable certainty of the best achievements in piano playing.

Martienssen's *Creative Sound Volition*

German pianist, pedagogue and theorist Karl Adolf Martienssen (1881-1955) used Mozart's phenomenal abilities to easily learn how to play different instruments as an example of the expression of one's self through playing - a process that happens innately in musical prodigies. He believed that the musical development of a student had to be based on the development of his aural abilities: abilities to listen, to recognize, and, most importantly, to *want* to create the sound that reflects the individuality of the particular person. He called this complex *schöpferischen Klagenwillens* and concluded that the model of the development of *creative sound volition* in prodigies could and should be applied as the general principle of instrumental pedagogy for every piano student (Martienssen 1966, 22-25). He outlines the process of tone production based on the development of the *creative sound volition* in Chart 1, in which he places an aural conception of the sound image at the top of the pattern:

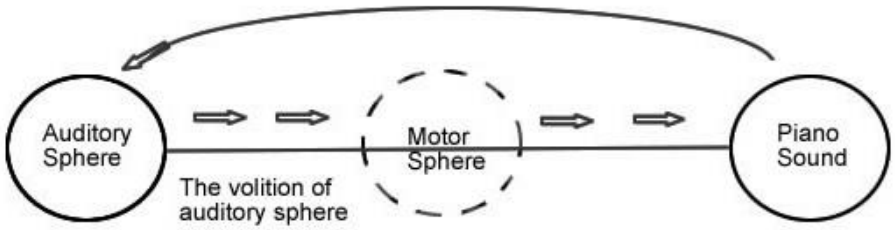


Chart 1. Engaging *creative sound volition* in tone production, K.A. Martienssen.

According to this chart, the impetus of the sound image, activated by *creative sound volition,* realizes into motor activity, which in turn results in the production of piano sound. The actual sound is immediately evaluated by ear, and the pattern continues in a circuit. Further, Martienssen breaks the concept of *creative sound volition* into five elements, *pitch sound volition (Tonwille), timbre sound volition (Klangwille), line volition (Linienwille), rhythm volition (Rhytmuswille),* and *form volition (Gestaltwille* and *Gestaltungswille).* He writes that although these elements come together as parts of the whole, the final product is more than just the sum of its components. Rather, while each single element cannot create an artistic performance on its own, *creative sound volition*, which is a bigger concept with new features, is the driving force behind artistic creation at the piano.

In his deeply philosophical work, Martienssen proclaims his main idea about piano technique, namely that the technique of each and any piano player can only be individual. This was a completely new understanding at the time of the book's first edition in 1930. In the preface to the Russian edition of Martienssen's book, Kogan writes that before Martienssen, authors searched for some universal approaches to piano technique and each believed that he or she found the right and only answer. While many understood that the artistic interpretation does depend on the individuality of the performer, this concept did not affect the technique (Kogan 1966, 4). Martienssen, on the other hand, made the artistic intention of the player his guiding principle, and concluded that the development of the technique is worthwhile only when it is based on the individuality of the pianist and therefore is also always unique.

Heinrich Neuhaus

The Art of Piano Playing by Heinrich Neuhaus (1888-1964), a Russian pianist and pedagogue, and the teacher of famous Svyatoslav Richter and Emil Gilels, was written in 1958. It has become a timeless resource for generations of pianists and teachers. Canadian-born pedagogue Alan Fraser writes, "Neuhaus's monumental work [...] still stands for many of us as the pianist's bible" (Fraser 2011, 1). Fraser further explains that in his own book *The Craft of Piano Playing,* he aims to guide pianists in implementing Neuhaus's precepts (ibid). Neuhaus covers many aspects of the processes of piano learning and teaching with the main underlying idea being the importance of the spiritual essence of music and its communication through piano playing. Neuhaus insists that the process of piano playing is a unity of three elements: music itself, the player, and the instrument, and that only "a complete mastery of these three elements (and first of all, the music) can ensure a good artistic performance" (Neuhaus 1993, 2). As he reveals his thoughts on various aspects of sound production, rhythm, pedaling and technique, Neuhaus always connects the craft (technique) to the inner content of music and requires the performer to imagine, conceive, and conceptualize this content. He writes that, above all, the pianist must have something to express, "in order to speak and to be entitled to be heard it is essential not only to know how to speak, but first of all to have something to say" (Neuhaus 1993, 4). This idea defines his position toward any technical work: "The clearer the goal (the content, music, the perfection of performance), the clearer the means of attaining it" (Neuhaus 1993, 3). In other words, the pianist has to envision the musical image clearly at any stage of working on a piece, be it the colour of one sound, the shape of a phrase, or an overall form of the piece. The technical means will follow

in the integrated process of searching deeper for the meaning of the piece. That is why Neuhaus devotes a good half of the book to the work on musical image and sound.

In the chapter *On Technique,* Neuhaus describes his approach to the pianistic apparatus, freedom of movements, as well as some of his practical exercises on scales, trills, arpeggios, and octaves. His advice is an invaluable source of information for teachers and advanced students who are seeking the wholeness of musical and technical growth.

Kochevitsky's Scientific Approach to Piano Technique

The next step in the exploration of the leading role of the mind in artistic performance was the inquiry into neurological connections and motor activity at the piano. Otto Ortmann only briefly outlined these connections and noted that further studies were needed to understand the role that the central nervous system plays in the development of piano technique. Martienssen and Neuhaus insisted that musical purpose, generated by the mind, defines pianists' movements. Kochevitsky was probably one of the first piano theorists who attempted to explain how the central nervous system functions in piano playing.

In his book *The Art of Piano Playing: a scientific approach,* Kochevitsky refers to the parts of the human brain that are responsible for initiating, controlling, and modifying motor activity at the piano. He explains that while involuntary movements occur on the subconscious level and are guided by unconditional reflexes from the spinal chord, more complex activities such as running, grasping an object, or eating are mapped, designed, and controlled in the cortex of the brain. It is in the cortex where the initiative and purpose of the movement belong, as well as the movement's strength and energy (Kochevitsky 1967, 21-

22). On this level, we "are not conscious of *how* we function but are concerned with the *purpose* of our action" (ibid). Kochevitsky writes that in performance as well as in practice, the purpose, i.e., "the musical incentive has to be a signal provoking the motor activity" (Kochevitsky 1967, 29).

He further states that in highly coordinated motor activities as piano playing, the voluntary and involuntary motor acts are intricately interwoven. Kochevitsky indicates that while "the direct interference of consciousness in the motor process while *playing* the piano would be detrimental," he insists that certain elements of motor activity should be brought to consciousness, and after being discerned at the higher level of brain activity, be allowed to settle down at the automatic level. This is especially important when something goes wrong in motor processing and movements need correction (Kochevitsky 1967, 22).

Kochevitsky provides an in-depth explanation of such processes of the central nervous system as the formation of conditioned and unconditioned reflexes, excitation and inhibition, and irradiation and concentration. He demonstrates how these processes underlie piano playing and practising. For example, referring to the precise balance of excitation and inhibition, which is paramount in piano playing, he describes how the weak process of inhibition causes rushed and uneven playing (Kochevitsky 1967, 25).

Based on the knowledge of neurological processes that happen during piano playing and learning, Kochevitsky makes many interesting and valuable conclusions for piano pedagogy. One of them is the importance of slow practicing to enhance the balance of excitation and inhibition. Another is the careful control of superfluous movements to allow for the processes of irradiation and concentration to adjust in order to localize the motor

activity in a specific group of muscles, i.e. fingers. Kochevitsky writes that when students first learn a new piano skill, nervous activity spreads, i.e. "irradiates," on a vast area in the motor centre of the brain. This often results in unnecessary movements or muscle contractions (Kochevitsky 1967, 26-27). For example, teachers can observe how beginner piano students sometimes strain or move the fingers of the resting hand when they play with the other hand. Kochevitsky also provides another interesting example of irradiation process, that of trill playing. He writes that often students experience difficulty not because their fingers cannot move fast enough, but because adjacent fingers get involved, become tense, and therefore impede the work of playing fingers (ibid). With time and watchful guidance, Kochevitsky continues, the irradiation lessens while the concentration process strengthens, thus allowing students to acquire more precise and focused movements.

Another salient conclusion that Kochevitsky draws from the scientific foundation he laid is the importance of building audio-motor connections before a visual component, that is, before note reading is added. He accuses the so-called traditional piano pedagogy of introducing note reading too early in the learning process, thereby promoting visual-motor connection in a beginner piano student, which prevents or significantly impairs the formation of correct audio-motor neural connections. In the following scheme, Kochevitsky echoes Martienssen's principles of establishing a strong "from within outward" foundation in the development of piano technique: "auditory stimulus (the inwardly heard tone) - anticipation of motor act - motor act resulting in actual sound - auditory perception and evaluation of the actual sound" (Kochevitsky 1967, 31).

Both Martienssen and Kochevitsky described the "wrong" pattern as well. Martienssen argued that the dominating tendency in piano pedagogy was the practice of teaching students to prioritise the physical aspect of playing, i.e., to focus on the movement first. This pattern shows the process from "outward within," in which sound is not conceived aurally but happens as a result of the movement and therefore leads to mechanical playing (see Chart 2).

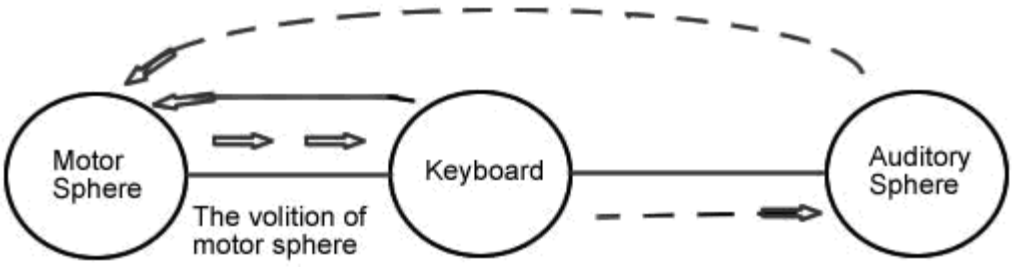


Chart 2. Prevalence of the motor volition. K. A. Martienssen.

Kochevitsky, in his turn, criticizes the "traditional piano pedagogy" that is based on the sequence "visual impression - search for a key - movement," and insists that the visual stimulus - a note sign- should only be added later when the right pattern of going from "within outward" is firmly established (Kochevitsky 1967, 30).

Abby Whiteside[11] writes along the same lines, when she insists that aural learners have much more ease and better coordination compared to those who start learning with notes: "The pupil who has learned music by the way it sounds hears the tone when he looks at the symbol [note]. The movements that make this imagined tone audible are directed by his ear. They are as fluid, as efficient, as co-ordinated as his movements when playing without notes" (Gerig 2007, 473).

[11] Abby Whiteside (18811956), an American pianist and pedagogue, author of *Indispensables of Piano Playing*.

Injury-preventive Work in the Twentieth and Twenty First Century

The search for efficient piano technique continued through the second half of the 20th century and is ongoing today. One of the new directions is an interest in re-training pianists with playing-related injuries. There have been a few pedagogues who made work with injured performers their focus.

Valentina Guterman, a Soviet pianist and pedagogue, began working with injured musicians in the 1940s. She wrote that she never had any technical problems herself and credited her teacher Igumnov[12] for instilling in her the right approach to technique. At the same time, in the Conservatory of Sverdlovsk (modern Yekaterinburg), where she worked, she witnessed many pianists and instrumentalists struggling with their playing, a number of whom suffered from playing-related injuries. She started to develop a method of re-training injured musicians, and she researched the fields of anatomy, physiology, and neurology. Eventually she described her findings and conclusions in her 1943 dissertation "Motor-tactile method of training in occupational diseases of pianists."

Guterman's method combined her pedagogical talent with her scientific knowledge, which in modern language could be called an inter-disciplinary approach. In her work with music students, Guterman paid close attention to the musical elements of technique. She wrote, "The principal criteria in my work is [piano] sound. After we begin our work, a student realizes that she is capable of a new sound result. From that moment, the healing starts..." (Guterman 1994, 28, translated from Russian). Although Guterman put a great emphasis on students' postures, which she corrected by adjusting the whole body's alignment

[12] Konstantin Igumnov (1873-1948), a distinguished Russian-Soviet pianist and pedagogue.

and muscle tone, she never worked on the physical side of the playing alone. She often had to deal with the frustration and emotional trauma associated with professional injuries and considered the correction of psychological problems to be an essential part of the healing process. She notes that "any human's action cannot be isolated from the complex system of one's personality," and "a teacher has to see and understand the person's inner spirit and individual features of the character" (ibid). She aimed for full connectivity of the student's mind, body, and instrument.

A pianist Svetlana Frolova, whose daughter suffered from a playing-related injury, wrote in the Introduction to Guterman's only published book that after a few weeks of lessons with Guterman, she saw a definite positive change in not only her daughter's mood and energy, but also her overall physical appearance (Frolova in Introduction to Guterman 1994, 4). Another of Guterman's students, Iliza Safarova, who currently works with musicians with professional injuries, noted that she discovered much more ease and pleasure in playing once she began lessons with Guterman, even though she did not have playing-related injuries (Piano Pedagogy conference 2001, Saint-Petersburg).

Further studies in the field of pianists' professional injuries have triggered an awareness of the necessity for the development of an injury-preventive pedagogy. An American pedagogue and a specialist in injury-preventive teaching, Barbara Lister-Sink proclaims "healthful, injury-free piano technique is a skill which every pianist has the ability and right to acquire" (Lister-Sink 2002, 189). She describes her quest for healthy technique after she had playing-related injuries in her formative years. Her recovery involved studying with pianist Lateiner-Grosz. Lister-Sink writes in her 2015 PhD dissertation that Lateiner-Grosz

paid particular attention to the functioning of the whole body, kinaesthetic awareness and listening skills. Later, Lister-Sink received help from physiotherapist Lange-Boeke who was attentive not only to her physical problems but also to her psychosomatic condition. Consequently, Lister-Sink has developed her own teaching method that focuses on injury prevention and on re-training injured professionals. She outlined the fundamental principles of the method in her dissertation as following:

1. Piano technique is a trainable but complex neuromusculoskeletal activity of the whole body, directed by the brain.

2. The technical model used in teaching, like other athletic models, should be based on rational, biomechanical principles of efficient whole-body use, and taught with consistent, accurate, and understandable terminology.

3. Piano technique is best acquired through neuromuscular programming in a step-by-step, carefully sequenced manner, from the simplest co-ordinations to the most complex, allowing sufficient time for the brain to process and master each step.

4. In the beginning stages of training, hands-on guided practice at least three times per week is necessary.

5. Enhanced auditory, tactile, and kinaesthetic awareness through mindfulness training is essential to successful training.

6. The teacher must teach kinaesthetic and somatic awareness of whole-body coordination through appropriate and professional tactile guidance (PTG).

7. Concurrent training in the Alexander Technique, or another somatic pedagogy, greatly enhances kinaesthetic and somatic awareness, as well as the rate and quality of learning.

8. Modeling, mental practice, self-assessment through video and audio recording, and written self-reflection are all important tools for teaching.

9. Teachers of students with playing-related injuries must work in partnership with a team of qualified healthcare professionals, including traditional and complementary practitioners.

10. Piano technique—all co-ordinations, movements, and sensations—must be chosen to best serve the musical requirements.

11. The teacher must adapt appropriately and creatively to each student's individual learning style, training history, and state of health in a positive learning environment, potentially leading to psycho-physical transformation (Lister-Sink, 2015).

One more important message should be added to the principles Lister-Sink lists above. She strongly applies in her writings that correct movements can only be conveyed to a student kinaesthetically, i.e. through physical feel and comparison. She writes that appealing to the students' cognitive/analytical intelligence is not enough to teach physical sensations: "It is like trying to describe the smell of a rose. Words and symbols cannot convey a smell or a sound or a kinaesthetic sensation" (Lister-Sink in Berenson 2003, 191). In the film "Free the Caged Bird," Lister-Sink demonstrates how she teaches students by direct physical contact with their arms and hands, getting them to feel and realize the teacher's movements and muscle-states and compare those to their own.

In this, Lister-Sink's method is close to that of Valentina Guterman who also worked "hands-on" with her students, as well as to the Schmidt-Shklovskaya-Minsker approach, which will be described later in this work.

Performing Arts Medicine

Performing arts medicine is a relatively new field that emerged about 30 years ago as a response to the physical and emotional challenges musicians, dancers, and drama artists experience and live with. Medical professionals, such as physiotherapists, osteopaths, and psychotherapists have to not only possess knowledge and experience in their particular areas of medicine, but they also have to understand the specifics of musical, speech, or dance techniques in order to efficiently work with artists. Performing arts medicine associations in UK (BAPAM) and US (PAMA) are leaders in the field, and there are other associations worldwide.

Owing to the ongoing research in the field of performance arts medical science, pianists and teachers can now deepen their understanding of the nature and causes of playing-related injuries. In the 19th century, doctors labelled all pianists' injuries as "pianists' spasm" and later in the 20th century used the umbrella term of "repetitive strain injury." However, today medical professionals distinguish a much greater variety of playing-related disorders. For example, Watson describes several forms of tendonitis, which include not only inflammation of the arm tendons, but also inflammation of the synovial sheaths of the tendons, ganglion cysts (swellings under the skin of the wrist) and de Quervain's syndrome, an inflammation at the base of the thumb (Watson 2009, 76-78). Among other playing-related injuries, Watson mentions joint dysfunctions such as inflammation of elbow or shoulder joints (bursitis) and nerve entrapments (Watson 2009, 80, 84).

Dr. Norman B. Rosen, a specialist in physical medicine and rehabilitation, names myofascial dysfunction, which is the tightness and weakness of muscles, as one of the most common predispositions to the development of more serious injuries, such as those listed by Watson (Rosen in Berenson 2002, 158). Rosen stresses the importance of close attention to the first signs of muscle fatigue because "once tissues are strained or overloaded (overused in terms of the muscles' capacity to withstand loads) they are rendered more vulnerable to injury through a variety of subsequent events, including damage occurring from additional loads and usage" (Rosen in Berenson 2002, 159). He also indicates that while pianists usually complain about pain in the forearms and wrists, these parts are often the areas of referred pain and tenderness, while the trigger of the problem might lie in some other body part, such as the player's shoulders.

Such in-depth studies of different pianists' injuries have led scientists and medical practitioners to a more detailed investigation of the causes of the problems, including those not directly related to playing. Watson, for example, notes that home-improvement projects or sport activities could be initial triggers of an injury because "these may involve short periods of intense physical effort of a type that the body is unused to" (Watson 2009, 77). These activities, he continues, may cause tendonitis in the shoulders, elbows, or wrists, and once developed, the injury may become aggravated by playing (ibid). Among other non-musical causes, researchers list chronic diseases such as diabetes and rheumatoid arthritis, genetic predispositions, and accidental damages such as fractures and sprains (Rosen in Berenson 2002, 156; Rogers 1999, 13).

When considering causes of pianists' physical injuries, we cannot ignore the psychological factors which can contribute significantly to the development and intensity of the problem. Performance anxiety, stresses due to competitive environment and repertoire challenges are among the most frequently mentioned psychological triggers of pianists' injuries (Rogers 1999, 14-15).

A better understanding of the nature and causes of piano-related injuries has also changed the views on treatments. If in older times, doctors prescribed rest as the first available and preferable option, nowadays medical professionals recommend that pianists become active participants in the healing process. The following options and their combinations are now available as active ways of treatment: physiotherapeutic exercises, cognitive therapy such as mindfulness training, body awareness techniques such as the Alexander or Feldenkrais methods, and re-training options with no prolonged pauses in

active piano playing. Adding to this last suggestion, Rosen writes that in many cases extended breaks do not solve the problem, but rather may make it worse. He explains that while an initial period of rest is still necessary at the onset of the problem, longer breaks are not always the best solution. Players' muscles become tighter and weaker without exercising, and returning to practising after a long break may put extra pressure on the pianist and add to the stress. To avoid these complications, he advises to combine medical treatment with careful re-consideration of the pianist's technique and practising habits by de-training old faulty habits and finding new correct ones (Rosen in Berenson 2002, 162).

The development of performing arts medicine shows the growing awareness in addressing artists' well-being. It is even more promising that piano pedagogy has also begun to reflect on pianists' overall health and playing-related issues. For the past decade or so, at the annual MTNA and CFMTA conferences, and RCM Summits presenters highlight one or another problem related to healthy piano learning and teaching. One of the most recent examples is a series named *Integrated Music Teaching*, published by CFMTA in the 2016-2017 issue of "The Canadian Music Teacher." The author, Dr. Vanessa Cornett, explores holistic teaching approaches by addressing physical comfort of a piano student and teacher, performance-related mental training, and spiritual involvement in playing (Cornett 2016-2017).

However, the change of attitude toward more balanced and healthier piano teaching is still slow. To promote this change, piano pedagogues have to work further on the development of a consensus on the important questions: what healthy piano technique is and

how to implement it into practise. Lister-Sink rightly notes that piano pedagogy is currently struggling with issues such as:

> The apparent lack of consensus in the piano profession regarding certain core principles of biomechanically efficient technique, as well as consistent means for teaching them to piano students;
>
> The need for greater communication between researchers in the relatively new field of performing arts medicine, and pianists and piano teachers;
>
> The contradictory information regarding injury-preventive piano technique articulated in both historical and contemporary forms (Lister-Sink 2015, 16) .

The importance of addressing these issues should not be underestimated, because working with piano students of any level in a healthy and holistic way is the best pathway to nurture not only a good piano player, but also a musician and person who can enrich his or her life by enjoyment from musical, comfortable, and injury-free piano playing.

Having looked at some of the directions and thoughts that emerged throughout the 300-year history of piano pedagogy, we can observe that many ideas still maintain their value today. Many concepts from the past, such as the primary role of the mind in the development of piano technique, the significance of musical image in a musical composition, and the importance of coordinated movements in playing, have gained new meanings in light of modern research and discoveries.

A few more conclusions can be valuable in shaping a modern view on healthy and efficient piano technique and teaching. First, piano pedagogy has been moving toward a more balanced and comprehensive approach to the problems of technical development. It has come a long way from the old harpsichord technique of isolated fingers, through the mechanical exercising of the Stuttgart school, then the "anatomic-physiological" school with

its primary focus on movement itself, to the understanding of playing as an integrated process, which involves the mind as much as the body.

Since the pre-piano epoch, great masters like Couperin, Bach, and Mozart focused on the prevalence of musical purpose over technical form. Likewise, in the 19th century, pianists of the Romantic era such as Beethoven, Liszt, and Rubinstein among others reinforced this idea in their playing. At the same time, piano pedagogy went through a period of misunderstandings of the "performer-instrument" relationship, which caused a shift of attention toward the physical side of piano technique. The balance was restored in the late 19th and 20th centuries when such piano pedagogues as Martienssen, Schnabel, Arrau, and Neuhaus, among many others, once again reiterated that it is musical purpose, i.e. the artistic image of music and its embodiment in piano sound, that should guide movement.

Later, in the middle of the 20th century, Kochevitsky focused on the leading role of the mind in piano playing. He connected the processes of the central nervous system with piano playing and learning. Although Watson notes that even nowadays only 20 percent of brain functioning is understood, he asserts that continued research in this area can help to further clarify the neuro-motor activities involved in the development of piano technique (Watson 2009, 213).

Toward the end of the 20th, and now in the 21st century, piano performers, teachers, and students have started to consider their general well-being. More studies have targeted healthy practicing habits, general health, and mental state of piano players. Lister-Sink, Csurgai-Schmitt, and Fraser are among pedagogues who incorporate a variety of mindfulness approaches in their practices, such as the Alexander technique, physiotherapy, and the

Feldenkrais method. They aim to enhance pianists' awareness of the fully integrated mind-body-instrument relationship.

Another derivation that we can make from the historical review offered above is that in spite of the progressive move toward more integrated teaching, piano pedagogy is often slow in acquiring new knowledge and incorporating it into practice. Returning to the earlier quote, Haake was right when he stated that a method always thrives on what is definite, referring to the percussive finger technique. We can add to this that many ideas in piano pedagogy that were rooted in mistakes, including isolated finger training, or teaching note-reading before the proper establishment of aural-motor connections, are unfortunately still often present in the minds of modern piano teachers. On the one hand, it has become quite a challenge to keep up with all of the available information related to the pedagogical arts due to a big number of studies that are concerned not only with the specifics of piano technique, but also with investigations in such areas as environmental influences on the performer, gender differences in learning processes, and performance anxiety. On the other hand, a thoughtful pedagogue can surely take advantage of the many opportunities that modern research offers and add new dimensions to the understanding of the relationship of the performer and music in general, and the performer and the piano in particular.

This brings us to yet another insight into the art of piano pedagogy, namely the uniqueness of every teacher's approach. In spite of all the common ideas found in different approaches at different times, when it comes to practice, a piano pedagogue works out her or his own set of beliefs and principles about piano technique. Practical teaching, which implies an infinite amount of subtle details and corrections, is difficult to describe in writing and

even more difficult to generalize into a fixed method. Breithaupt admitted that he was reluctant to describe his practical work in writing because of the difficulty to convey the principles of technique without practical demonstration (Breithaupt 1909, 5). Leschetitzky[13] was known to declare: "I *have* no method and I *will have* no method... Adopt with your pupils the ways that succeed with them, and get away as far as possible from the idea of a method" (Gerig 2007, 273). Even audio and video aids, which Neuhaus proposed back in 1961, although immensely helpful, are no substitute for the live communication between a piano teacher and student and the hand-to-hand conveyance of practical knowledge.

[13] Theodor Leschetitzky (1830-1915), famous Polish pianist and teacher, among his many students were Artur Schnabel and Ignace Paderewski.

Chapter 2

The Schmidt-Shklovskaya System

Anna Schmidt-Shklovskaya (1901-1961), a Soviet pianist and pedagogue, was widely known in the Soviet Union for her work with pianists with professional injuries. In addition, she taught many other students, all who benefited greatly from her approach. As Galina Minsker, one of Schmidt-Shklovskaya's prominent students and followers, writes in the *Foreword* to Schmidt-Shklovskaya's book *On the Development of Piano Skills*, Schmidt-Shklovskaya developed methods appropriate for all pianists, methods that help students "get rid of discomfort and tension during playing, overcome technical lags, and find necessary means for expressing their [musical] individualities" (Minsker in Schmidt-Shklovskaya 2002, 5).

Schmidt-Shklovskaya explains that her own professional injury was what triggered her interest in the physical and technical problems of other pianists. She believed that erroneous ways of teaching were to blame for the faulty technique she acquired during her childhood,

> I was taught to play with elbows kept tight to the body, claw-like fingers, rigid static hands; wrist was tense, elasticity of hands was absent. The ear control was underestimated in the process of learning. With advancement of repertoire, [I started experiencing] fatigue [and] severe pain in the hands. On the outside, I seemed to play well and even virtuosically, but the pain I felt was at the limit of my tolerance. Doctors [...] could not help (Schmidt-Shklovskaya 2002, 16).

In her search for ways to heal, correct her technique, and maintain her professional career, Schmidt-Shklovskaya met Ivan Kryzhanovsky, a physiologist who worked with pianists' playing-related injuries. As a result of this work with Kryzhanovsky as well as of

her subsequent studies in physiology, not only did Schmidt-Shklovskaya rebuild her own technique, but she developed a full system of teaching that promotes healthy piano skills.

In this chapter, I will describe Kryzhanovsky's discoveries, which provided the theoretical and practical foundations for Schmidt-Shklovskaya's work, and I will explain Schmidt-Shklovskaya's own unique system of piano teaching. The two main sources for this section are Kryzhanovsky's *The Physiological Basis of Piano Technique* and Schmidt-Shklovskaya's *On the Development of Piano Skills* (Kryzhanovsky 1922; Schmidt-Shklovskaya, 2003). All quotes from these books, which were published in Russian, are my own translations. While my research of Kryzhanovsky's work is based solely on his above-mentioned book, Schmidt-Shklovskaya's approach was "handed over" to me by her student and my teacher Galina Minsker, who compiled, edited, and promoted the first publication of Schmidt-Shklovskaya's book. Therefore, although I derived many descriptions of Schmidt-Shklovskaya's principles from her book, I connect them to my personal experience and insight I gained through teaching and learning with Minsker.

Ivan Kryzhanovsky, *The Physiological Basis of Piano Technique*

Ivan Ivanovich Kryzhanovsky (1867-1924) was a Russian physiologist and a medical doctor. Besides being a physician, he studied violin and music theory in the Kiev Conservatory, and in 1900, he graduated from the Saint-Petersburg Conservatory where he had studied composition under Nikolai Rimsky-Korsakov. Kryzhanovsky left a number of pieces, including sonatas for violin and piano, cello and piano, piano trio, vocal songs, and "Theme and Variations for Piano." Considering his compositional output, some music

theorists, such as David C. F. Wright (b. 1946), believe that Kryzhanovsky deserves more attention from the musical world (Wrightmusic, 2016).

Kryzhanovsky wrote two books: *The Physiological Basis of Piano Technique* (published in Russian in 1922) and *The Biological Basis of the Evolution of Music* (translated into English and published by Oxford in 1928). Between 1922 and 1924, Kryzhanovsky taught anatomy and physiology at the Petrograd Conservatory. At that time, as Schmidt-Shklovskaya writes in *On the Development of Piano Skills,* he also worked individually with students with professional injuries. Schmidt-Shklovskaya notes that in each of these cases, Kryzhanovsky carefully studied the cause of the injury, and then used exercises, which he had designed, to cure it. In *The Physiological Basis of Piano Technique,* Kryzhanovsky does not describe any such exercises. Nevertheless, considering the theoretical foundation that he lays out and the exercises that Schmidt-Shklovskaya later developed in her teaching, we can assume that Kryzhanovsky's methods were of a physiotherapeutic nature and were directly connected to piano playing. For example, while Kryzhanovsky writes how important it is for pianists to support their arms using the back muscles, Schmidt-Shklovskaya's book offers exercises that can help players establish this connection. Likewise, based on Kryzhanovsky's emphasis on the necessity to strengthen the smaller muscles of the hand and increase elasticity and flexibility of the hand and fingers, Schmidt-Shklovskaya developed many specific exercises to address these issues. In the following sections, I will enumerate the many insights that Kryzhanovsky offers including his views on piano mechanics, muscular tension, anatomy and physiology of movement, and some of the practical suggestions that he included in his writing.

The Piano Mechanism

In the beginning of his book, Kryzhanovsky describes in detail the mechanism of the piano key and confirms the fact that a player cannot change the sound after the hammer hits the string. Thus, he concludes, any pressure on the key or circular arm movements after the key is depressed are extraneous (Kryzhanovsky 1922, 9). Next, Kryzhanovsky explains how volume depends on the place where the key is depressed, that is, for sound with same volume we need stronger pressure on the key closer to the board and lesser if we play closer to the edge of the key. This happens because the key is a type of a lever that transfers more energy if hit closer to the edge. Later in the 20th century, piano theorists Otto Ortmann and József Gát explored the mechanism of the piano in greater detail in order to better understand piano technique. However, even before them, Kryzhanovsky had started investigating this issue and even compared different piano brands on the subject of how much force is required to depress the key, measuring ranges from 43 g on an Ibach piano to 90 g on an Erard piano (Kryzhanovsky 1922, 10).

After this full discussion of piano mechanism, Kryzhanovsky however concludes that piano key is still a rather inaccurate medium for expressing the finest nuances. He argues that it is the complexity of the neuro-muscular work of the pianist's hand that allows for richness of expression and gradations in the individual styles of different pianists (ibid). As evident from the rest of *The Physiological Bases of Piano Technique*, he thoroughly attends and studies this neuro-muscular work, offering solutions for the development of the most effective piano technique.

Influence of R. M. Breithaupt and Kryzhanovsky's Explanation of Tension and Relaxation

Kryzhanovsky took Breithaupt's theory of natural weight as a starting point for his work. He called Breithaupt's approach "the natural system of piano technique" and praised Breithaupt for using anatomic and physiological knowledge as a solid foundation for solving riddles of the finest movements of pianists. Considering the many inaccuracies and inconsistencies that Breithaupt allowed in his writing in the areas of anatomy and physiology, we can assume that Kryzhanovsky himself, being a medical professional and researcher, clarified and finalized some of Breithaupt's ideas. Even though Breithaupt was subjected to abundant criticism, Kryzhanovsky seems to have been able to read between the lines and understand details of Breithaupt's theory with sympathy for how the latter meant them, and how they could be productively applied to practical teaching. As a result, Kryzhanovsky's description of Breithaupt's "natural system of piano technique" becomes a clear holistic concept, which offers a sensible explanation of the physiology of tension-related issues in piano technique.

From Kryzhanovsky's explanation, it follows that the tension and relaxation of different groups of muscles are closely connected in piano playing and are in constant alternation. He writes that it would be faulty to refer to proponents of the "natural system" as advocates of completely relaxed hands: "It would be a mistake to conclude that in playing by the 'natural system,' hands should be relaxed like rags. On the contrary, at certain moments, there is more muscle contraction and fixation of the joints than in playing by other methods. The essence is

in conscious application, *in the ability to control one's neuromuscular apparatus* and obtain from it everything it is capable of" (Kryzhanovsky 1922, 38, italics in the original).

Although Kryzhanovsky insists that a certain amount of muscle contraction is necessary, he is very clear that pianists should avoid excessive tension. He analyses the physiological and mechanical consequences of such tension. First of all, by tensing muscles more than necessary, pianists use more muscle energy than required. This leads to rapid fatigue of the muscle. Kryzhanovsky writes that from among the many different movements and positions that pianists use, only those that require contractions of the least amount of muscles are correct from the physiological point of view. Such physiologically justified positions and movements allow for the rest of the muscles to be free, and therefore ready for the next move (Kryzhanovsky 1922, 25). He strongly criticises the "finger system," in which a constantly curved and lifted position of fingers demands an enormous amount of neuro-muscular energy (ibid).

The second negative effect of excessive muscle tension is the physiological imbalance in the work of antagonist muscles: while one extended muscle is over-tensed, the complementary flexed muscle is overstretched. This imbalance causes extra pressure of the surfaces against each other in the corresponding joint, which in turn leads to a reduced range of motion of tendons in the tendon sheaths and to overall rigidity. To overcome the reduced range of motion and inflexibility, the player has to use even more tension and muscle energy for the movements of hands and fingers, thus creating a vicious cycle that could lead to injury (Kryzhanovsky 1922, 39).

Finally, Kryzhanovsky emphasises that for pianists, a keen spatial muscular feeling is of utmost importance, because this proprioceptive sensation and not the visual orientation guides the position of the hand and arm on the keyboard. He insists that only a minimum amount of contraction of the working muscle and quiet of the other muscles will provide the necessary condition for achieving the refined muscle-feeling so indispensable for a freedom of motion in piano playing (ibid).

In spite of Breithaupt's influence on Kryzhanovsky's views, there is a significant difference in their theories. Unlike Breithaupt, who searched for some universal movements suitable for every pianist, Kryzhanovsky believes that it is impossible to pre-plan the work of pianist's muscles in all details. He writes that the chains of movements in piano playing are so complex that even experimental studies cannot result in an exact picture of all the contractions and relaxations of the working muscles (Kryzhanovsky 1922, 20). Needless to say, nowadays, almost 100 years since Kryzhanovsky's writing, there are a number of studies that aim to accomplish those measurements. By using advanced equipment such as electromiograph and MIDI-connected piano, for example, researchers are trying to obtain the data, which, they hope, will help pianists to better monitor their muscular work (see Chapter 1 for examples of the experiments). Still, Kryzhanovsky's point that it is impossible to access all the fine neuro-muscular work during playing remains credible. He foreshadows later scientific beliefs and research on the complexity of these neuro-muscular connections, such as those explained by Nicholai Bernstein (discussed in Chapter 3).

Kryzhanovsky's Physiological Fundamentals of Pianists' Movements

As Kryzhanovsky approached piano technique mainly from the viewpoint of a physiologist, he believed that findings in physiology were a valuable source of information and should be taken into consideration by pianists and teachers (Kryzhanovsky 1922, 11). Although even today, many piano players and teachers would argue against the usefulness of such knowledge in their work, growing evidence on playing-related injuries proves the merit of Kryzhanovsky's position (for statistics on pianists' playing-related discomfort and injuries, see, for example, Rogers 1999).

Kryzhanovsky's physiological expertise allows him to describe possible movements of the hands and arms and to specify those that are particularly important for piano playing. Following his description, we can highlight the following:

1. The arm is a system of bone levers[14] of different size, from the biggest, the shoulder, to the smallest, the finger phalanx. The bone levers are connected by joints and are set in motion by muscle contractions.

2. Rotation of the forearm in the radioulnar joint of the elbow, which also includes pronation and supination of the hand, is an indispensable movement in piano technique.

3. Palmar, dorsal, and interosseous ligaments of the hand can be developed and stretched to promote a greater mobility of metacarpal joints.

4. The thumb joint is very mobile and capable of both opposing position of the hand and of circular movements.

[14] With this understanding of the bones as a system of levers, Kryzhanovsky foreshadows the work of Ortmann, which was discussed in Chapter 1.

5. The separation of fingers is limited by the ligaments in the palm, but can be improved with exercise.

Based on the above physiological features of bones, joints, and muscles, Kryzhanovsky deduces three laws for the efficient use of the hand, arm, and the whole upper body in piano playing. He names them the law of arc-like movements, the law of bigger levels, and the law of rest.

The law of arc-like movements concerns circular motion of the bones, which, as Kryzhanovsky explains, is an inevitable result of the working mechanism of joints, that is, "During any movement occurring in a joint, the distal end of the bone always follows a circular trajectory" (Kryzhanovsky 1922, 16). Based on that integral circularity, Kryzhanovsky insists that all movements during playing, be it finger lifts, or movements of the thumbs or shoulders, should be arc-like or at least nearing such. Let us remember Neuhaus who also wrote that against geometry rules, for pianists, "our shortest distance between two points is a curve" (Neuhaus 1993, 108).

Next, Kryzhanovsky's law of application of the bigger levers refers to the muscles as the sources of pianists' moving power. In order to use muscle energy efficiently, Kryzhanovsky argues that pianists should use "the least movement of the biggest levers," so that the strength required from different muscle groups will be proportionate to the physiological capacities of those muscles (Kryzhanovsky 1922, 34, 18). For example, the production of louder sound would need the work of the larger levers of the pianist's apparatus, such as the shoulders and forearms, while the more delicate power of the hand and fingers would be most appropriately used to produce a quieter sound (ibid). Once again

Kryzhanovsky criticizes the old "finger school" because he considers its requirements to create, for example, powerful *forte* by using the strength of fingers alone to be ill-founded from the physiological point of view, "[We] cannot demand from interosseous or vermicular muscles the work that needs the strength of biceps or triceps" (Kryzhanovsky 1922, 18).

The third law could be called the law of rest or the law of balance of tension and relaxation**.** Kryzhanovsky formulates it in the following way, "During any pianist's movement, the only muscle group contracted should be the one that initiates that movement. Other muscles, which do not directly participate in the movement, should not go into the state of tension" (ibid). As this law is the main principle of any muscle work, Kryzhanovsky considers it a cornerstone of the "natural system," and ensures that its application allows for the most effective work at the piano with the minimum degree of fatigue.

Practical Solutions

1. Body position

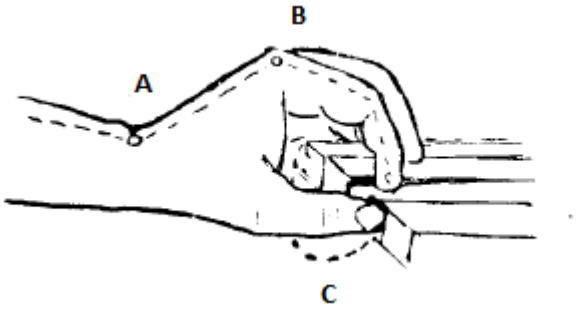
Although Kryzhanovsky believed that pianists' muscular work is too complex to measure it precisely, he suggests ways for pianists to distinguish the state of tense muscle from the state of normal physiological tone. He writes that pianists can develop a state of alertness, which is different from tension, and learn to inhibit any excessive tension and use only those groups of muscles that are required for playing purposes. He recommends that piano teachers start with the larger muscles such as biceps, triceps, deltoid and pectoral muscles and teach students to notice, observe, and distinguish tension in those first, gradually moving to the smaller muscles of the forearms and hands (Kryzhanovsky 1922, 22).

Kryzhanovsky further maintains that the main condition for this free-from-tension working state is the position of the body. Therefore, by adjusting and changing the position of torso, shoulders, arms, and hands, a pianist will be able to find the best state for free and comfortable playing. Talking about body position, Kryzhanovsky comes to an important conclusion that "disturbance of the law of the 'tension-rest balance' [...] inevitably leads to the impairment of the quality of sound" (ibid). This is a valuable point in Kryzhanovsky's work, because even though he mainly focuses on the physiology of piano playing, a number of times throughout the book does he emphasise the connection between the work of the body and quality of the sound. We will further see how Schmidt-Shklovskaya implemented this connection in her practice directing each exercise or technical pattern toward the search and development of beautiful and meaningful piano sound.

Returning to the physiologically-justified position of the pianist's body, we can observe that beyond recommendations regarding the player's conscious attendance of tension and relaxation, Kryzhanovsky adds specific advice dealing with the position of the back, shoulders, and hands. He suggests that pianists slant the torso slightly forward (10-30 degrees) arguing that this position promotes freeing of the muscles of the back and shoulder blades, and that consequently, the muscles of shoulder girdle become free of tension. He further states that players should avoid lifting the shoulders unless significant volume in chordal texture requires a bigger swing of the arm.

2. "Bridge" position of the hand

Moving on to the hand and fingers, Kryzhanovsky writes that the best position is when the fingers and hand form an open angle in the metacarpal joints (angle "B" in *picture 1*), and the hand and forearm form an open angle in the wrist ("A"). Kryzhanovsky lists multiple benefits of this "bridge" position. First of all, these two angles create points of support for the ligaments of the hand and wrist. Next, thanks to such support, the muscles of the forearm will need to use only minimum energy to keep fingers on the keys. As well, in this "bridge" position, the stability of the fingers will allow muscles to rest after a contraction, rest being, according to Kryzhanovsky, a necessary condition of successful muscular work. Yet, Kryzhanovsky asserts that the most important benefit of the "bridge" position is the role that the fingers can thereby play in transferring the weight of the arm into the keys. Because this position uses minimal lifts of the fingers and therefore does not overload the fingers' flexor and extensor muscles, it allows for the combined work of the arms and the fingers. A contemporary American pedagogue, Seymour Fink and a Canadian Alan Fraser advocate similar positions (Fink 1997, 36, Fraser 2011, 51).



Picture 1. **Angles in "bridge" position (Kryzhanovsky 1922, 27)**

3. Thumb

Kryzhanovsky writes that most pianists do not use the thumb to its full capacity in spite of its anatomical benefits such as its opposition to the palm, the span between the thumb and index finger, and the thumb's great mobility at the metacarpal joint, including capability for circular movements (Kryzhanovsky 1922, 14). The general resistance to using all of the thumb's abilities might have historical roots. J.S. Bach was one of the first keyboardists who insisted on a wider utilization of the thumb in keyboard playing, but before him, harpsichordists and clavichordists considered the thumb to be too heavy and clumsy to adequately control its touch (Schweitzer 1966, 206).[15] In modern piano pedagogy, the thumb does get addressed. Fraser, for example, pays substantial attention to the thumb technique in *The Craft of Piano playing* and in *All Thumbs: Well-coordinated Piano Technique*. Still, piano students often encounter technical challenges and tension caused by movements of the thumbs, which may mean that they do not fully realize the natural and potential benefits of the thumb structure.

One of Kryzhanovsky's suggestions deals with the role of the thumb in position shifts, i.e., crossing the thumb under the fingers. Kryzhanovsky recommends that the player move the thumb down, below the keyboard level, following the circular trajectory until it reaches a required key ("C" in *picture 1*). In Kryzhanovsky's opinion, this circular thumb motion corresponds to other arc-like movements, which, as I have mentioned, Kryzhanovsky believes should be preferred to straight horizontal moves -- even if the latter are more evident

[15] Johann Sebastian's son, Carl Phillip Emmanuel, also describes the common practice of thumb avoidance and his father mentioning that "in his [Johann Sebastian's] youth he had heard great men who never used the thumb except when it was necessary to make big stretches" (Schweitzer 1966, 206; also, Bach 1949, 43).

(as with crossing the thumb under fingers). Although the recommendation to lower the thumb below the keys is arguable, Kryzhanovsky's essential suggestion of expanding the range of thumb movements is convincing.

4. Stretching

Although Kryzhanovsky recognizes that the separation of the fingers is limited by the hand ligaments, he nevertheless argues that the span and flexibility of the hand can be increased. He writes, "One of the essential conditions in piano playing is a sufficient span of [pianist's] fingers, the ability for a maximum abduction from the middle line [of the hand] in order to play wide intervals and chords" (Kryzhanovsky 1922, 48). By careful exercising, pianists can stretch hand ligaments to make them more supple and elastic, which will not only promote a wider span of the hand, but will also make the fingers more flexible, mobile, and better equipped for their sideways and circular movements (ibid).

However, Kryzhanovsky continues, often pianists lack flexibility in their hands and fingers in spite of many years of practicing. In his opinion, this paradox occurs because of the players' often incorrect approach to the development of finger independence, which is an important condition for virtuoso playing: many methods (including the notorious "finger system") emphasise high finger lifts in order to develop independence and strength in the fingers. While these methods aim to give fingers more mobility, because of inevitable build-up of excessive tension and fatigue of extensor muscles, the result of such finger workouts is exactly the opposite and often lamentable: rigidity of the hand and difficulties in fast and precise finger movements (Kryzhanovsky 1922, 46). Instead, Kryzhanovsky insists, correct

distribution of the working load between the larger levers of the pianist's apparatus will create ideal conditions for gradual stretching of the hand ligaments, which in its turn will promote flexibility and mobility in the fingers (Kryzhanovsky 1922, 49-50).

Kryzhanovsky's View on Pedagogical Practices

When Kryzhanovsky wrote *The Physiological Basis of Piano Technique*, the "finger system" was still one of the leading methods of piano teaching and practising. Kryzhanovsky mentions that this system was widespread in Russia in both professional and amateur worlds, and it dominated in the German conservatories where it originated (Kryzhanovsky 1922, 52). Not surprisingly then, in his book he evaluates and compares the two systems: the new "natural system" and the old "finger school." As evident from the above discussion, his comparison balanced out against the "finger system," which Kryzhanovsky denounced as physiologically wrong and which he blamed for an upsurge of professional injuries at the turn of the 20th century.

Kryzhanovsky, who devoted a sufficient part of his medical practice to injured pianists, clearly and emphatically appealed to pianists and pedagogues to abandon the injurious approaches and to follow the "natural system." To the question of whether medical specialists alone should cure "pianist's spasm," he answers with certainty that they cannot do it without piano pedagogues playing their role in teaching and re-training pianists. He writes that doctors curing most common pianists' ailments such as tendonitis and myositis tend to find the cause of injuries "in too long hours of practicing, too difficult repertoire, too small hands, etcetera" (Kryzhanovsky 1922, 62). However, the real cause, in most cases, is incorrect

positioning and faulty habits, acquired by students due to poor teaching methods. In this light, Kryzhanovsky's advice to engage piano pedagogues to play a bigger role in curing playing-related injuries remains convincing and reasonable even now. Even more valuable for today's pedagogy is his strong insistence on a more educated approach to piano teaching, wherein teachers would base their students' training on knowledge of pianists' apparatus and would avoid going against the physiological laws of the body's movements.

In the modern world of piano pedagogy, while such extremes as the "finger system" with its long hours of idle finger exercises, are vanishing (not always and not everywhere!), there is still a lack of education in the physiology of movement amongst piano teachers. Kryzhanovsky writes that more often than not, teaching methods ruin the correct movements that many students adopt intuitively (Kryzhanovsky 1922, 25). If we add that nowadays there is still no consensus on what is right or wrong in teaching piano technique, the urgency and importance of addressing issues of healthy piano technique is made clear (Lister-Sink PhD Dissertation, 2015). Kryzhanovsky mentions that there are as many methods of teaching as there are teachers, a hardly arguable fact. He believes that the credible opinion of physiologists will help pianists and pedagogues to realize that only a system that takes into account the physiological nature of movement will be the best one for playing and teaching (Kryzhanovsky 1922, 43).

The Fundamental Principles of the Schmidt-Shklovskaya System

Minsker calls Schmidt-Shklovskaya's method "The system of principles of organization and improvement of pianists' playing apparatus, based on clear understanding of its [the

apparatus's] nature and functional abilities" (Minsker in Schmidt-Shklovskaya 2002, 6). It follows that Schmidt-Shklovskaya built every one of her fundamental principles on thorough anatomic-physiological knowledge, which she gained first from Kryzhanovsky and later from her extensive pedagogical experience (ibid). In laying out these principles, Schmidt-Shklovskaya also makes clear that this careful attention to the pianist's apparatus does not obscure the high musical purposes, which technical skills serve. Rather, Schmidt-Shklovskaya subordinates fine muscular work to constant ear control, thus incorporating musical and technical sides of piano playing into one process.

Sound and Touch

The first and the most important concept of Schmidt-Shklovskaya's system is piano sound. In piano pedagogy, sound often loses its primary position, becoming obscured by other elements of the learning process, such as sight-reading or technique. This may be exacerbated because some features of the piano, including equal temperament, abstractedness of timbre and the physical remoteness of the player from the source of sound (the strings), can make it challenging for the pianist to create expressive sound. Nevertheless, we may find it surprising that piano sound is, as Boris Berman writes, "frequently neglected by teachers and students or ... receives only perfunctory attention. For music, this omission is as strange as ignoring colour in visual art or body movement in acting" (Berman 2000, 3). Minsker points out that Schmidt-Shklovskaya followed her teacher Blumenfeld[16] in her aspiration to achieve a singing tone, "the clear sound of the string, as much as possible without any extraneous noises from the colliding wooden parts of the piano mechanism or from the

[16] Felix Blumenfeld (1863-1931), a Russian pianist, pedagogue, and composer.

'flopping' finger strokes" ((Minsker in Schmidt-Shklovskaya 2002, 7). Schmidt-Shklovskaya did not tolerate "white" meaningless sound, and always required from her students that they convey the music's contextual meaning through expressive, colourful tone (ibid).

Minsker further explains that this attitude to sound underlies all of Schmidt-Shklovskaya's guidelines for the development of students' technical skills, beginning with those pertaining to touch. Schmidt-Shklovskaya worked on a variety of tactile sensations to instil in students a feeling of fusion of fingers with piano keys, so that the fingers become imaginary "extensions of the string" (ibid). With this philosophy, Schmidt-Shklovskaya was not inventing an entirely new concept, but rather creating a more systematic and intentional way to broach a much older understanding of playing "beyond the keys." In fact, ever since Beethoven's time pianists have cultivated the notion of perceiving piano sound from the strings, and many renowned pedagogues have promoted close-to-the-key touch to achieve deeper cantabile tone. This way of sound production became especially notable in the 19th and early 20th centuries when Romantic composers and performers realized that piano sound opened great opportunities to create broad melodic lines and singing tone. Rachmaninoff expressed this idea of integration of a performer and an instrument when he compared pianist's fingers to the roots of the tree growing into the keys. Schmidt-Shklovskaya was certainly a successor of this tradition.

Intonation

Close to the sound production is Schmidt-Shklovskaya's next principle, which is her work on intonation. In order to achieve the desired singing sound and expressive intonation,

many pianists have put a lot of effort into overcoming the percussiveness of the piano. A Hungarian pianist Andras Schiff notes that even though the piano cannot produce "a perfectly smooth legato... the art of piano playing rests on the ability of a musician to create the illusion of these things [diminishing sound and legato]" (Schiff in Isakoff 2011, 197-198). Other pedagogues, although not directly connected to Schmidt-Shklovskaya, also support her insights on intonation. Nadezhda Golubovskaya, a famous Russian-Soviet pianist and pedagogue of the 20th century, writes that while melodiousness is an essential concept for working on sound, it is not necessarily the legato touch or the character of each individual tone that contributes to melodious playing on the piano. According to her, legato on the piano is an acoustic concept, while melodiousness is a creative one. Therefore, when attempting to create expressive sound, pianists should work first of all on intonation, or inflection of the melodic interval (Golubovskaya 2007, 152).

Because the piano is an instrument with a fixed pitch and equal temperament, deviations from a pitch are impossible, so pianists are deprived of this natural way of expression. Moreover, the physical effort that is involved in the production and expression of sound by a vocalist or an instrumentalist is also different on the piano. Leon Fleisher says:

> As a pianist, we have a built-in difficulty that is unique only to us, and that difficulty is that every other instrument...is physically involved in the production of sound, the maintaining of the sound. A wind player keeps breathing out the life's breath in order to maintain a sound. A string player must keep the bow in movement ...Me, push down a key, and somehow, through magic, we have to pretend that we are hearing it, supporting it, maybe even making a crescendo, until- boom- we push down the next lever which is what this keyboard is (Noyle 1987, 94).

What this means is that a pianist must understand that the physical ease of producing the sound of a required pitch on the piano is both a benefit and a drawback when one wants

to create expressive intonation, and this should make pianists "terribly aware of the amount of tension or density that's involved in the interval" (ibid). Golubovskaya extends this idea by adding that pianists should treat a melodic interval not like a space on the keyboard, but like an effort to overcome this space. To realize this effort as expressive intonation, pianists have to employ subtle changes of volume and timing, among other means of expression. However, the attention to sound is not meant to produce exact measurements of these slight changes, but rather to nurture the player's ability to follow the live curves and breaths of a melody and to express these when playing (Golubovskaya 2007, 152, 173).

The above lengthy deviation helps us understand the roots of the Schmidt-Shklovskaya's approach to intonation. Minsker writes that once again Schmidt-Shklovskaya followed Blumenfeld's traditions of touch when she taught students to open the fingers from the palm to reach for the key. Such touch not only helps make an interval more expressive, emotionally charged, and spacious, but it also creates those subtle time variations that Golubovskaya talks about. Thus, Minsker continues, not only is this way of touch anatomically reasonable, but it is musically justified, too (Minsker in Schmidt-Shklovskaya 2002, 8).

"From inside out"

The next important principle for Schmidt-Shklovskaya is that pianist should focus on the inner feeling rather than on the outer form of a movement. Minsker indicates that the main task Schmidt-Shklovskaya set for her students was "not to copy [teacher's] movement, but to find sound" (Minsker in Schmidt-Shklovskaya 2002, 10). For Schmidt-Shklovskaya,

the search for expressive piano sound always originates with the ear and only then connects to a specific muscle tone and sensation. As a result, Schmidt-Shklovskaya's students developed a strong bond between the conception of a certain sound colour and a corresponding muscular feeling in the hand (ibid). Therefore, Minsker continues, when Schmidt-Shklovskaya taught that the search for a certain sound and inner muscular feeling should shape a pianist's outer movement, she maintained the idea of going from "inside out," promoted by other distinguished pedagogues of her time such as those mentioned in Chapter 1 -- Martienssen, Kogan, and Neuhaus among others.

One substantial feature of Schmidt-Shklovskaya's method of connecting the inner to the outer was a direct hand contact. To help students find the correct muscular feeling, Schmidt-Shklovskaya asked them to touch her own hands and arms, conveying the required state of the muscles through direct contact. Other piano pedagogues, including Breithaupt, Guterman, Lister-Sink also found this way of teaching highly effective (see Chapter 1). Minsker mentions that Schmidt-Shklovskaya also used direct touch to check for any knots of unnecessary tension or spasmodic contractions of the muscles, which could occur even when playing looked comfortable on the outside (Minsker in Schmidt-Shklovskaya 2002, 11).

Individual Approach

Finally, one more fundamental feature of Schmidt-Shklovskaya's work is her close attention to students' personalities and her talent for revealing each student's best musical abilities. According to Minsker, Schmidt-Shklovskaya's main pedagogical goal was to help every student to adapt to the instrument individually, to find and learn to cultivate his or her

own comfortable feelings. The guidelines she provided were the bases on which students would be able to build their personal individual technique (ibid).

In addition, Schmidt-Shklovskaya emphasizes that for successful work at the piano, a teacher has to create the right atmosphere. Because piano playing requires resilient and active tone in the muscles, which by no means should be limp or weak, Schmidt-Shklovskaya recognized the necessity that students attain a state of confidence and joy (Schmidt-Shklovskaya 2002, 20). According to Minsker, Schmidt-Shklovskaya built such working environments with a great success because of her extraordinary soulful attitude to every student and because of her goodwill, which was contagious to others (Minsker in Schmidt-Shklovskaya 2002, 6).

Specific Guidelines

Schmidt-Shklovskaya's fundamental principles, such as her attitude to sound and intonation, her prioritization of musical conceptions in technical work, and her close attention to the individual abilities of her students, are rooted in the best traditions of piano performance and pedagogy. Her innovations were the specific methods of work and unique exercises she came up with to fulfill these requirements. Minsker highlights the following guidelines that differentiate the Schmidt-Shklovskaya method from other schools of piano pedagogy.

1. Players should support their arms by the muscles of the back, underarms, and by the lower muscles of the shoulder bones. Such support prevents the arms' fatigue and creates the

working tone of the torso (Minsker in Schmidt-Shklovskaya 2002, 11). Schmidt-Shklovskaya specifies that the arms should work not from the shoulders but from the torso, so the main workload is assigned to the strong muscles of the back and chest. Pianists can imagine a vertical "stem" going through the spine to help them maintain the correct body position. Schmidt-Shklovskaya insists that attention and care of players' posture should be the first teacher's task when organizing students' movements (Schmidt-Shklovskaya 2002, 24). In addition, she points out, this correct position of the back promotes freedom of the neck and a higher position of the head. In its turn, a high head allows the player to hear sound from further away, "from the hall," rather than from the spot at the piano, thus contributing to better overall control of performance (ibid).

2. Schmidt-Shklovskaya insists that a steady position of the hand on the keys should be created not by the more traditional support of the metacarpal joints ("bridge" position), but by support of the whole palm. She explains that the "bridge" fixates the position of the hand to a certain extent, which makes the work of the fingers more difficult, whereas the flatter "palm" position with wide springy "dome" inside the hand provides the best condition for independent work of fingers (Schmidt-Shklovskaya 2002, 22).

3. Schmidt-Shklovskaya compares the arm to a channel, through which sound flows. This image helps to deliver music, or "breathe it out," in an unconstrained effortless way (Minsker in Schmidt-Shklovskaya 2002, 12). Schmidt-Shklovskaya suggests that a player should feel such free fluidity, that is, the absence of any tension, spasms, or fixations, not

only in the arms, but also in the whole body. Consequently, this state of "channelling" sound through the body and arms can help the player to connect with the piano so that the performer and the instrument become one unified organism and the player almost does not sense the arms physically, but instead is free to focus on listening, feeling, and controlling the flow of music (Schmidt-Shklovskaya 2002, 25).

4. Schmidt-Shklovskaya recommends careful stretching of fingers, the idea she adopted from Kryzhanovsky. She insists that stretching should never be forced, but should rather be an effortless spreading or expansion of fingers. It is important that a pianist feel the stretch inside the palm and not in the extensor muscles (Schmidt-Shklovskaya 2002, 21).

5. Schmidt-Shklovskaya approaches repetition, which is one of the important skills in piano technique, in a different way than other teachers. While most players perform repetition, flexing fingers toward the palm, she suggests letting fingers out after each touch -- the position that promotes more efficiency and lightness (Minsker in Schmidt-Shklovskaya 2002, 12).

6. Players should avoid isolated wrist movements. Schmidt-Shklovskaya insists that the function of the wrist in piano playing is to complement the movements of the arm and to serve as an absorbent spring. She writes that integral movements of the large parts of the arm promote better control and precision, while isolated movements of the wrist are less precise and might cause unwanted "wooden" and flopping noises. Moreover, this unity of the whole

arm from shoulder to finger tip will help to avoid unnecessary and unclear movements, which could disconnect a player from immediate contact with the keyboard (Schmidt-Shklovskaya 2002, 24).

An Overview of the Exercises

The exercises developed by Schmidt-Shklovskaya and compiled by Minsker in *On the Development of Piano Skills* are "rather rudimentary technical formulas, in which various ways of sound production and working methods are encoded" (Minsker in Schmidt-Shklovskaya 2002, 9). Minsker points out that these exercises are brief patterns, which piano teachers can take as a basis to design their own combinations and versions (ibid).

On the Development of Piano Skills is divided into chapters on different aspects of piano technique, such as "The basics of sound production," "Rotation and trills," "Repetitions," "Scales and arpeggios," "Chords and double notes." This approach of arranging exercises according to a specific type of piano technique is quite common in piano literature. What differentiates Schmidt-Shklovskaya's writing from others is the way she describes the exercises. Rather than giving a general idea of the position and movements (Neuhaus) or putting together note examples (Cortot), she describes in detail *what* pianists should feel when executing each exercise and *how* to connect and subordinate this feeling to ear control. For example, in the very first exercise at the piano, that is making one sound, Schmidt-Shklovskaya advises that the students be encouraged to constantly focus on sonority and listen for the rich deep sound produced by each finger. At the same time, she attracts students' attention to the feelings of the arm, which ideally become a channel for an

unobstructed flow of sound. For this, she recommends that, before playing, the pianist raises his or her arms up and thinks of their weight flowing down into the back, so that the arms become light; next, during playing, the pianist is enjoined to reverse the feeling, and so to transfer weight from the back, through the finger tip, into the key.

Referring to Schmidt-Shklovskaya's specific methods of work, Minsker highlights a series of exercises that use exaggeration as a technique and compares this method to ballet practice, when dancers expand their technical abilities by gradual stretching. For example, "flying" movements, which are intended for the development of lightness and independence of fingers, use exaggerated openings of the palm and fingers (Minsker in Schmidt-Shklovskaya 2002, 9). While some exercises, such as the one above, have to be performed "fast in slow tempo" (quick movements with stops and rests in between executions), others need an actual slow pace. Minsker calls this type of work "practicing through a magnifying glass" where, by exaggerating the movement and touch, a player perceives a more definite and clear sensation, thus reinforcing and maintaining the correct feeling (ibid).

A remarkable feature of the Schmidt-Shklovskaya system is the adaptability of her exercises to any piano texture, which allows pianists to use them in a wide range of piano repertoire of different styles and levels of difficulty. Moreover, a brief and concise design of the patterns encourages creativity because both teachers and students can and should work out their own variants depending on the task at hand.[17]

Schmidt-Shklovskaya designed a special group of exercises, which she called "Gymnastics," to be practiced away from the piano. The purpose of these exercises help to activate and strengthen muscles that participate in pianist's work, and to promote the correct

[17] Additional references as well as description of sample exercises are found in Chapter 4 and Appendix 1.

posture and interactions between all parts of the pianist's apparatus (Schmidt-Shklovskaya, 26). She was not alone in using preparatory exercises before playing. Seymour Fink, for example, provides exercises to help pianists develop muscular sensations and to prepare the player for the specific movements of piano technique, such as rotation and swings (Fink, 1997). A Hungarian pedagogue, Geza Kovacs also developed an interesting system, which includes alternating activities at the piano and away from it, as well as games with a ball, which he believes will help students develop dexterity and precision of movement (Kovacsmethod, 2015). Likewise, physiotherapists recommend doing warm-up exercises and stretches before and after playing, similar to those described by Csurgai-Schmitt and Horvath (Csurgai-Schmitt 2002, Horvath 2002). It is unfortunate that all these useful recommendations have so far had very little impact in modern piano pedagogy, where not only students, but teachers themselves, are bound to a sitting position for long hours, and would therefore greatly benefit from more movement.

Schmidt-Shklovskaya was best known for her work with pianists' playing-related injuries. Her contribution in this area is hard to overestimate. Minsker mentions that during her active career, Schmidt-Shklovskaya helped more than 100 pianists in rebuilding their skills, improving their work habits, and ultimately curing their ailments and returning to the musical world. However, as I have explained above, the Schmidt-Shklovskaya system offers a comprehensive foundation for integrated musical and technical development of students with different abilities and musical goals, and thus could be incorporated into general piano pedagogical practices.

Schmidt-Shklovskaya based her teaching on the best musical traditions in piano performance, including advocating attention to sound and intonation, and the integrity of musicality and technique. At the same time, using her studies with Kryzhanovsky and thorough knowledge in the physiology of movement, she stepped forward by offering a unique and practice-oriented system for the development of piano skills and healthy piano technique.

Almost all Schmidt-Shklovskaya's students became professional musicians and a few of them followed her path and became specialists in playing-related injuries. Still, her system deserves more attention from the world of modern piano pedagogy. Its impact would undoubtedly benefit piano students of all levels.

Chapter 3

Bernstein's Theory of Multi-levelled Coordination as Applied by Galina Minsker in Piano Pedagogy

Galina Minsker

Galina Minsker is one of just a few worldwide specialists in pianists' professional injuries. Currently retired from her position at the University of Culture and Arts in Saint Petersburg, Russia, she continues to lecture, and to work with pianists with playing-related injuries. Minsker's innovative approach stems from her discovery of Nicholai Bernstein's theories. She proposes that Bernstein's theory of multi-levelled motor control creates a universal theoretical foundation for piano technique, and consequently for piano teaching.

Nicholai Bernstein

The Soviet scientist Nicholai Bernstein (1896-1966) dedicated most of his professional life to the study of how the brain controls movement. His theoretical conclusions were well supported by experimental data and medical observations: he established experimental laboratories and collaborated with other neurologists, pathologists, and specialists in sport and music physiology. One of the most important and groundbreaking concepts that Bernstein formulated based on his experiments was the hierarchical theory of coordination. Latash notes that Bernstein was ahead of his time in understanding many aspects of motor control: while contemporary studies describe various versions of multilevel systems of human coordination, "the Bernstein scheme even now seems to be quite modern, and perhaps it remains the most complete" (Latash 1998, 7).

Levels of Motor Control

Bernstein compares the human brain to a multi-storied building whose stories emerged successively, one after another during the evolution process. During each new evolutionary step, a new section of the brain emerged, and a new, higher level of motor control developed, while the older levels took subordinate positions. In other words, what was the highest level of motor control for the fish became the lowest for humans. While our simplest movements are controlled by those older, lower centres of the brain and do not reach the threshold of consciousness, coordination of more complex skills is a "multi storied" hierarchical structure: such movements are controlled from different "floors" of the central nervous system, and each of the floors performs a certain function. The highest of the levels that participates in a motor task takes on the role of conductor; it becomes the leading level of this task and controls the whole motor act, the purpose of which we understand consciously. Consequently, the lower levels become backgrounds of the leading one, and the components of the movement that they control are performed automatically (Minsker 1988, 3). Thousands of daily actions that we deem simple, such as putting on clothes or washing hands, require participation and coordination of several of these levels of motor control. In consideration of piano playing, Altenmuller believes that it is "one of the most complex, multifaceted psychomotor activities known to humankind" (in Lister-Sink 2015, 5). This belief makes Minsker's quest into Bernstein's theory of multi-levelled motor control incredibly valuable and worthy of piano pedagogues' attention.

Levels E and B

As *Table 1* demonstrates, music performance is led by the highest level. E. Bernstein proposed that there is not one, but several levels above the level of actions D. However, as he recognized the lack of scientific data on the functioning of the cerebral cortex at the moment of his research and writing, he suggested combining these levels in one group, E (Bernstein 1947, 37).

Regardless of the lack of empirical study, Bernstein speculates that the levels of group E are not just psychological links, but are actual whole co-ordinations with specific features (Bernstein 1947, 145-146). He explains the coordination in musical performance via the example of the process of bowing in string instruments. Although level D participates directly in manipulating the bow, the motivations of the player to move the bow this or that way over the strings cannot emerge on this level, because such movements do not make any sense in relation to the objects: the hair of the bow applied to the strings of the instrument (Bernstein 1947, 149). Besides, level D does not have sensory corrections that correspond to string players' movements: neither artistically effective sound, nor expressive dynamics of the sequence of sounds belong the synthesis of level D; meanwhile exactly those features define the control of the entirety of the coordination corrections of a string player.

Table 1[18]

Levels of Motor Control

	Name by the brain centre	"Common" name	Emergence during evolution	Functioning	Examples of movements
E	High cortical	Group of high cortical levels	Humans	Higher purpose controls movements: content in language and writing, artistically effective sound, expression in musical performance.	All types of meaningful speaking and writing, musical, theatre and dance performance.
D	Parietal-pre-motor	Level of actions	Humans; High apes in certain actions.	Sequences (or chains) of movements that together solve a motor problem. All the movements that are part of the chain are related to each other by the meaning of the problem	Infinite list of actions with objects in a) daily life (putting on clothes, cooking, washing); b) professional labour (tool operating, putting a thread into a needle, loading paper into copying machine); c) sports (games with the ball, wrestling).
C	Pyramido-striatal	Level of space	Birds, mammals	Ability to use space. Movements are aimed, purposeful, have beginning and end, lead to a definite result.	Movements based on locomotion; athletic, acrobatic, and dance movements in space; transferring objects in space field; swinging-throwing movements.
B	Thalamo-pallidar	Level of muscular synergies	Arthropods, Amphibians.	Controls muscular-articular links; important in the formation of motor skills and automation of movements.	Mechanisms and background corrections for many movements: running, walking, jumping, swimming, and more.
A	Rubro-spinal	Level of tone and posture	Ancient vertebras, fish	Responsible for neck and trunk motions; controls involuntary and some semi-voluntary movements.	Involuntary: shivering from cold, wincing. Semi-voluntary: maintaining equilibrium in free jumps such as parachute, ski, and diving jumps. Piano: fast octave tremolo; strings: left hand vibrato.

In piano teaching, there are different ways to set a task. The teacher can ask the student to simply press the key down, or "take" a sound from the key, or make a *cantabile* sound.

[18] The table is compiled based on the materials from *On Construction of Movements* and *Dexterity and its Development.*

Likewise, the student can think of bringing the hand to the keyboard, or breathing the sound out from the arm, or breathing out a few sounds, or saying out a musical phrase, or saying it out happily. Minsker insists that the formulation of a task on the highest level of motor control is a crucial consideration for pianists. Regarding piano pedagogy, she writes that a teacher has to frame the task in such a way that in its rendition, a student is guided by the highest level of motor control for this particular task. In order to set it on the right level, the teacher has to direct the student's attention to the ultimate purpose of the motor task, that is an artistic goal -- musical content, sound, and expression (Minsker 1988[19], 6).

She indicates a common pedagogical mistake, namely, attracting students' attention to an outer form of movement or to a certain shape of the hand, thus setting the goal on a lower level of motor control. One classical example is teaching a student to hold the hand in an "apple" position. Other examples are requirements to keep elbows at a certain distance from the body or asking students to watch their hand position when lifting it off the keys. By directing students' attention to the movement itself rather than to its purpose, teachers propel the central nervous system to work from the level of muscular-articular links (B). While this level provides important background corrections for virtually all human movements, pianists' skills that are shaped on this level only, that is, without aural supervision from a higher level, will be substantially limited in potential to grow. Such skills are not flexible, and a student will find it difficult to adapt them to new tasks, for example mastering a different type of piano texture.

This "inflexibility" is necessary and advantageous for the body, because in the complex process of acquiring a new motor skill, Level B is responsible for the automation of the

[19] References and quotes from *Organization of Piano Skills* are translated from Russian.

movements. For example, once we learn to ride a bicycle or float on the water, our bodies never forget these skills (Bernstein 1998, 186). That is why Bernstein also calls level B the "level of clichés." It is on this level that the mechanisms for many basic movements, such as walking or jumping, as well as organization of movement rhythm on a muscular level, such as the alternating activity of flexor and extensor muscles, are built. They become stored in the "library" of the central nervous system, and we perform them automatically (Bernstein 1998, 128). Applying this concept to piano playing, Minsker writes that pianists' muscular activity is very firmly imprinted on the brain at this level. This activity includes such elements of muscular work as contractions associated with movements of fingers and the whole arm, muscular power used for a span of the chords, and muscular energy associated with intensity of the sound (Minsker 1988, 7). Such lasting muscular retention explains why, in cases of playing-related injuries, it is so difficult to undo incorrect piano technique. As noted above, if Level B skills are not supported by aural corrections, they can become disadvantageous, and even more so if the students' technique has not been developed correctly.

As we saw from the historical review in Chapter 1, the "anatomic-physiological school" made focus on the movement its cornerstone: first, with Breithaupt promoting the use of natural weight as a universal remedy for pianists, and later with Otto Ortmann and József Gát diligently measuring all the angles and speed of pianists' arms and hands in order to find some ideal positions and movements suitable for everybody. Nevertheless, the importance of aural control of pianists' movements is not in the least a new idea in the theory of piano technique and in piano pedagogy, and has been formulated in one or another form from the

"pre-piano" time. Among many others, Martienssen and Kochevitsky insisted that aural intention should guide pianists' search for technical means, and Neuhaus was famous for his saying, "The worse the ear, the rougher the sound."

What seems to be new in the Schmidt-Shklovskaya-Minsker approach is teaching a student to establish strong audio-motor connections, that is, the "sound-muscular fusion" (Minsker 1988, 4). Both pedagogues required relentless alertness of the ear at the piano and continuous aural feedback on muscular work in exercises and pieces. On a historical scale, this understanding of piano technique as an integral and indispensable aspect of pianist's musical self-expression is closest to that of Franz Liszt and his followers, such as Claudio Arrau. According to Charles Rosen, for Liszt, "physical execution or virtuosity is not transparent or peripheral to expression; nor is the musical experience itself exclusively aural, intellectual, or emotional. Rather, virtuosity takes on a broader significance, certainly as generator of sound, sensation, and emotion, but also as a unifying force that grounds all three in somatic experience" (Rosen retold in von Arx 2014, 31). Von Arx also notes that this conception of piano performance as a musical and technical unity counters the views of some other pianists, who encouraged treating musical and technical sides of pianist's development separately. Pianist Josef Lhévinne advised practicing technique and musical pieces in two separate sessions and compared technique to the grimy engine of an automobile, which has nothing beautiful about it, but is nevertheless the only means to take you to "the musical dreamland of interesting execution and interpretation" (Von Arx, 30-31; Lhévinne, 43-44).

Schmidt-Shklovskaya based her work on her deep knowledge of physiology and genuine musical intuition. Minsker explored it further using Bernstein's principles of multi-

levelled motor control as theoretical basis. Nonetheless, we can say that they both worked from this Listzian notion of the significance of both the physical and spiritual sides of piano playing and their mutual and absolute integrity to the process.

Level A

While level E leads, the other participating levels are important in solving motor tasks in piano performance. According to Bernstein's hierarchy, the level of tone and posture, A, is the oldest and lowest one. Bernstein explains that although level A evades our consciousness most of the time, it is never absent from human actions as it provides a foundation for the whole structure of hierarchical motor control (Bernstein 1996, 115). Often, however, the natural balance of bodywork on this level, which Bernstein credited as responsible for the motions of the neck and trunk, is disturbed in the process of learning piano. One reason for a player's loss of neck and trunk balance would be the focus on other requirements and demands of piano technique. For example, when students concentrate on finger work or wrist movements, they can easily overlook the connections between different parts of the playing apparatus, and this negligence would interrupt the harmonious work of the whole body. Another explanation why neck and trunk posture often causes problems has to do with ideas of relaxation, which are deeply rooted in the minds of piano teachers since Breithaupt's theory of natural weight. Many teachers might not fully realise that while excessive tension is a pianist's curse, relaxation without proper tone balance is also a double-edged sword. More often than not students perceive relaxation as a collapse of some muscular-skeletal regions, which leads to more tension in other parts of the body. Guterman describes many cases from

her practise when students were continuously trying to relax while they were in fact "too relaxed" and lacked tone in their back and neck muscles (Guterman 1994, 29-30).

According to Bernstein, the state of readiness of postural muscles of the neck and trunk is a vital component of coordination. He calls this state "tonus" and describes it as pre-tuning of the neuromuscular apparatus, which prepares "the periphery for reception of the right impulse at the right moment" (Latash 1998, 15). Minsker follows this conception and pays close attention to the balance of trunk and neck posture. By doing exercises away and at the piano, and constantly monitoring students' body position, she makes sure that students develop an overall body tone that supports complex movements in piano playing.

Level C

Level C includes the spatial field, which, according to Bernstein, is "an exact, objective perception of external space based on cooperation of all sensory organs" (Bernstein 1996, 133). The fact that piano playing requires aimed and precise movements within a field of space, that is, the keyboard, makes Level C a significant component of pianists' technical skills.

Traditional piano pedagogy underestimates the challenge of mastering the piano space field. Even though most piano teachers explain the layout of the keyboard and direct beginners' attention to the groups of two and three black keys, they often do not spend enough time and effort to help students build the motor skills that are guided by level C, the spatial skills that are necessary for comfortable playing.

Following Bernstein, we can distinguish two causes of the challenges to building motor skills on this level. First, unlike many other skills of everyday life, such as walking, running, jumping, reaching for something, taking something, putting it somewhere and so on, the movements over the piano keys do not develop in a natural way during early childhood. Therefore, sensory corrections for these Level C movements are not stored in the "library" of the central nervous system. Nor are lower, muscular-articular, Level B movements. Such corrections not only have to be built "from scratch," but they have to be very well defined and refined, because, as mentioned earlier, the movements at the piano require a high degree of precision and accuracy.

The second challenge lies in the nature of the brainwork on this level. Bernstein writes:

> [...]level C corrections care only about how the movement fits the external space outside the body. This level does not care much about the biomechanical side of the movement (unlike Level B, which primarily cares about its own body). Level C does not care how joint angles will change, or even how comfortable or uncomfortable intermediate postures are. It knows one thing: there are enough degrees of freedom in an arm to place the wrist into any point of accessible space and by many paths. It is none of its business how joint angles are actually grouped to reach the goal (Bernstein 1996, 138).

Therefore, if the skills supervised by this level are not given enough time and proper exercise, the body might adapt in an awkward way and wrong background corrections will develop. Minsker insists that beside time and exercise, reducing and eliminating visual control of the movement heightens muscular-articular sensations, helps to master the piano space field and develop muscular feeling of the space. To support the development of Level C motor control Minsker suggests practicing certain exercises with closed eyes, for example.

Perhaps most significantly, she recommends delaying note reading until the piano space field is well mastered.

Level D

Level D plays a tremendous role in human life. It is the highest level of motor control for many casual, sports, and tool-operating activities. It is also the first level that almost entirely belongs to humans, unlike the lower levels, which animals have often mastered better: many animals run faster, swim better, have more endurance, not to mention flying, etcetera. To some extent, Bernstein follows the dialectical materialist philosophy, for example when he notes, "perhaps humans became human largely thanks to this level and in relation to it" (Bernstein 1996, 145). By this, he refers to our meaningful actions with objects, in which, during the evolutionary process, the human hand became a vital and indispensable participant. Considering the vast experience we obtain in manipulating the objects throughout our entire lives, it is astounding to learn that Bernstein did not consider level D to be the part of the motor control scheme of piano playing. The following chart from *On Construction of Movements* demonstrates this:

Level E - the leading level, creates motivation for a motor act, and performs its main meaningful correction, that is working out the sound result in accordance with player's intentions

Level D - <u>most likely does not participate</u> (emphasis added)

Level C - aimed and precise movements in space field

Level B - background synergies of:
a) touch related to body and hand position
b) background components for level C (Bernstein 1947[20], 149)

[20] Quotes from *On Construction of Movements* are translated from Russian.

As the central nervous system develops and stores thousands of high automatisms for many actions on Level D, its absence in piano playing (unlike, for example, string instruments, in which Level D is part of the chain) explains, at least partly, the challenge of mastering piano technique.

Minsker, however, believes that precisely because meaningful actions with objects are abundant in our motor experience and we usually perform them easily, they can and should be used in the processes of acquiring and teaching piano skills. She repeatedly reinforces that the main function of the human hand is to "take and hold" and explains that all our actions with objects require maximum precision of the balance of muscle tone, even seemingly simple actions, like dressing up or wiping hands. Therefore, representations or images of actions with an object of a certain purpose and weight, which are based on the same parameters of sensory corrections as certain pianists' skills, will contribute to transferring of muscle sensations onto piano playing (Minsker 1988, 8). Descriptions and examples of exercises that draw parallels between the actions with objects and the sensations associated with certain elements in piano playing are found in *Appendix 1*.

One way to forge these muscular associations is to use imagery. Abby Whiteside, for example, writes that "failure in achieving a result, when working with a planned procedure which includes many repetitions [...], can sometimes be turned into success by a flash of good imagery" (Whiteside 1961, 59). Her example of a flower is very much in line with Minsker's idea of the application of object actions in piano playing:

> All we need is a desire, an imaged result, and we move and act expertly to get the things we desire. [...] for instance, you are dealing with a hand that is flabby or a hand that is tense. Either condition will change instantly if it is suggested that a delicate flower be held in the palm in a manner which will not crush it (Whiteside 1961, 60).

Both Whiteside and Minsker emphasise the challenge that teachers face in finding the right associative words because as Whiteside puts it, "sometimes it takes a lot of fishing to pull out the right imagery for the right person at the right time" (ibid). Nevertheless, both believe -- and Minsker points it out often during her lessons -- that one right word can work wonders.

To explain the phenomenon of the application of skills from different motor experiences, Bernstein uses the term "skill transfer" or "training transfer." Often, we can use our previous experiences in actions that do not look alike; however, in some cases even where movements are visually similar, we cannot apply previously learned skills. This happens when skill transfer is not based on the movement itself but "on the use of earlier elaborated automatisms... [which] are corrections that control movements and their components. Therefore, in cases in which movements appear very similar but are based on different corrections there are no signs of transfer" (Bernstein 1996, 190). As an example of an absence of skill transfer, Bernstein compares playing violin to sawing wood. These actions, although similar in their outer form, do not imply any skill transfer because they have a) different leading levels (E for the violin, and D for the sawing), and b) different sensory corrections.

Minsker also emphasises this difference. For example, she writes that it is wrong to compare the movements of a pianist to those of a ballet dancer. In dance, she writes, "arm movements are an element of artistic expression, which we perceive visually; these movements bear conceptual meaning. 1By contrast, in piano playing arm movements play the role of a "tool", an auxiliary role of a vehicle between pianist's inner aural intentions and

their realization through the sound of the instrument; the outer form of the movement is not the purpose here" (Minsker 1988, 8). However, she suggests a different analogy, that of speech and breath, as very appropriate because "the meaningful purpose of piano playing is the delivery of musical speech, which structurally is similar to actual speaking" (ibid). In connection with speaking, she especially emphasises the importance of breath finding that thinking of "breathing the sound out" from the arm helps to release fixation and tension.

Some contemporary studies of brain activity during speaking and musical performance prove the relevance of such parallels. Bangert explores how language-related regions of the brain (known as Broca's and Wernicke's areas) are also "part of the cortical network dedicated to musical expression in skilled instrumentalists" (Bangert in Altenmuller 2006, 183). At the same time, he indicates that visuomotor and visuo-auditory aspects of music performance (notation and sight-reading) employ a substantially different cortical network, with almost no overlap with auditory-sensorimotor processing (ibid). These findings bring up, once again, the matter of teaching notation later in the process. As already addressed in this work, many progressive piano pedagogues of the past and present have recommended establishing strong audio-motor connections before proceeding to note reading (see, for example, references to Martienssen, Kochevitsky, and Whiteside in Chapter 1). Right now, their voices sound even stronger as they are supported by scientific evidence.

Stages of Development of a Motor Skill

According to Bernstein, the process of acquiring a new motor skill involves certain stages:

Choosing the right **leading level**
↓
Defining the **composition of the motor structure**
↓
Developing the necessary **sensory corrections**
↓
Developing **automations**
↓
Stabilization

The central nervous system goes through this complex process even when a person learns seemingly simple, every day actions. While all the steps are important in mastering the intricate coordination that is involved in piano technique, the following aspects of this development process seem to be the most significant for pianists:

1. Choosing the right leading level

2. Developing sensory corrections

3. "Repetition without repetition"

4. Creative pauses

Choosing the Right Leading Level

Bernstein writes that the first stage, choosing the leading level, does not take much time and often happens without much pondering. Because during childhood and adolescence we accumulate enough experience performing actions with objects on level D, our central nervous system chooses this level as the leading one for most new motor skills (Bernstein

1996, 182). However, we saw earlier that in piano playing, level D participates only through mediation, so the motor task has to be set on the higher level, E. One of the primary goals of a piano teacher will therefore be to find ways to appeal to this highest level of motor control and to engage students' aural intentions so those guide any motor task at the piano.

Sensory Corrections

The complex, multi-layered system of motor control requires continuous adjustments based on information from sensory organs. Bernstein calls this the principle of sensory corrections, and explains that motor control is a closed, circular process, which combines transferring of motor impulses from the brain and spinal cord to the muscles, as well as a continuous flow of corrective signals transmitted to the brain along nerves belonging to all sensory modalities including tactile, visual, muscular-articular, auditory, and others. This informative flow is absorbed and assessed by the brain, and corrections follow in a split second (Bernstein 1996, 42). Minsker calls sensory corrections "the institution of a feedback" and adds that when the brain sends "a signal to working organs, the information about whether we have achieved the purpose and to which extent goes back to the brain, [then] the next signal follows already with corrections, all in just moments, bypassing our consciousness" (Minsker 2014). Likewise, Coker describes the constant harmonious work of sensory corrections and attunement of ear, mind and hands:

> When properly 'wired', the ear will hear something, either in the mind's ear or from an outside source [...], the aural sensation being forwarded to the mind, where intellectual computations and translations take place. Then the mind issues directives to the muscles of the hands, which hopefully will respond obediently, quickly and cleanly. Now the ears repeat and coordinately with the mind decide what to hear and play next, repeating the whole cycle again (Coker quoted in Bangert, 171).

The development and adjustment of sensory corrections is a continuous and often time-consuming process that happens on each level of motor control and involves different stages of motor development. During the third stage, the body determines the sensory corrections that are necessary for a particular skill. Next, during the fourth stage, the central nervous system readdresses those corrections down to background levels. While during the initial stages of building a motor skill, conscious attention may be required for all or most details, switching corrections to lower levels frees up the consciousness, so it then "obtains only information relevant to what is being controlled by the leading level" (Bernstein 1996, 188). That the corrections start to proceed subconsciously does not mean that the components of movements that become automatic will be unchangeable or uncontrolled. Bernstein writes that the automatisms, i.e. background corrections, may be more flexible and adaptive than the conscious movements (Bernstein 1996, 185). Automatization of more complex skills, such as those involved in playing a musical instrument, takes a longer time because their background corrections do not have independent meaning outside of the whole action (unlike basic motor skills: for example, background corrections developed for walking and running could be easily applied to many sport activities). Finally, the concluding phases of the development of a motor skill, standardization and stabilization, also need time and exercise. The next paragraphs focus on the meaning of exercise, namely on Bernstein's theory of "repetition without repetition," which will help us understand what happens in the central nervous system during the practicing of a motor skill, and to distinguish between mindful and mechanical exercising.

Repetition Without Repetition

With the notion of "repetition without repetition," Bernstein opposed Ivan Pavlov (1849-1936), a Russian neurophysiologist, who is best known for the discovery of conditioned and unconditioned reflexes. While Bernstein acknowledged Pavlov's enormous contribution to the emergent understanding that the control of movements resides in the brain and not in the arms, legs, or back as was believed before, Bernstein was strongly against Pavlov's theory of "beating a neural path" in the brain in order to acquire a motor skill (Bernstein 1996, 174-175). Pavlov based his concept on experiments with laboratory dogs, and concluded that a motor skill is a formula of permanent muscle forces imprinted in some motor centre of the brain. Bernstein, on the other hand, insisted that all living beings, from snails to humans, do not passively submit themselves to the flow of impressions (like Pavlov's laboratory dogs do), but catch and grab those impressions in an active process (ibid). One of the biggest flaws of the "beating of a neural path" theory is the belief that the development of a motor skill relies on mindless repetition. However, according to Bernstein, repetitions of movements are important for different reasons. First, they are necessary "in order to solve a motor problem many times (better and better) and *to find the best ways of solving it."* Second, because in a natural environment, external conditions never repeat themselves and the course of the movement is never ideally reproduced, through repetitions we gain experience "*relevant to all various modifications of a task"* (ibid).

Bernstein's understanding of the elaboration of motor skills as "repetition without repetition" has a direct application to the question of meaningful practicing, which has always been a vital topic in piano pedagogy. In the 18th century, Couperin advised not to

allow beginning students to practice without a teacher's supervision, "so that in my [i.e. the teacher's] absence they cannot undo in one instant what I have painstakingly taught them in three quarters of an hour" (Couperin 1983, 2). In the 20th century, Wanda Landowska once noted, "If everyone knew how to practice, everyone would be a genius." When focusing on technical formulas, it is easy to slip into mechanical repetitions and let the lower levels of motor control take over before the proper audio-motor connections are established. Not only children, but even advanced pianists, are not always immune to this "sin."

The goal (and the challenge) of imposing the right practicing habits onto piano students is therefore a crucial element on the "to-do" list of piano teachers. One of the ways to ensure that students follow the concept of mindful practice is to devote substantial time to repetitions of the same task during lessons, so that the teacher can control and direct students' attention toward improvements with each repetition. Therefore, in order to refine students' inner feedback system, Marianne Uszler advises that teachers use lesson time to practice a particular motor skill with the student. She assures that "guidance that supports and encourages a student's development of the inner feedback system will pay off in the long run" (Uszler 2003, 29). Minsker further explains that with each meaningful repetition we improve the means and get a little closer to the purpose. She therefore makes sure that students not only conceive every new task on the highest level of motor control, and that they not only understand the given means for improvement, but begin to stabilize audio-motor corrections of any new skill. This way, when students take these lessons to their unsupervised practice, there will be less chance for them to take false steps in exercising the new skill.

Creative Pauses

Every pianist has experienced times when a certain passage or technical pattern, although nearly mastered, stops improving or even becomes worse. On the contrary, pianists often notice that after a short break, a technically challenging part improves in spite of not having been practiced for one or two days. According to Bernstein, this happens because background corrections and newly elaborated automatisms, which, as we have learned, develop on different levels during the process of a motor skill acquisition, have to find ways to co-exist together. He calls this process "achieving harmony of background corrections" and characterizes it by both qualitative leaps and delays.

During a delay ("creative pause"), hesitation in the development of a motor skill, or even its temporary deterioration may occur, which would indicate that there is "an interference between background corrections which does not allow them to co-exist peacefully" (Bernstein 1996, 193-94). Bernstein strongly asserts that pianists not force themselves to continue training during a "creative pause," because if the central nervous system is not given enough time to find the solution for the situation, "it might haphazardly adjust to a *compromise in quality"* (Bernstein 1996, 195). Moreover, once such compromise develops, it would be hard to eliminate. Bernstein specifically points out challenges in piano technique like fast passages that would require accuracy in speed and touch. He writes that during the initial stages of training, corrections of precision cannot coexist with quickness of movements. Pianists might sacrifice precision of touch to keep up with the required rhythm and tempo of a piece, which would result in "smudging," and thus affect the overall quality

of the performance. Bernstein advises teachers to be very careful and attentive to delays in motor skill development and to consider either a complete break or a radical change in their approaches to practice (ibid).

Kryzhanovsky also recommended taking one day a week off from practising piano, although he based this suggestion on the needs of muscles and joints to rest rather than on the work of the central nervous system. Bernstein's findings prove the relevance of such recommendations from a neurological point of view and seem to be more scientifically justified. In either case, these directives deserve attention in piano pedagogy.

While Minsker followed Bernstein's understanding of the need for creative pauses, she would often apply it in a different context, specifically advising students to take a daylong break from practicing during the final phases of working on a piece before a stage performance. The reason that she gives for recommending such a pause is similar to Bernstein's explanation that the central nervous system needs time to sort out and harmonize background corrections and automatisms.

The value of Bernstein's theory for pianists and pedagogues is two-fold. Firstly, pianists and teachers can benefit from Bernstein's description of how the brain works during human motor activities, which help them to understand what happens in our bodies during piano playing and learning. Secondly, Bernstein did not merely support a theory through his numerous experiments and observations on motor control but he also developed a thorough and well-defined system of possible applications of the results of these experiments.

Musicians can apply his conclusions directly to their practice, which is especially valuable in instrumental pedagogy.

Until the moment of this writing, Minsker was the first and the only piano pedagogue who studied Bernstein's theory in-depth and successfully applied it in her practice. Piano pedagogy will truly benefit from further implementation of her pedagogical ideas based on Bernstein's theory, and from her indispensable teaching experience.

Chapter 4

Application of the Schmidt-Shklovskaya-Minsker Method to Beginner and Advanced students

In this chapter, I describe how I follow the Schmidt-Shklovskaya-Minsker approach in my work with piano students. Both Schmidt-Shklovskaya and Minsker indicate that their principles are the guidelines only, based on which, teachers can work out their own methodology. Therefore and in accordance with the ideas of both pedagogues, I build my teaching principles on the following essential concepts:

1) Piano sound should be the first and foremost focus in the musical and technical development of a student;

2) Musical intonation should be understood as expressive musical speech;

3) Control of physical sensations should be developed for comfort and ease in playing;

4) Every student deserves an individual approach.

Beginner Students

A teacher of beginner piano students faces the challenge of pulling together many strands of musical knowledge. There are rhythms to explain, hand position to monitor, notes to memorize, and other components to address. While all aspects need to be attended, the distribution of priorities plays a big role at the start of the learning process. What is placed in the centre of students' attention at the beginning will not only define their musical and technical development during their years of studying, but might influence their overall

relationship with music. Out of a wide variety of topics that piano teachers choose to address in the beginning, the next two are often in the spotlight: note reading and hand position.

While the majority of method books focus on note reading as a starting point, I support a different approach. I delay note reading until first, students are familiar and comfortable with the piano space field (see references to Bernstein, Minsker, Chapter 3), and secondly, students develop strong audio-motor connections (see references to Martienssen, Kochevitsky, Chapter 1).

Unlike note reading, it is hard to argue against the importance of work on hand position, because good habits here will lay a foundation for comfortable playing, while bad habits acquired at the beginning can significantly impede students' technical development. While I agree with the necessity of careful attention to beginners' hand position, I attempt to not teach students the hand position itself, which might imply that the student copy the outer form of the teacher's movements. Instead, I guide students so that they can find their own correct feelings and develop inner necessity to use their bodies comfortably and efficiently. This is especially tricky with beginners, for whom the pianist's hand position is a rather abstract concept since the sound of correct pitch and decent sonority can be obtained from the piano in many different and not necessarily comfortable ways. Therefore, I bring beginners' attention to the piano's sound first and then connect the quality and character of sound to a physical feeling. A focus on such a connection rather than on a nicely looking "correct" hand position complies entirely with the Schmidt-Shklovskaya-Minsker system, which through imagery and associations, teaches students to recognize and control inner

feelings. In the following paragraphs, I describe the benefits of the system when it is applied to work on sound production and technique with beginner students.

Preparatory Exercises

Exercises away from the piano (covered in "Gymnastics" by Schmidt-Shklovskaya) work very well as a warm-up routine. They also help students calm down after any other activities they might have had before a piano lesson and "tune" students' minds for attentive work at the piano. Moreover, following Schmidt-Shklovskaya and Minsker, I use each exercise for a specific purpose such as:

- activation of the big muscles of the back;

- loosening of the shoulders and neck;

- finding the feeling of lightness in the arms and their support by the back;

- stabilization of the feet (in standing position) and evocation of an active, working tone in the whole body;

- connection of the fingers to the whole arm;

- development of the smaller muscles of the hand and refinement of the fine motor movements of the fingers.

In my own teaching, I often set movements to the words of a poem.[21] Poetry provides rhythm and imagery, which help students better relate to movements and perform them with more precision.

[21] A credit should be given to Iliza Safarova, a piano pedagogue from Yekaterinburg for this innovation of combining movements and words (Safarova, 1999).

Sound Production and Touch

The ease with which sound is produced on the piano makes our instrument very appealing for beginners. It is also relatively easy to learn to play simple tunes early in the learning process. These two circumstances, the easy sound production and the early opportunity to play tunes, can make it hard for a beginner to acknowledge the necessity of working on a more interesting sonority, and, consequently, on the best body position to achieve best results. Although I encourage beginners to play familiar songs by ear, I put substantial effort into directing students' attention to the character and colour of sound, which I view as a more important task in the beginning. This constant focus on piano tone will contribute to the development of students' listening skills, expand their aural conceptions, and, ultimately, will encourage students to look for more expressive and meaningful sound.

The choice of repertoire also plays an enormous role in engaging beginners in the co-creation of a sound picture of a certain character. Minsker writes that artistic picturesque pieces stimulate students' interest in practicing and promote their all-around musical development (Minsker in Stukolkina 2007, 198). Likewise, Olga Kurnavina, a specialist in children's piano pedagogy, notes that the choice of repertoire is one of the most important components of musical pedagogy. In one of her presentations, she said, "Well-chosen pieces can make a lazy student work, a shy student -- become more daring and open, a non-confident student -- trust herself or himself; whereas random and negligent choice of pieces can turn students away from the piano and make them tense physically and psychologically"[22] (Kurnavina 1987). Pieces like "Starlight the Pony" and "March of the Goblins" by Boris Berlin, "Starfish at Night" and "Dreamcatcher" by Anne Crosby among

[22] The quote is translated from Russian.

many others, and later, more advanced repertoire from collections for beginning pianists by Schumann, Tchaikovsky, and Prokofiev, not only appeal to students' musical imagination but are also excellent material for work on sound colour.

In piano playing, sound is closely connected to touch. In this regard, I found that the next two concepts of the Schmidt-Shklovskaya-Minsker system are physiologically justified and fully applicable to piano playing and teaching. The first concept involves the movements that allow the pianist to manipulate a variety of objects, the movements that are abundant in every person's life. When students associate the work of hands and fingers with object actions, such as holding something flat, picking up something light, taking something out, flicking fingers, et cetera, they develop their hand position in the most natural way. Moreover, rather than treating piano hand position as a rigid and static form, as in the traditional "apple" approach, students start viewing the hand as a working medium that can be adapted to many different technical situations at the piano.

The second concept of touch involves focus on the inner feeling rather than the outer form of movement. By directing students' attention to what they should *feel* when making sound at the piano we will achieve the required results of rich tone and comfortable hand posture faster than if we ask students to monitor the hand position itself. This is where imagery can help both teacher and student. For example, we can ask a student to imagine their finger to be an extension of the whole arm, and thereby encourage a feeling of unity. Or, we can ask them to think of breathing the sound out through their arm, which will help them to eliminate any extraneous tension in the body. Or, we can suggest they work to obtain a sound "right-from-the-string," for a close-to-the-key touch. Through imagery, students relate

to sound expression more readily and start developing ear control, as well as the necessary "audio-muscular fusion," both of which were discussed in Chapter 3. One more example of how to emphasize inner feeling through imagery is a comment Minsker once made about *staccato*. She noted that *staccato* should not be taught as related to arm, wrist, or finger movement; instead, *staccato* should be introduced as happy, bouncy, mischievous, and so forth (Minsker 2014). I would add that prioritizing image and character rather than "right" movement or position is especially fruitful in working with beginners. For that reason, I allow beginner students to play with some imperfections in their hand position, but emphasize that they feel related to the musical content. This seems preferable than demanding a nice-looking hand while leaving the student disconnected from sound and character. Guterman speaks along the same lines, commenting that when students, especially young beginners, adapt to the instrument with joyous spontaneity and manage to make sound they conceived, a teacher should not interfere or rush to "chain" a student into the "only correct" movements, even if students own ways look pedagogically incorrect (Guterman 1994, 54). To help resolve the dilemma of the extent to which touch, sound, and hand position should be polished, I teach beginner students more pieces of a similar pedagogical goal. Even if a certain skill is not fully mastered in one piece, with careful attitude to sound and touch, that skill will continue to improve with the next piece. The goal is not the immediate mastery of one component or one piece, but rather students' gradual but still thorough musical and technical development.

Technique

Regarding technical skills, traditionally taught with drilling scales, arpeggios, and chords, Minsker commented that in the beginning, it is not necessary to bring these elements to perfection in terms of speed and flawless performance. Rather, she continued, it is much more important to work on the formation of competent and healthy technical skills while giving students a chance to try many different types of piano texture (Minsker in Stukolkina 2007, 198). Following this view and pursuing a pedagogical goal of the development of students' strong audio-motor skills, I use the traditional scales, arpeggios, and chords not to drill the speed but to promote understanding of sound and melodic line and to create intuition about correct posture and movement. To do this, I incorporate exercises by Schmidt-Shklovskaya or Minsker either unchanged, or with minor modifications when needed.

The following description is an example of an exercise that uses scales for my particular purposes. The "Swing and add" exercise helps to achieve full and even *legato* sound with the weight of the arms projected equally into every key. Sitting at the piano, a student starts with an arm down along the side of the body, swinging it freely back and forth a few times and perceiving the arm as a whole unit from shoulder to fingertip. With the last swing, the student brings the hand to the keyboard feeling the back lifting the arm, and plays the first note of the scale. After taking time to listen to the sound and "breathe out" any residual tension, the student repeats the whole pattern, every time adding one more note to *legato* scale. The exercise can continue for as little as three notes or for as long as four octaves, depending on the task. In addition to freeing up the arm muscles, this exercise

promotes precision of touch, eliminates unnecessary preparation of a finger and extraneous movements of the hand, and facilitates comfort and freedom in controlling the keyboard space field. Yet another important benefit of practicing scales in this way is that it fosters the perception of the melodic line as a continuous "seamless" *legato* flow.

Although in exercises similar to the described above, students focus mainly on a certain character of sound and touch, and the corresponding physical feelings, they also learn other technical necessities, such as accidentals and fingering, without giving them conscious priority. This way, we turn accidentals and fingering from a subject of struggle (which it is for many beginners) into a subjacent layer of skills which develops alongside the more important improvements on sound and touch.

Note Reading

As noted above, I strongly agree with many piano pedagogues and theorists, including Kochevitsky, Whiteside, Minsker, and Bruser,[23] who recommend postponing note reading until students 1) master the piano space field, and 2) develop initial audio-motor connections. As they argue, and I strongly advocate, note reading introduces piano playing as a predominantly visual activity, where it should be mainly auditory and tactile. Therefore, rather than introducing beginners to notes, I first focus on teaching them the layout of the keyboard by tactile feeling and ear. For example, I follow Minsker's suggestions and have students find single keys and chords with closed eyes. This type of work also helps students get rid of physical stiffness, which is often caused by intense visual control (Minsker 1988, 18).

[23] Madeleine Bruser, an American pianist and pedagogue, author of *The Art of Practicing*

In order to develop audio-motor rather than visual-motor connections, I teach beginners pieces by ear and "from the hands." This way I allow students sufficient time to learn comfortable muscular feelings, recognize and correct them in accordance with sound conceptions, and reinforce newly built audio-motor connections, all before the next component, that is, reading music, is added. However, during this pre-reading time, I make sure to do work that will prepare the brain for this next component, for example, rhythm reading in music pieces (syllabic method), learning directions and spaces in melodic line (intervallic method), and coordinating two hands according to the layout of the notes on the grand staff.

When evaluating students' readiness for note reading, it is important to consider the development of their musical ear and the extent of their overall musical experience. Often, students who have a stronger ear, a broader musical exposure, and can hear sound behind the written sign, i.e. note, will be able to read music comfortably and musically sooner. Therefore, one of the goals of the pre-reading period is to develop students' aural abilities and to introduce them to a variety of musical material. As with other components of teaching process, individual abilities and musical development of each particular student are always the best criteria and they should define the length of the pre-reading period.

Advanced Students

If advanced students lack a thorough technical foundation and this problem is not carefully addressed, the gap between their musical growth and technical skills will continue to increase. In such cases, I see my role as helping students to gradually build the missing

steps in their technical development, and at the same time bringing their attention to the integrity of piano playing, when musical expression and its physical embodiment are components of the same creative process.

Because the exercises developed by Schmidt-Shklovskaya and Minsker can be adapted to a large variety of piano texture, I use them in many different situations and contexts. Often, even with advanced students, I have to return to such basics as initial sound production and *legato* touch. *Table 2* demonstrates a few common problems that I encounter in my work with advanced students, as well as some causes that are responsible for these problems.

As shown in the table, no technical challenge that advanced students often deal with exists in isolation from musical causes. In the next section, I describe how in two case studies, which I undertook during my work on the thesis, I worked toward finding solutions to students' technical and musical problems by integrating the Schmidt-Shklovskaya-Minsker system. I asked two prospective students to volunteer for my research before they would join my studio on a regular basis. The purpose of this study was to investigate whether and how students who had no prior exposure to the Schmidt-Shklovskaya-Minsker system could benefit from this approach. During the course of seven 45-minute individual sessions, I worked with these students on sound production and touch while attempting to build their awareness of purposeful use of the body in connection to piano playing. I followed the fundamental principles of Schmidt-Shklovskaya and Minsker and used a variety of their exercises. After seven lessons, the volunteers filled out a *Questionnaire* (Appendix 2) about their experience. The study was beneficial for the students not only because they had a

chance to develop better attention to sound and gain some level of physical comfort at the piano, but because they also experienced my teaching "in action" and were therefore able to make a more informed decision about joining my studio.

Table 2

Common Technical Problems of Advanced Students

Problem	Cause(s)
Sound Students do not create full sound and often play with feeble colourless tone in *piano* dynamics and harsh in *forte.*	Causes are often both musical and technical. From a musical perspective, it could be lack of sound conceptions and of intentions to produce expressive sound; or weak listening skills and inadequate reflection on sound. On the technical side, muscle tension, physical and mental "blocks" of sound flow, and segmental work of body parts of the pianists' apparatus often result in poor sound production.
Legato Students perceive *legato* mainly as an outer movement of key connections. This approach often results in choppy, syllabic, mechanical playing.	"Finger" technique, note by note playing, lack of ear control, underdeveloped intonation.
Unclear melodic line in fast tempo and "tangled" passages Students play unevenly, lack clarity in pronunciation of melodic line, "smudge" notes in fast passages.	In this problem, too, musical and technical causes are closely intertwined. Often students do not perceive passages as melodies, which results in lack of intonation, expression, and ear control. Technically, fingers might lack flexibility and independence; at the same time, hands and arms could be tense.
Lack of differentiation Students play with insufficient attention to the tonal balance and cannot bring forth sound differences in various types of piano texture.	Students' lack of sound conceptions and imagery is often coupled with uncomfortable hand coordination as well as poor control of physical sensations in fingers of the same hand.

Case Study 1

Nancy* had played piano since her early years; she had completed Grade 8 RCM examination and, at the time we met, had been studying some pieces of Grade 9 repertoire for about a year. She played these pieces with thorough attention to notes and rhythms, but metrically unstable, with inexpressive sound and lack of overall comfort. Nancy was eager to learn new skills, was attentive to my comments and her own feelings. Being a professional ballet dancer, she demonstrated excellent coordination and control of her movements.

We started each of the seven sessions with "Gymnastics," then proceeded with exercises at the piano, on which we spent most of the lesson time. I also incorporated exercises into the work on small parts of Nancy's repertoire pieces at the end of each lesson. After the third lesson, I wrote in my journal that Nancy's sound was still superficial and that she still had a tendency to play very close to the edge of keys as if she was afraid of the piano and did not know how to "befriend" it. There was a thumb problem as well: Nancy was used to holding it stretched out and tense.

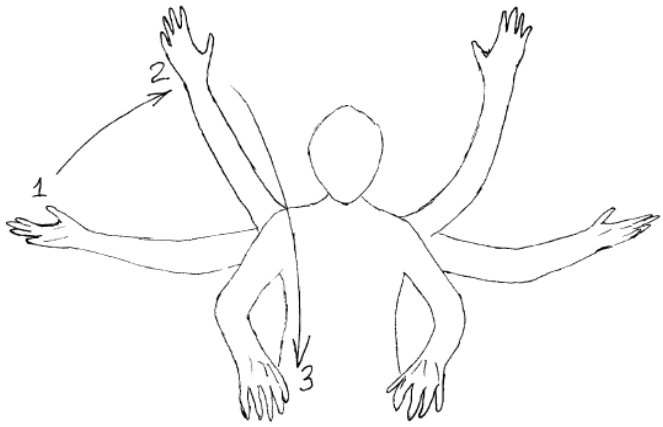
I further noted that Nancy was very quick to grasp the physical form of the exercise, but she did not give herself enough time to listen to and reflect on sound. Therefore, I set and pursued a teaching goal of attracting Nancy's attention to sound as much as possible. We began with simple exercises such as "The walking man," in which a student stands at the piano sideways and slowly "walks" on the keys with index and middle fingers. I asked Nancy to listen for the full singing tone and check that the whole length of the arm "empties" with each "step," i.e., becomes free of tension. Next, Nancy played a D major *legato* scale hands separate. She would have to begin the scale standing (facing piano) and play it slowly focusing on lasting quality of the tone; at some point during playing, I would ask her to sit

down and continue scale while still being very attentive to each tone and to smooth connection between any two notes. Schmidt-Shklovskaya writes that changing positions from sitting to standing and back while playing helps to check for tension in the whole body (Schmidt-Shklovskaya 2002, 34).

To address an issue of fingers kept too close to the edge of keys, I asked Nancy to play Db major scale in clusters, blocking the black keys together and playing white keys with the thumb. I would give her an image of holding a flat object so she develops a feeling of playing "with the keys" rather than "on the keys." To further increase the feeling of closer contact with the key, I would ask Nancy to play scales and arpeggios *non legato,* pressing each key at the fallboard and then slowly sliding down toward its edge as if "petting" the key. I used Minsker's association when I told Nancy to imagine each finger as an extension of the string, so she could achieve a deeper singing tone.

Because Nancy was very attentive and showed understanding of musical and technical tasks, I found it reasonable to work with her on different types of technique. For example, we practiced the following exercise for octave and chord technique: the player brings her arms up, checks that they are well supported by the back ("grow" from the back), then opens the arms wide to the sides, and brings the arms and hands to the keyboard in a slow semi-circular motion, as if embracing something big (*Picture 2).* Once an octave or a chord is played, the hand should feel steady on the keys, but the arm can bounce slightly like a suspension bridge. The tone is deep but not harsh. This exercise helped Nancy engage bigger muscles of the back and switch attention from finger preparation on the keys to the fullness and volume of sound and movement.

Nancy seemed to enjoy the new ways of work on sound, movements, and piano texture. She particularly appreciated the guidance and attention to any details that could help her play with more ease and confidence. In the *Questionnaire*, she wrote that before the course, she was not aware of how she used her body during playing and that the exercises she learned during the course helped her play with more comfort and listen to piano sound more attentively. She joined my studio and completed her Grade 9 examination very successfully.



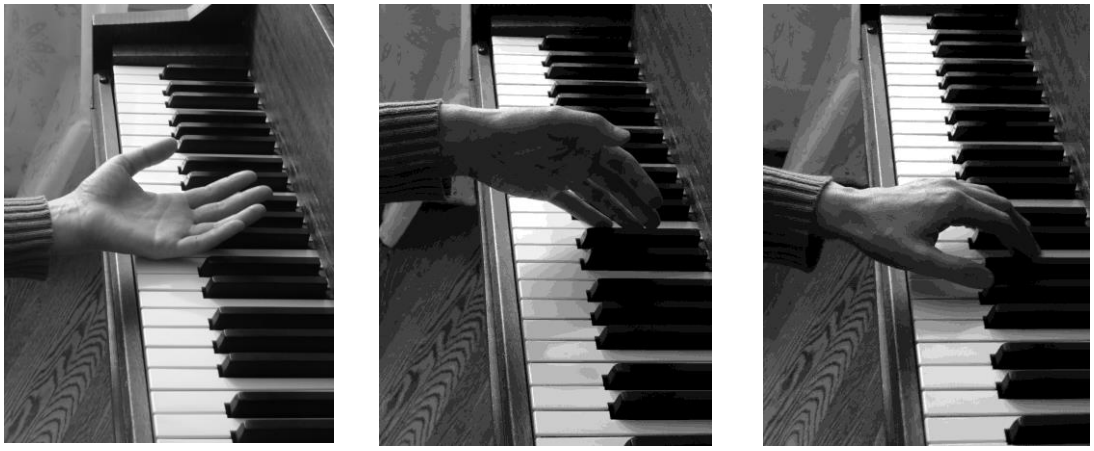
Picture 2. "Open arms" exercise

Case Study 2

Maria* is an adult student. She started playing the piano about 10 years ago, and as advised by her teacher took RCM examinations up to Level 8. She commented that although she liked the idea of examinations because of the motivation and sense of accomplishment, she had a rather negative, and even painful, experience of taking them. She attributes it to her enormous anxiety when she plays before an adjudicator and thinks she loses most of her preparation because of that. My first observations and journal notes about Maria referred to her tremendous tension during playing everywhere in her body, including fingers, forearms,

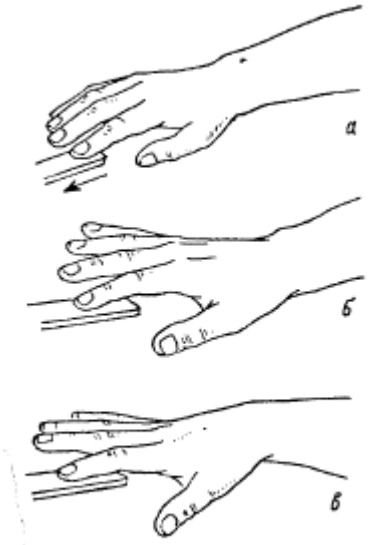
and even her lips. In exercises away from the piano, Maria appeared to be physically fit; she followed my instructions closely and could easily coordinate movements of her arms with support from the back muscles. At the same time, I noticed that in spite of Maria's very good physical shape, once she sat at the piano, her back collapsed and she would slouch all the time during playing. Notwithstanding her good musical ear, Maria played with a monotonous sound, a very insecure touch, and "choppy" melodic line separating each note by pushing her fingers into every key.

As in Nancy's case, I started Maria with "The Walking Man" and "Standing-sitting" exercises, but soon added simpler movements to help Maria distinguish between tense and relaxed muscle states. For example, I would ask her to play a scale with the same finger *non legato*. I would instruct her to turn the hand out (supinate), keeping it close to the keys, then turn back (pronate) and play the first note without lifting the hand off the keys or preparing the finger in any special way (*Picture 3)*. We would repeat the pattern for a few notes of the scale. Further, we would proceed with two, then three *legato* notes and so on. I stopped Maria every time she slipped back into her old habit of lifting and tensing each finger before pressing the key. As Maria's listening improved, she began to recognize the flow of a few *legato* notes and was able to connect this flow to absence of tension in her arms, hands, and fingers. Still, I would often ask her to return to *non legato* playing and focus on listening to a single tone so to notice how sound lasts while releasing any muscular tension. Old habits were slowly giving in when we practiced exercises, but were still very pronounced in the pieces. Playing small parts of the repertoire pieces *non legato* helped Maria to engage the whole arm in a free, unobstructed way.



Picture 3. Non legato playing with supination and pronation

Another problem I encountered with Maria was her fear to be imprecise with touch, to miss the right key. This issue was especially serious in the chords. To address it, we practiced an "Open arm" exercise, similar to the one described in octave work with Nancy. This movement helped to redirect Maria's attention from finger touch to the work of the shoulder, which, according to Schmidt-Shklovskaya, is responsible for the most precise movements (Schmidt-Shklovskaya 2002, 23). We also practiced chords with a "petting" motion, first playing only one note of the chord, then two, and so on. Later, I added the "Glove" exercise, which involves sliding with a finger "into the key" toward the fallboard ("toward the string") while slightly expanding all fingers out and feeling their separation inside the palm, then bringing fingers back together and resting (*Picture 4)*. A player has to actively listen to the sound during the entire movement pattern. Minsker compared this motion to slipping fingers into a glove. "Glove" and "Petting" exercises helped Maria feel more confident and secure with her touch.



Picture 4. Finger expansion in "Glove" exercise: correct position shown in "a" and "b," incorrect in "c" (Schmidt-Shklovskaya 2002, 37).

Maria often noted that one of her biggest concerns was her poor sight-reading skills, which she struggled to improve. While I was sympathetic to this problem and agreed that on this level it could be an impediment to further development of her musicianship, I did not see that resolving the sight-reading problem had to be a priority at that stage of learning. I explained to Maria that once she felt more comfortable and secure in her technical skills, she would start building more reliable sight-reading skills and would be able to coordinate audio, visual, and motor perception with more ease.

At the end of each lesson, Maria looked happy with the results of our work and throughout the course, she commented more than once that she felt more connected to music and piano. She continued to take lessons for a few more weeks after the initial course of

seven sessions, but then stopped, explaining that she had to speed up her preparation for Grade 9 examination.

While I cannot consider these two case studies to be a quantifying tool in research of the Schmidt-Shklovskaya-Minsker system, I draw two important conclusions from conducting them. The first one, the importance of the right start in teaching piano to beginners, is hard to overestimate. Not only does a thorough, physiologically informed method create a solid foundation for pianists' technical development, but it also promotes a healthy and enjoyable relationship with music in the future. It can help to avoid contradictions between students' expectations and their technical abilities such as those occurred in Maria's case. Maria was determined to follow her dream and pursue her studies so she can reach a higher level in piano playing. It is very unfortunate that her poor basic skills created serious obstacles for the fulfillment of her wishes and led to anxiety, struggle, and pain instead of joy and contentment from music making. In the framework of this study, I was not able to account for all aspects that might have played a role in Maria's musical and technical development, such as her individual character traits or any personal circumstances. Nevertheless, I believe that other factors, such as her good inner musical abilities and harmonious physicality, would allow for a better development of her piano skills if those were initially taught in a healthy way.

The second fact, or rather phenomenon I came to believe in while working with my two volunteers and researching relevant information, is a humans' ability to infinitely change and

improve their skills. Minsker noted that it is never too late to change wrong habits. I especially became convinced in this belief in virtue of the study of Bernstein's theory of multi-levelled motor control and its application to piano playing and teaching initiated by Minsker. In my work with two volunteers as well as other piano students, I have had numerous opportunities to observe how by setting a task on the highest level of motor control, which processes musical content, expression, and sound, I teach students to adopt correct physical sensations and improve their technical skills faster than when I address the issue on a lower level, for example, when I focus on hand position. I consider this second conclusion especially valuable because it "opens doors" for pianists of any level and encourages them to build and improve their piano skills and musicianship at any point of their musical journey.

Conclusion

Teaching healthy mind-body-instrument relationship to students of all levels, abilities, and expectations should be one of, if not *the* priority, of modern piano pedagogy. Otto Ortmann's postulate that most piano students who practice incorrectly would never reach the point of injury anyway does not seem to be credible nowadays. It is not only comfortable and injury-free technique that a piano teacher should be aware of in his or her practise. Apart from physical comfort, a competent teaching approach, such as the Schmidt-Shklovskaya-Minsker system, helps students become explorers in the development of their musicality and technical skills. By instilling in students habits of mindful practicing and by encouraging them to pursue creative musical goals, the Schmidt-Shklovskaya-Minsker system provides a strong foundation for pianists' own quests into the intricacies of piano art. By no means is this approach the only one that supports such goals, a fact that Schmidt-Shklovskaya pointed out in her book. However, what is amazing, and perhaps unique, about this system is that it provokes pianists and teachers to look deeper into their art and the science behind it. That is how I discovered Kryzhanovsky, Bernstein, and many others in the course of this research and its practical application. As these discoveries have helped me to grow as a pianist and teacher, I hope they will influence others in the same way.

Bibliography

Books

Altenmuller, Eckart, Wiesendanger, Mario and Kesselring, Jurg. 2006. *Music, Motor Control and the Brain.* New York: Oxford University Press.

Bach, Carl Phillip Emanuel. 1949. *Essay on the True Art of Playing Keyboard Instruments.* Translated by W. J. Mitchell. New York: W. W. Norton and Company.

Berenson, Gail, Csurgai-Schmitt, Jacqueline and Devan, William. 2002. *A Symposium for Pianists and Teachers: Strategies to Develop Mind and Body for Optimal Performance.* Heritage Music Press.

Berman, Boris. 2000. *Notes from the Pianist's Bench.* New Haven and London: Yale University Press.

Bernstein, Nicholai A. 1947. *On Construction of Movements (O postroenii dvizhenij)*. Moscow: Medgiz

Bernstein, Nicholai A., ed. by M. Latash. 1996. *On Dexterity and its Development*. New Jersey: Lawrence Erlbaum Associates.

Bernstein, Seymour. 2001. Translated by Svetlana Govorun. *Twenty Lessons in Keyboard Choreography.* Saint-Petersburg: Kompozitor.

Breithaupt, Rudolf. 1909. *School of Weight-Touch*. Translated by J. Bernhoff. Leipzig: C. F. Kahnt Nachfolger.

Bruser, Madeline. 1997. *The Art of Practicing: a guide to making music from the heart.* New York: Bell Tower.

Comeau, Gilles. 2009. *Piano Pedagogy: A research and information guide.* New York and London: Routledge.

Cornett, Vanessa. 2016-2017. "Integrated Music Teaching." *The Canadian Music Teacher, Volume 68, numbers 1 and 2.*

Cortot, Alfred. Transl. R. LeRoy-Metaxas. 1986. *The Rationale Principles of Piano Technique.* Editions Salabert.

Couperin, François. 1983. *The Art of Playing the Harpsichord.* Translated by M. Parker. Toronto: The Aliquando Press.

Dimon, Theodore. 2008. *Anatomy of the Moving Body.* North Atlantic Books.

Fay, Amy. 1888. *Music-Study in Germany.* Chicago: A. C. McClurg & Company.

Fink, Seymour. 1992. *Mastering Piano Technique: A Guide for Students, Teachers, and performers.* Portland: Amadeus Press.

Fraser, Alan. 2011. *The Craft of Piano Playing: a new approach to piano technique.* Lanham: The Scarecrow Press, Inc.

Fraser, Alan. 2012. *All Thumbs: well-coordinated piano technique.* New Belgrade: Maple Grove Music Productions.

Gát, József. 1980. *The Technique of Piano Playing.* White Plains: Pro Am Music Resources.

Gerig, Reginald R. 2007. *Famous Pianists and Their Technique*. Bloomington: Indiana University Press.

Gieseking, Walter and Leimer, Karl. 1972. *Piano Technique.* New York: Dover Publications, Inc.

Golubovskaya, Nadezhda. 2007. *The Art of the Performer.* Saint-Petersburg: Compozitor Publishing House.

Guptill, Christine, and Zaza, Christine. 2010. "Injury Prevention: What Music Teachers Can Do." *Music Educators Journal.* 96.4: 28-34.

Guterman, Valentina. 1994. *The Return to the Creative Life: professional injuries of the hands (Vozvrashenie k tvorcheskoj zhizni)* . Ekaterinburg: Lyceum of Humanities and Ecology.

Hofmann, Josef. 1976. *Piano Playing: With Piano Questions Answered.* New York: Dover Publications.

Horvath, Janet. 2002. *Playing (less) Hurt.* Kearney: Morris Publishing.

Isakoff, Stuart. 2011. *A Natural History of the Piano: the instrument, the music, the musicians- from Mozart to Modern Jazz, and everything in between.* New York: Alfred A. Knopf.

Kleiman, Judith. 2013. *The Alexander Technique for Musicians.* London: Bloomsbury

Kochevitsky, George. 1967. *The Art of Piano Playing: a scientific approach.* Evanston, Illinois: Summy-Birchard Company.

Kogan, Grigori. 1966. Introduction to *Individual Piano Technique: based on creative sound volition,* by Karl Adolf Martienssen, 3-12. Moskva: Izdatel'stvo Muzyka.

Kryzhanovsky, Ivan. 1922. *The Physiological Bases of Piano Technique.* St-Petersburg: The State Academic Philharmonic.

Kurnavina, Olga. 2012. *On Primary Musical Education (O pervonachalnom muzykalnom vospitanii).* Saint Petersburg: Kompozitor.

Latash, Mark. 1998. *Progress in Motor Control, V.1: Bernstein's Traditions in Movement Studies*. Champaign: Human Kinetics.

Latash, Mark. 2002. *Progress in Motor Control, V.2: Structure-Function Relations in Voluntary Movements*. Champaign: Human Kinetics.

Lhévinne, Josef. 1972. *Basic Principles in Pianoforte Playing.* New York: Dover Publications, Inc.

Lister-Sink, Barbara. 2015. "A Study of Students' Perception of the Effectiveness of an Interdisciplinary Method for Teaching Injury-Preventive Piano Technique." PhD diss. Columbia University.

Mark, Thomas. 1999. *What Every Pianist Needs to Know about the Body*. Chicago: GIA Publications, Inc.

Martienssen, Karl Adolf. 1966. *Individual Piano Technique: based on creative sound volition.* Translated by V. L. Michelis. Moskva: Izdatel'stvo Muzyka.

Matthay, Tobias. 1909. *The First Principles of Pianoforte Playing. The Act of Touch.* London: Longmans, Green, and Co.

Mazel, Vladimir. 2001. *A Musician and his Hands (Muzykant i ego ruki).* Saint-Petersburg: Kompozitor.

Minsker, Galina. 1988. *Organization of Piano Skills of the Choreography Students at the Institute of Culture: methodological work.* Leningrad: The State Institute of Culture, Department of Piano.

Neuhaus, Heinrich. 1993. *The Art of Piano Playing.* Translated by K. A. Leibovitch. London: Kahn and Averill.

Novara, Thomas Jay. 2015. "A Comparative Analysis of the Writings and Technical Approach of Ludwig Deppe and his Contemporaries in Piano Pedagogy." MMus Thesis, Southern Illinois University.

Noyle, Linda. 1987. *Pianists on Playing: interviews with twelve pianists*. Metuchen, N. J.: Scarecrow Press.

Ortmann, Otto. 1962. *The Physiological Mechanics of Piano Technique.* New York: E. P. Dutton and Co, Inc.

Parakilas, James. 2000. *Piano Roles: Three Hundred Years of Life with the Piano.* New Haven: Yale University Press.

Riley, Kathleen, Coons, Edgar E. and Marcarian, David. 2005. "The Use of Multimodal Feedback in Retraining Complex Technical Skills of Piano Performance." *Medical Problems of Performing Artists*. June 2005: 82-88.

Rogers, Margaret. "Survey of Piano Instructors: awareness and intervention of predisposing factors to piano-related injuries." PhD diss., Columbia University.

Schmidt-Shklovskaya, 2002. *On the Development of Piano Skills.* Moscow: Klassika-XXI.

Schnabel, Artur. 1970. *My Life and Music.* Gerrads Cross: Colin Smythe.

Schweitzer, Albert. 1966. *J. S. Bach, V.1.* Translated by E. Newman. New York: Dover Publications. Inc.

Stukolkina, Svetlana, ed. 2007. *A Road to Perfection (Put' k sovershenstvu).* Saint Petersburg: Kompozitor.

Von Arx, Victoria A. 2014. *Piano Lessons with Claudio Arrau.* New York: Oxford University Press.

Watson, Alan A. D. 2009. *The Biology of Musical Performance and Performance-Related Injuries.* Lanham: The Scarecrow Press, Inc.

Whiteside, Abby. 1961. *Indispensables of Piano Playing.* New York: Charles Scribner's Sons.

Whiteside, Abby. 1969. *Mastering the Chopin Etudes and Other Essays.* New York: Charles Scribner's Sons.

Wristen, Brenda G. 2000. "Avoiding Piano-related Injury: A Proposed Theoretical Procedure for Biomechanical Analysis of Piano Technique." *Medical Problems of Performing Artists*. June 2000: 55-64.

Online Sources

Barbara Owen, et al. "Organ." Grove Music Online. Oxford Music Online. Oxford University Press, accessed October 14, 2017
http://www.oxfordmusiconline.com.ezproxy.library.yorku.ca/subscriber/article/grove/music/44010pg4.

Edwin M. Ripin, et al. "Clavichord." Grove Music Online. Oxford Music Online. Oxford University Press, accessed October 14, 2017
http://www.oxfordmusiconline.com.ezproxy.library.yorku.ca/subscriber/article/grove/music/05909.

Edwin M. Ripin, et al. "Harpsichord." Grove Music Online. Oxford Music Online. Oxford University Press, accessed October 14, 2017
http://www.oxfordmusiconline.com.ezproxy.library.yorku.ca/subscriber/article/grove/music/12420.

Paul Dekeyser. "Kalkbrenner, Frédéric." Grove Music Online. Oxford Music Online. Oxford University Press, accessed December 29, 2016
http://www.oxfordmusiconline.com.ezproxy.library.yorku.ca/subscriber/article/grove/music/14623.

English Oxford Living Dictionaries, accessed December 5, 2017
https://en-oxforddictionaries-com.ezproxy.library.yorku.ca/definition/pantograph
https://en-oxforddictionaries-com.ezproxy.library.yorku.ca/definition/electromyography

Choreography of the Hands: the work of Dorothy Taubman.
https://www.youtube.com/watch?v=suwdLaYBaAs
https://www.youtube.com/watch?v=SSCyb43wQdA
https://www.youtube.com/watch?v=pxeWx6q24Po
https://www.youtube.com/watch?v=r6DedWiTogM

Barbara Lister-Sink's Freeing the Caged Bird: Potentially Harmful Technical Habits
https://www.youtube.com/watch?v=IO4JROq_sgw
https://www.youtube.com/watch?v=qjOGk3TtG0M
https://www.youtube.com/watch?v=SmnEU0PU7Q4

Alexander Technique for Pianists
https://www.youtube.com/watch?v=w_YB3c_Z320
https://www.youtube.com/watch?v=fl2IecdGKg4

Dr. David Wright. Accessed November 30, 2016
http://www.wrightmusic.net/pdfs/ivan-kryzhanovsky.pdf

The Kovacs Method. Accessed July 23, 2016
http://kovacsmethod.com/

Minsker, Galina. 2014.
https://www.youtube.com/watch?v=uZDlhQP5AzY

Appendix A

Examples of Exercises

1. "Flying" exercises. Open the hand and fingers pushing off the key lightly as if you flicked off a speck of dust. The finger opens from its initial position of **touching the key**, not by moving onto the key. The opening has to be effortless, without abrupt movements as if fingers fly open by themselves. "Land" with the same finger on the key two octaves apart (right hand goes up, left hand down). Variants of this exercise include use of "click-and-land" movement on the same key, in a distance, in different melodic patterns (scales, arpeggios), with the same or different finger numbers. Schmidt-Shklovskaya describes two versions of execution of this exercise: a) using the whole arm that "takes off" and "lands" along with fingers (promotes lightness in the arm); b) using fingers only, which "fly up" easily and drop down fast (Schmidt-Shklovskaya 2002, 39).

2. Exercises with imaginary objects

1) Start standing; from an imaginary low shelf in front of you (or from the floor), "pick up" something very light (imagine feathers, silk scarf) with thumb and index finger of both hands, slowly straighten up holding your object(s) in front of you, then slowly turn to one side and to the other. Feel the back supporting arms, which should be light due to the feeling of holding light object(s).

2) Play a blocked "Chopin position" (right hand E-F#-G#-A#-B, left hand F-Gb-Ab-Bb-C) or a blocked whole tone position; think of taking and holding a flat object (eyeglasses

case, for example). This exercise helps to feel strength of inner muscles of the hand without extraneous contractions in forearms.

3) Play any melodic pattern *non legato*, slowly sliding down toward the edge of a key and imagining "a bear getting honey from a jar with its paw" (lessons with Minsker). The image helps to include the whole arm in the movement, develop a sensitive finger pad, and obtain deep singing sound "from the strings." This exercise is also used in work on differentiation of sound in chordal or polyphonic texture.

4) Play a *staccato* note, "grasping" it into a fist as if catching a mosquito. A fast supination turn promotes dexterity and active engagement of the hand. The movement can also be performed after a series of *staccato* or *legato* notes.

Appendix B

Questionnaire

I. Warm-up exercises away from the piano

1. Did you ever do warm up exercises away from the piano before this course?

2. Do you think these exercises are useful? Do they help you to prepare for playing?

If yes, how? (e.g. feeling more relaxed, finding and maintaining the state of muscle tone and alertness, warming up fingers and hands, etc.)

3. Before the course,

a. did you ever consider the importance of correct posture at the piano?

b. did you think of back muscles as an important part of a pianist's playing apparatus?

c. were you aware of the connections between and alignment of the different parts of the body involved in the playing process (e.g. neck, spine, shoulders)?

4. Did the warm-up exercises we used help you realize (understand) these connections?

5. Have the exercises made you more aware of the importance of having correct posture and alignment?

6. After the course, will you continue to do warm-up exercises away from the piano?

II. Exercises at the piano

Most of these exercises are based on major and minor scales, solid and broken chords and arpeggios. I grouped the exercises as follows:

1. Exercises that promote an unconstrained approach to the keyboard and to the tone production (e.g. the "three levels" exercise, "petting" the keys, "piano position" on the fallboard)

2. Exercises that focus on the movements and feelings needed for development of legato and ease in the flow of sound (e.g. "walking man", standing-sitting scale, "swing-and-add a note" scale, "umbrella" arpeggios)

3. Exercises that promote comfortable solid and broken chord positions (e.g. octaves with arm opening, octaves with added middle blocks of tonic chords)

4. Exercises that focus on the development of independence and lightness of the fingers (e.g. "parachute", repetition, "click-and-scoop").

Questions:

1. Were all or most of these exercises new to you?

2. Do you think they can help improve your technique?

If yes, how so?

3. In your opinion, do all or most of the exercises help to connect movement to its purpose – piano sound?

4. Did the exercises help you to gain more confidence in your control of touch and sound?

5. Has your attitude to sound changed?

If yes, how?

6. Do you now listen more attentively to your playing?

7. Have you become more attentive to the singing quality of piano tone?

More aware of its nuances?

8. Did you find any discomfort in doing exercises?

If yes, please describe.

9. Did you practice the exercises at home between the lessons?

10. Did you find it hard to practice them without an instructor's guidance?

Have you become more confident in practicing alone as the course continued?

11. When you practiced at home, did you pay more attention to sound or to physical feeling and movement?

Did the focus change toward the end of the course?

If yes, how?

12. Has your view on piano technique changed after the course?

If yes, how?

13. Do you think, you will benefit from if you continue to practice the exercises?

If yes, how?

14. Do you want to learn more exercises of the Schmidt-Shklovskaya-Minsker method?

Why or why not?

III. Working on pieces

1. Compared to your previous experience, what was new for you in this method?
2. Has working on technically challenging places become more progressive and satisfactory when we applied specific formulas from the exercises?
3. Does this kind of work (using specific formulas from the exercises) give you a different perspective on a piece or some parts of it?

If yes, how?

4. Does using these formulas help you to connect the movement to a certain character of sound in a particular place in a piece?
5. Does this kind of work promote a better understanding of music (e.g. the structure of the phrase, emotional context)?
6. If you find this work beneficial, what are the benefits for you?
7. What did you find most interesting and/or engaging in the work on pieces using this method?
8. Do you have any negative feelings about the method?

If yes, please elaborate.

9. Did you experience any discomfort or uneasiness when we worked on pieces?

10. Were you confident in following the instructions on practicing the pieces at home?

In the beginning of the course	*Toward the end of the course*
very confident	very confident
quite confident	quite confident
not so confident	not so confident
not confident at all	not confident at all

Thank you!