PIANISM FOR SMALL HANDS: STRATEGIES AND SOLUTIONS TO OPTIMIZE PERFORMANCE AND MINIMIZE CHANCES OF INJURY

by

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Introduction

Whether it be in the necessary steps to pursuing professional success, or the simple act of choosing a piece of music, pianists with small hands are severely disadvantaged. The concert stage canon of piano works in the Western art tradition favor large hands. When pianists with small hands take on such repertoire, they encounter immediate technical difficulties related to hand span. As a result, the small-handed pianist is pigeon-holed to repertoire that fits small hands, regardless of the music that they are drawn to, or run the risk of injury.

It wasn't always the case that small hands equated to a disadvantage at the keyboard. Prior to the standardization of keyboard size in the 1860's, pianists enjoyed a large array of sizes.[1] This is similar to the freedom that owners of string, wind, and brass instruments currently enjoy in choosing aspects of their instruments that cater to the physical form and musical idiosyncrasies of the player, such as mouthpieces, head joints, bows, and mallets. In other contexts, a dancer chooses her/his shoes; a cyclist chooses her/his bicycle. Variety of choice in equipment fosters a smoother path to effortlessness, confidence, and mastery in any arena.

Pianists and pedagogues alike are generally unaware of ergonomically scaled piano keyboards (ESPK) produced for decades by makers like David Steinbuhler in Pennsylvania, USA. Such keyboards are produced in a variety of sizes which may be custom fit to any existing instrument including the Steinway model D, a piano that has long dominated the concert stage. The lack of knowledge, support, and availability of ESPK's may be indicative of conservative attitudes of pianists in the field, a culture that preserves tradition over innovation. The piano

[1] Naotaka Sakai, "Keyboard Span in Old Musical Instruments," *Medical Problems of Performing Artists* 23 (2008): 169-171, journalviewer.aspx (iu.edu) (accessed Feb 22, 2021).

manufacturing industry has also largely supported the status quo, perhaps due to endorsements of successful performing artists who possess large hand sizes, combined with costs associated with custom building versus standardized factory manufacturing. Regardless of reason, the accepted standard size of keyboards deepen gender, racial, and socioeconomic inequities in the professional field.

In a 2015 study measuring hand span in 473 adult pianists, males had an average of 1 inch (2.5 cm) reach above females measuring a 1-5 finger hand span. In addition, the data showed a difference of 0.4 inches (0.1 cm) on average between adult female Caucasians and female Asians. Findings also substantiate the larger hand sizes of internationally acclaimed pianists, who on average have larger hands than the average male hand size.[2] The data indicates a staggering need for ESPK's in concert venues, music schools, and piano stores.

Sadly, until there are widespread options to replace the one-size-fits-all piano keyboard, small-handed pianists must rely on adaptive techniques to avoid injury. Overuse syndromes are rampant, as supported in the research stating that at any given time 40-60% of pianists show symptoms of injury (1997, p. 57).[3] As several research studies have shown the direct correlation between small hand size and musculoskeletal disorders[4] it is of utmost importance for teachers

[2] Rhonda Boyle, Robin Boyle, and Erica Booker, "Pianist Hand Spans: Gender and Ethnic Differences and Implications for Piano Playing," in *12th Australasian Piano Pedagogy Conference* (Melbourne, Australia, July 2015), 8-29, https://www.appca.com.au/pdf/papers2015/part1/2015-APPC-Boyles-Booker---Pianist-Hand-Spans-Gender-and-Ethnic-Differences.pdf (accessed March 1, 2021).

[3] Alice G. Brandfonbrener, "Pathogenesis and Prevention of Problems of Keyboardists," *Medical Problems of Performing Artists* 12 no. 2 (1997): 57-59, journalviewer.aspx (iu.edu) (Accessed Feb 22, 2021).

[4] Lora Deahl and Brenda Wristen, *Adaptive Strategies for Small-Handed Pianists* (Oxford University Press, 2017): 18-19.

and small-handed pianists alike to develop an arsenal of coping strategies to optimize performance while minimizing chances of injury.

This document aims to serve pianists and teachers by uniquely framing the problems and solutions of small-handed piano playing, guided by basic principles of ergonomics and biomechanics; my personal enduring battles as a pianist with small hands and an appetite for a challenge; as well as my pedagogical work in constant search of individualized solutions. It is impossible to delve into these ideas without crediting the incredible mentors who have shared their wealth of expertise with me: Arnaldo Cohen, Angela Cheng, and Elisabeth Wright. The second part of this document will delve into exploring permanent solutions for small-handed pianists. In a world where classical pianists come in all shapes and sizes, it is imperative to re-evaluate universal design, and begin to form standards that support inclusivity for all groups of people.

Chapter 1: Identifying the Barriers for Small-Handed Pianists

In identifying strategies for small-handed pianists, one must first define the small hand. As described by Deahl and Wristen in their seminal book, *Adaptive Strategies for Small-Handed Pianists*, small-handedness is a self-defined condition. The factors that may influence such a denotation include, but are not limited to, finger length; spread in between the fingers; palm width; finger width; thumb-to-fifth-finger span; ability to comfortably play an octave or ninth; flexibility of the joints and hand; and the musculature of the upper body.[1]

Another consideration I'd like to introduce in defining a small hand is the inability to place the hand on diatonic five-note scales using a neutral or near-neutral posture. As such scales are the basis of the melodies and harmonies that makeup a majority of piano music in the Western art tradition, pianists steeped in this repertoire will regularly align themselves on these notes. A neutral posture in the hand may be experienced when "the heavy arm … (hangs) loosely from the shoulder while standing so that the hand is in a straight line with the wrist and forearm in all planes".[2] Such neutral postures support maximum control of the joints and force production, thereby creating maximum control of sound.[3] Neutral postures also "minimize the stress applied to muscles, tendons, nerves, and bones".[4] According to this research, a pianist who cannot play diatonic melodies and harmonies in a neutral posture suffers from a reduction of sound control and heightened risk injury.

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[1] Deahl and Wristen, *Adaptive Strategies for Small-Handed Pianists,* 3-5.

[2]Deahl and Wristen, *Adaptive Strategies for Small-Handed Pianists, 46.*

[3] Don B. Chaffin, Gunnar B. J. Andersson, Bernard J. Martin, *Occupational Biomechanics*, 4th ed. (Hoboken: John Wiley & Sons, Inc., 2006), 7.

[4] U.S. Department of Health and Human Services, "Practical Demonstrations of Ergonomic Principles," by Susan M. Moore, Janet Torma-Krajewski, and Lisa J. Steiner (July 2011), 4.

Such definitions of small-handedness may result in the struggle of reading, learning, and performing piano repertoire in the following ways.

Reach

The difficulty of reaching wide intervals in chordal or arpeggiated form is perhaps the most easily identifiable obstacle in indicating small-handedness. The opening of Rachmaninoff's Second Piano Concerto, Op. 18 or Schubert's Impromptu in G-flat Major, D. 899 are exemplars of this, as shown in Figures 1 and 2. The reach for smaller intervals must not be overlooked, as any form of a stretch expends greater energy and requires more endurance than staying in a neutral position.

Figure 1. Rachmaninoff, Piano Concerto No. 2, Op. 18, i, mm. 1-8

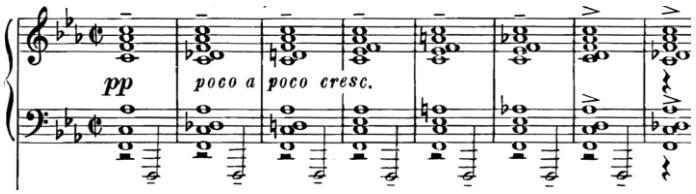
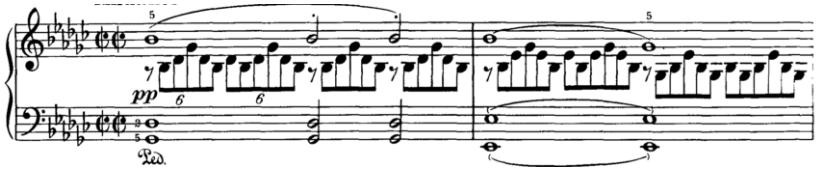


Figure 2. Schubert, Impromptu No. 3 in G-flat Major, D.899, mm. 1



Control in Sound Quality

The further a hand extends beyond a neutral position, the more loss of control there is in the sound production, thus creating a barrier to creating the sound that is imagined by the player. This can manifest specifically in areas of voicing, producing loud volumes, and forming a connection of sound. Figure 3 demonstrates the difficulty of voicing the melodic line placed on top of the widely-spaced repeated chords. Figure 4 exposes a passage where a small-handed pianist may struggle to bring out the forte, pesante sound requested by the composer. Figure 5 highlights

a melody that invites a beautifully-shaped connected phrase in the upper voice, a feat that is challenging in itself without the added obstacle of the small hand jumping around. Even the production of a singing, legato melody in a Mozart slow movement, as shown in figure 6, requires extra calibration for a small-handed pianist, especially when the score is muddied by editorial fingerings that serve larger hands.

Figure 3. Beethoven, Sonata No. 13 in E-flat Major, Op. 27 No. 1, i, mm. 9-12

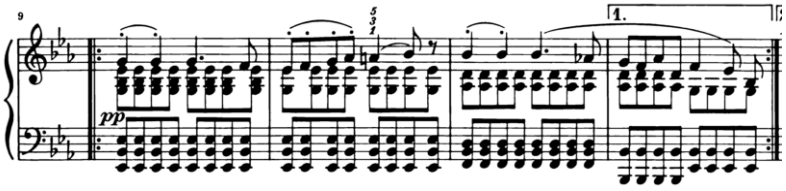


Figure 4. Prokofiev, Sonata No. 6 in A, Op. 82, ii, mm. 84-88

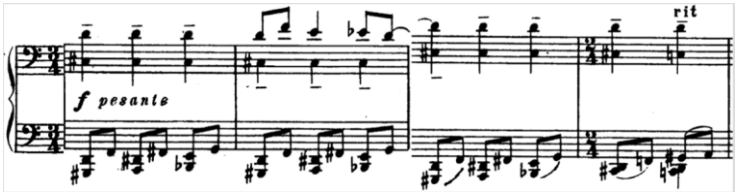


Figure 5. Chopin, Etude Op. 25 No. 1, mm. 3-4

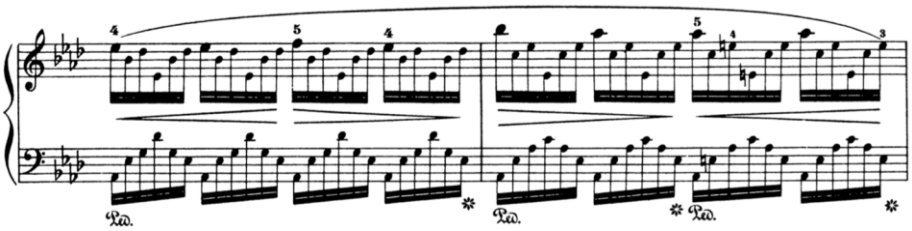
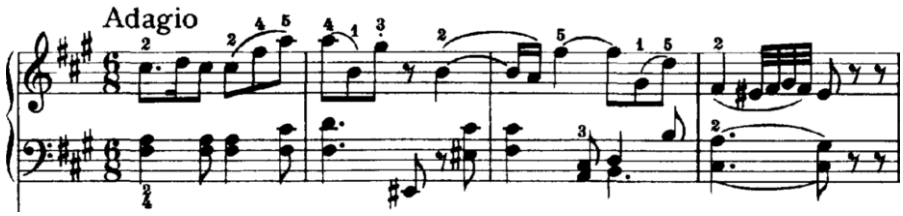


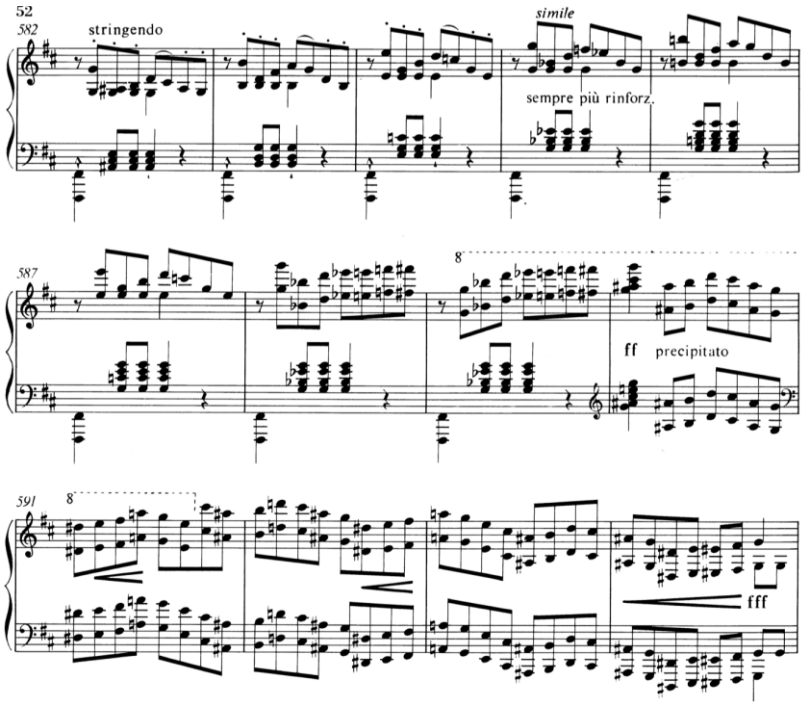
Figure 6. Mozart, Piano Concerto in A Major, K. 488, ii, mm. 1-4



Fatigue

The fatigue that stems from constant stretching, jumping, creating uncomfortable angles in the wrist, and repetitive motions have been the subject of numerous studies.[5] Figure 7 is indicative of fatigue that may arise from the aforementioned descriptions in order to play a long and loud passage of octaves, compounded by a stringendo in an already rapid tempo. As stated by the U.S. Department of Health and Human Services in their document demonstrating ergonomic principles in the workplace, "… fatigue occurs sooner when working in awkward postures", with awkward postures defined as a deviation from a neutral position.[6] This suggests that even small deviations from a neutral hand position can contribute to fatigue.

Figure 7. Liszt, Sonata in B, S. 178, mm. 582-594



[5]Naotaka Sakai, "Hand Pain Related to Keyboard Techniques in Pianists," *Medical Problems of Performing Artists* 7 (1992): 63-65. MPPA flat (iu.edu) (accessed Feb 22, 2021).

[6] Moore, Torma-Krajewski, and Steiner, *Practical Demonstrations of Ergonomic Principles*, 4.

Repertoire

A huge body of repertoire reflects idiomatic keyboard writing that poses difficulties for small hands, particularly in the romantic period onwards. In effect, small-handed pianists are often confined to repertoire with sparser textures, reduced virtuosity, and softer sound palettes. Further studies may show a correlation between female pianists and their "preference" for the music of composers like J.S. Bach, Mozart, and Debussy. While many pianists may protect their physical health with choices of repertoire that fit, gigging pianists are often only given the choice to accept or decline repertoire. Therefore, small-handed pianists have a reduced chance of experiencing performance success and career stability.

Adaptability

Outside of the home, pianists rely on the instruments of others while practicing and performing. Therefore, the success of a pianist is often reliant on her or his abilities to adapt to constantly changing contexts of situation and acoustics, on pianos that wildly vary in sound, key weight, and key depth. The surprise of a heavy keyboard may decimate the strategic choreography of efficiency a small-handed pianist has prepared.

Mental and Emotional Strain

The physical struggles and musical compromises that must be considered by small-handed pianists for the sake of efficacy are the cause of added emotional stress on players. Deahl and Wristen write, "Many small-handed players suffer in silence, overtaxing themselves to succeed on a keyboard that does not fit their hands."[7] The severity of this stress cannot be overstated, and is likely a dominant cause in the self-termination of piano performance pursuits.

[7] Deahl, *Adaptive Strategies for Small-Handed Pianists,* 20

Chapter 2: Coping Strategies

The following concepts are meant to support the expression and intention of sound of the individual, the best guide to any physical motion. Seymour Fink describes this process of audiation as the starting point for all movement, naming musical intention as a protective device against injury.[1] This has implications for teaching the most basic exercises with musical and sonic intention. A directive may look like, "Play your scale with clarity, energy, and shape, like you would see in the first movement of a Mozart sonata."

In addition, all technique is unique in that it considers "the particular piano, repertoire, and the individual's body and psyche".[2] These strategies aim to allow access to previously unattainable repertoire; alleviate problems of reach, sound control, and fatigue; increase comfort and adaptability with playing different pianos; and support the emotional health of small-handed pianists.

Efficiency and Ergonomics

Preserving physical well-being should remain at the center of any pianist and teacher's objectives. Ergonomics is the study of the interaction between the worker and machine to optimize performance and conserve resources, thereby minimizing the risk of injury and increasing job satisfaction.[3] With research indicating a correlation between small hands and pain and injury, the small-handed pianist must assume the role of the ergonomist in his or her work.[4]

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[1] Seymour Fink, "Biomechanics of Healthy Pianistic Movement," *A Symposium for Pianists and Teachers: Strategies to Develop the Mind and Body for Optimal Performance,* ed. Kris Kropf (Dayton: Heritage Music Press, 2002), 33.

[2] Brandfonbrener, "Pathogenesis and Prevention of Problems of Keyboardists," 57-59.

[3] "Ergonomist", October 2020, https://www.workplacetesting.com/definition/1574/ergonomist (accessed March 1, 2020).

[4] Deahl and Wristen, *Adaptive Strategies for Small-Handed Pianists,* 19.

Such a job involves the study, design, and evaluation of various interfaces between the worker, work environment, and equipment to maximize efficiencies and remove ineffective contributions from the process of performance.[5] Ultimately, the small-handed pianist must develop incredibly efficient near-reflex actions on the piano in order to place the focus of performance on expression and rhetoric.

The Neutral Hand

"Curl your fingers." "Imagine a ball in your hand." "Keep your bridge high." All of these highly used instructions direct the pianist to "do" something, perhaps prompting a static, inflexible posture. The neutral hand, or the hand at rest, is a natural position that requires no "correct" positioning or effort. It is also the posture that allows for the maximum control and flexibility of sound while safeguarding against injury.[6] The neutral hand benefits the efficiency of all pianists, but while the large hand can withstand certain inefficiencies, the small hand cannot. Pianists with small hands exhibit higher degrees of abduction in the fingers and contorted wrist positions related to stretch when compared to pianists with large hands. Therefore, it is crucial that the small-handed pianist return to a neutral position whenever possible. The following directives aim to aid in this endeavor.

Let It Go

In cases where stretches are unavoidable, the formation and release of the stretch should be achieved as quickly as possible.[7] If the composer indicates a continuation of tones, employ the

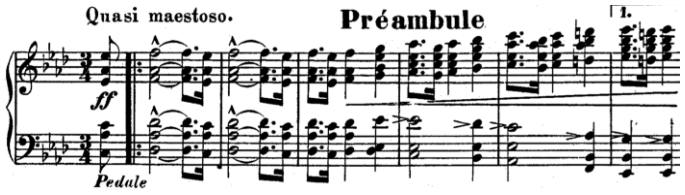
[5] William B. Meinke, "The Work of Piano Virtuosity: An Ergonomic Analysis." *Medical Problems of Performing Artists,* 10, no. 2 (1995): 48, journalviewer.aspx (iu.edu) (Accessed Feb 21, 2021).

[6] U.S. Department of Health and Human Services, *Practical Demonstrations of Ergonomic Principles*, by Susan M. Moore et al., (July 2011), 4.

[7] Patricia Eger, *A Study of the Problems Encountered by the Pianist with Small Hands and a Compendium of Practical Solutions.* Doctoral Dissertation, Ball State University, 1982. A study of the problems encountered by the pianist with small hands and a compendium of practical solutions (bsu.edu) (Accessed Feb 22, 2021).

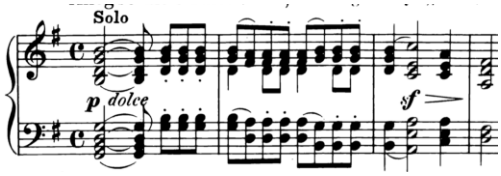
damper pedal. The sound has been created and cannot be changed; holding down the notes in an awkward position will only add to fatigue. The Préambule of Schumann's Carnaval serves as a prime example, as shown in Figure 8.

Figure 8. Schumann, Carnaval, Op. 9, Préambule, mm. 1-6



This concept may be employed in less strenuous situations as well, shown in Figure 9's opening chord of Beethoven's Piano Concerto No. 4 and the following sforzando chord.

Figure 9. Beethoven, Piano Concerto No. 4 in G Major, Op. 58, I, mm. 1-3



Deahl and Wristen are not the first in pointing out that effective legato is merely the connection of the tones,[8] which can be produced without the actual physical connection when using the damper pedal. Other contexts of letting go of arpeggios and melodies can be in Figures 1 through 7, with the exception of Figure 6.

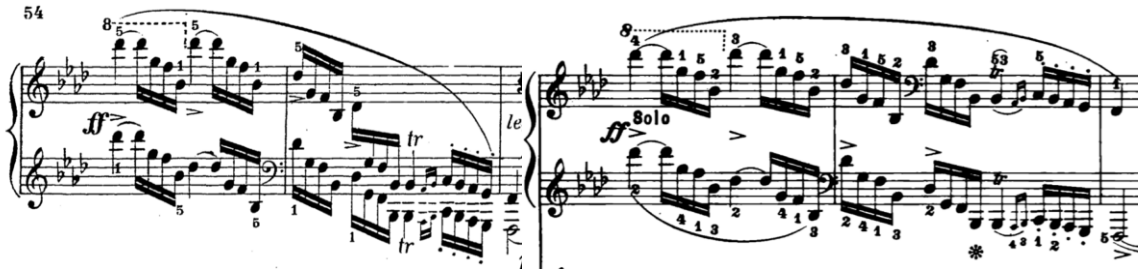
That Fingering Was NOT Written by a Small-handed Pianist

The following figure shows two different editions of the piano entrance in Chopin's Piano Concerto No. 2, edited by Carl Mikuli and Rafael Joseffy. The first implies a physical connection between the first four arpeggiated notes, a stretch for a small-handed pianist that can be pulled off, particularly when the arm is centered on top of the finger playing while the hand

[8] Deahl and Wristen, *Adaptive Strategies for Small-Handed Pianists,* 203.

stays in a neutral position throughout. The second reduces the stretches in the same arpeggio, perhaps allowing for more connected, rounded gestures.

Figure 10. Chopin, Piano Concerto No. 2 in F Minor, Op. 21, i, mm. 71-73



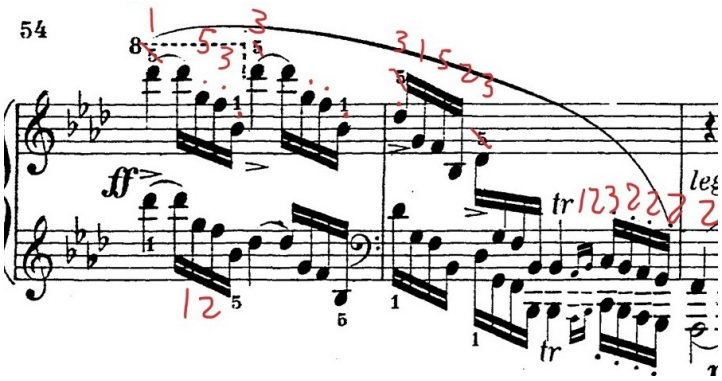
Neither editor considers the struggle the small-handed pianist may experience in producing a grand, soaring sound to fill a concert hall, creating an entrance of fury and frustration after the orchestral tutti. According to Deahl and Wristen, "volume is a product of both force and speed"[9], and this concept is supported by several researchers of piano technique. The often-seen karate chop motion is harsh in sound and creates strain of the upper limbs. By using a technique of forearm rotation, or pronation and supination, the speed of attack is very fast, thereby creating a large sound with more efficiency. In addition, the knowledge that the middle finger and thumb are the strongest while the index finger is the fastest may help in the determination of fingering. This is supported in Meinke's Laws of Motion Economy in his paper encouraging the use of an ergonomic evaluation system in virtuosic piano playing.[10] Since both force and speed determine volume, utilizing fingers 1, 2, and 3 as much as possible when producing a loud sound is desirable. When using the thumb with forearm rotation (pronation), this creates the fastest key speed, thus the loudest sound, with any single finger. In the case of the opening piano phrase of Chopin's 2nd Piano Concerto, forearm rotation towards the 5th finger (supination) can create a lot

[9] Lora Deahl and Brenda Wristen, "Strategies for small-handed pianists." (2003): 4.

[10] Meinke, "The Work of Piano Virtuosity: An Ergonomic Analysis," 50.

of volume, but the surface area of a small 5th finger on a black key using this type of motion can be a less consistent. Instead, I propose the following fingering in Figure 11.

Figure 11. Chopin, Piano Concerto No. 2 in F Minor, Op. 21, i, mm. 71-73



By using finger 1 in the opening note of both hands, pronation of the forearm allows for a loud volume. This leads to my next point of:

Stop Stretching, Just Jump

We continue with Figure 11 after the downbeat. By letting go of the sound while keeping the damper pedal depressed, the next four notes in each hand can be played with a near-neutral hand position, allowing for maximum control of sound to aid in the shaping of the phrase. In addition, these 16th notes can be played with a detached articulation, to allow more arm weight to contribute to the fortissimo sound and promote a neutral hand position. This is one of countless examples in which the damper or sostenuto pedals may be employed to the advantage of a neutral hand position. In playing the 3rd finger on the third beat of the first measure, supination of the forearm can be used to contribute to the accent. The fingering in the closing scalar figure has been chosen to allow for the portato articulation using a closed hand shape, aiding in slow, heavy key attacks for a deep sound within a diminuendo.

A non-legato touch allows the player to maintain a neutral hand position while jumping from key to key. Meinke emphasizes the inefficiency of searching for or locating an object

during performance.[11] It is therefore imperative for small-handed pianists to develop a refined memory of the topography of the keyboard, minimizing the search for "the object" or key.

You Are Not a Robot

When using the jumping or leaping motion, Meinke turns to the Laws of Motion Economy in advising "continuous curved motions rather than straight and/or sudden changes of direction."[12] Although a straight line is the shortest route, incorporating curved motions in piano movement creates a more ergonomically friendly gesture.

Figure 12. Ravel, Scarbo from Gaspard de la nuit, mm. 32-35

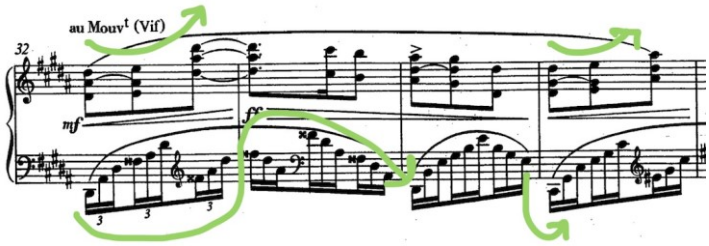


Figure 12 suggests sweeping curved gestures to be used in both hands, as indicated with green arrows. The right hand melody navigates the octave chord leaps with a larger oval gesture, supporting the shape of the phrase. One also uses momentum of the gesture to achieve the peak of the phrase. As Meinke confirms, inertia from momentum produces larger volumes. He references momentum's equal and opposite reaction, advising pianists to use this energy to help move to the next keystroke.[13]

While momentum can be of assistance, it can also waste energy.[14] Small-handed pianists should be wary of extraneous gestures that waste energy rather than conserve resources. This

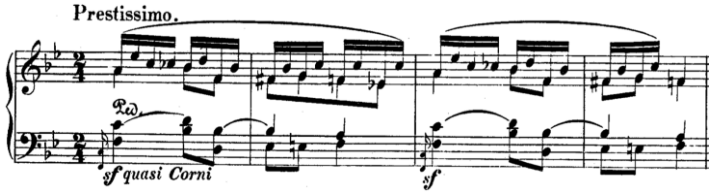
[11] Meinke, "The Work of Piano Virtuosity: An Ergonomic Analysis," 49.

[12] Ibid., 50.

[14] Meinke, "The Work of Piano Virtuosity: An Ergonomic Analysis," 50.

supports motions that start from the key, as may be witnessed in the left hand opening of Figure 13. Rather than using the momentum of a vertical drop to play the first 5th chord, then lifting and dropping again for following 5th, the momentum starting from the key and using an upward curved gesture of the wrist toward the fallboard of the piano is much more efficient at achieving a quick leap and sforzando.

Figure 13. Schumann, Carnaval, Op. 9, Papillons, mm. 1-4



You Are a Robot…

Pianists manipulate a complex system of levers in the body during performance. The finger has three levers around three joints that work quickly but has the least power. Strength increases and speed decreases from the wrist, to forearm, upper arm, and body. This can be demonstrated in fast, repeated note passages in which a 3-2-1 fingering employs the smallest levers of the finger, creating the most speed. Another description is cleaning the least amount of key with tiny mouse fingers. At the same time, smaller muscles are more easily fatigued. The finger/wrist/forearm/arm/body motion is the least easily fatigued as compared with just a finger motion.[15] This suggests maintaining a constant connection from the core of the body to the fingers in the consideration of speed, strength, and fatigue at any given time.[16] The balancing act of finger to arm ratios is constantly shifting to support sound and interpretation. A focus of efficiency in movement may point to conscious decisions in forming choreography.

[15] Meinke, "The Work of Piano Virtuosity: An Ergonomic Analysis," 51.

[16] Fink, "Biomechanics of Healthy Pianistic Movement," *35*.

In the determination of such a choreography of levers, efficiency principles demand staying within the mid-range of motion for all levers and joints to reduce fatigue.[17] This ergonomic rule rejects high-finger technique, a method that is used for strength and finger-independence training. This author sees the merits of using such a technique during practice for small quantities of time.

Get Comfortable

Adjustment of the seated position to give the best mechanical advantage to the individual is an important consideration when concerning ergonomics. The height of the chair should be adjusted so that the forearms and wrists are level or slightly above the keyboard. In determining the distance of the chair from keyboard, one should not have to lean forward or backward very much to reach any note on the piano. The elbows should be slightly in front of the body's trunk. This care and attention will not only aid in injury prevention, but also maximize efficiency.[18] In observing Dr. Karen Taylor's piano lessons for children with small hands working on advanced repertoire, the students were seated high, with a slight bend to the wrist that was higher than the bridge of the hand. She attributed the high wrist as a bridge of support for a collapsed bridge when playing large intervals.[19] Further research should investigate raised seat heights and slightly varying angles of the elbow and wrist to accommodate small-handed pianists.

Taming the Beast

Many pianists loathe the unpredictability of different instruments, but as pianists cannot carry around a concert grand, one must develop strategies in adaptability. Small-handed pianists

[17] Deahl and Wristen, *Adaptive Strategies for the Small-Handed Pianist, 60.*

[18] Alice Brandfonbrener, "Pathogenesis and Prevention of Problems of Keyboardists," *Medical Problems of Performing Artists* 12 (1997): 58.

[19] Karen Taylor, interview by author, Bloomington, IN, February 1, 2014.

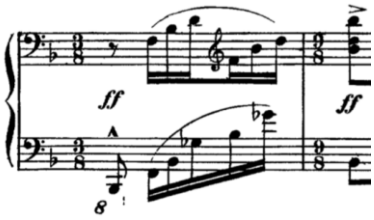
rely on efficient strategies of motion, yet physical choreography is reliant on the traits of each specific piano. In the constant adjustment to each piano's varying weight, depth, and even size of keys, Meinke advocates a series of steps to improve efficiency.[20] This plan of action includes obtaining facts, making an analysis, developing a method, and finishing with a follow-up. In other words, an acclimatization period in using a new instrument is expanded and codified into a system that helps to optimize performance. The first steps of gathering information and making an analysis may include facts about the space and piano, as well as considering the purpose of the performance. For example, if one knows the performance space has extremely reverberant acoustics, the proposed method may include lightening the use of the damper pedal, using greater finger articulation, and taking slightly slower tempi. Follow-ups may occur in the moment or during pauses, altering the method based on observation and success. In this way, efficiency would rise according to the time spent gaining comfort on the instrument and acoustical space. While such a system may seem commonplace, it stresses the importance for small-handed pianists to carefully map out a plan for every performance, in addition to scheduling plenty of rehearsal time and gaining experience using the method in a variety of settings. In situations where a small-handed pianist does not have the luxury of spending time at the instrument before a performance, one can program less technically challenging pieces to begin, allowing acclimatization to happen under less strenuous circumstances. In addition, a performer can embrace more moderate tempos, apply softer choices of interpretations, and find more areas of rhythmic stretching until an acceptable level of understanding the instrument is achieved.

[20] Meinke, "The Work of Piano Virtuosity: An Ergonomic Analysis," 49.

Use Everything You've Got

In Ravel's Alborada del gracioso, the downbeat of Figure 14 surprises the listener, and continues into a flurry of festivities in a fortissimo dynamic. Ravel, in his orchestral transcription, gives us another timbral concept by scoring this note for bass drum, timpani, bassoons, and double basses.

Figure 14. Ravel, Alborada del gracioso from Miroirs, mm. 30



As it is written in an extremely low register, one might expect to play it with the 5th finger of the left hand. Supination of the forearm may help to generate more volume. The small-handed pianist must consistently think outside the box to achieve what may be easily produced by the 5th finger of pianist Yefim Bronfman. This author experimented with the 3rd finger braced by the thumb in an up gesture; fingers 2, 3, and 4 braced together to create contact with the key, producing more mass; and finally, a closed fist with the thumb on top. The fist was, by far, the easiest and most consistent option for creating the sound I desired. The process was an experimentation of adjusting mass and key speed to produce the sound. There must also be the awareness of the limits of mass and/or key speed on changing the sound. Meinke suggests that many pianists go past "[the point] beyond which the addition of more force will no longer appreciably change the quality of the tone".[21] The process of experimentation and awareness of the motion in relation to the sound cannot be emphasized enough.

[21] Meinke, "The Work of Piano Virtuosity: An Ergonomic Analysis," 50.

It's Not Cheating

You can't play that note? Don't. The successful rendering of the score must involve omitting notes in difficult passages that may take countless hours of practicing, only to produce a disappointing result. Likely, the omission of the note will make way for superior sound and rhythmic flow.[22] If omissions prove to be too intrusive and/or there are too many instances, repertoire choice must be considered. Covering up the omission may involve shifting of voicing, rewriting a chord, and/or using more pedal. Figure 15 omits G's in mm. 10, as indicated with red slashes, to avoid rolling and displacing the rhythm and compromising the sound of the melodic line. The green dots indicate added notes, to be played together with the bottom note of the chord using the thumb.

Figure 15. Beethoven, Sonata No. 13 in E-flat Major, Op. 27 No. 1, i, mm. 9-12

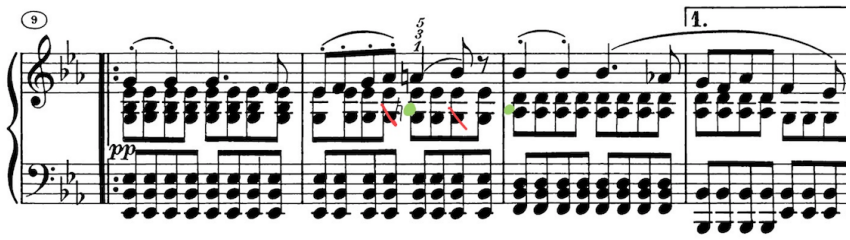
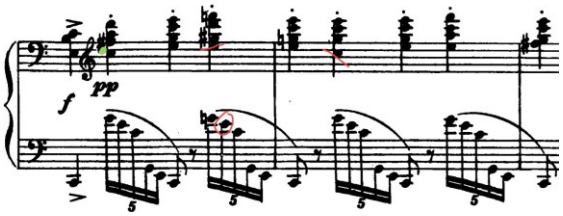


Figure 16 shows a similar procedure of omission and addition. The choice to avoid rolling the chords in the right hand support the musical intention to embody a sprightly character with light, precisely articulated, and well-voiced chords.

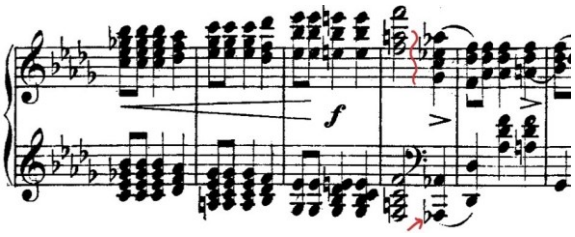
Figure 16. Prokofiev, Sonata No. 6 in A, Op. 82, ii, mm. 36-37



[22] Deahl, *Adaptive Strategies for Small-Handed Pianists, 189.*

On the other hand, Figure 17 demonstrates the choice to roll based on the desire to voice the top note. As a rolling gesture allows the hand to stay in more of a neutral shape, voicing the top or bottom note of the chord becomes easier. This author also experimented with playing the same chord blocked, while bringing out the bass line to bolster the A-flat.

Figure 17. Schumann, Papillons, Op. 2, #8



The redistribution of notes written for one hand into the other is another technique that small-handed pianists must constantly consider. Figure 18 displays a redistribution of the bottom two notes in the right-hand chord, marked in red; these two notes would be taken by the thumb of the left hand. The following red marking shows a similar redistribution. The primary purpose is to gain a neutral hand position, thereby having the ability to produce more power in the fortissimo peaks that Ravel writes.

Figure 18. Ravel, Alborada del gracioso from Miroirs, mm. 157-158

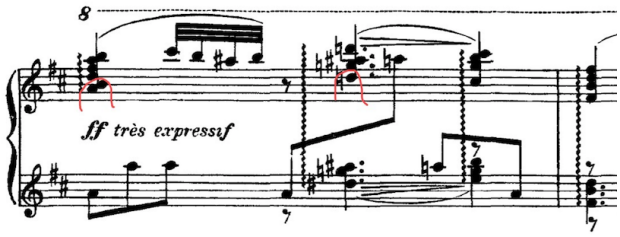
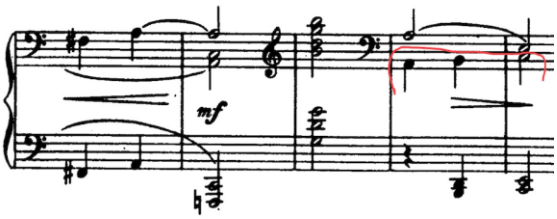


Figure 19 displays less need for power, but the right hand, when uninhibited by the octave stretch, can control the sound of the top melodic voice with ease in a neutral position.

Figure 19. Prokofiev, Sonata No. 6 in A, Op. 82, iv, mm. 43-44

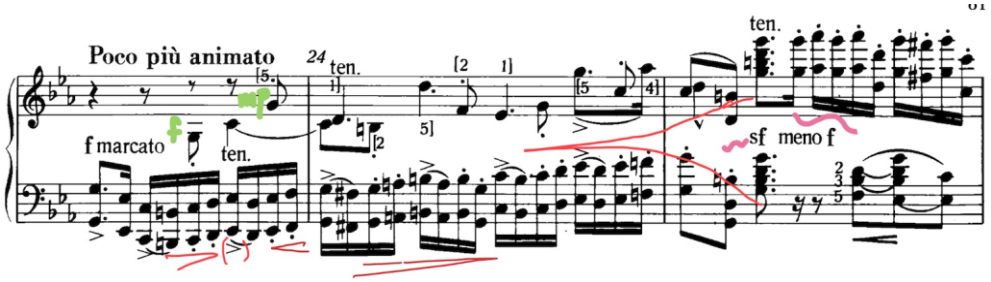


Expressive, Not Aggressive

"When we make war with our music, we need an attitude adjustment to allow us to find ways to embrace it instead."[23] The refusal to acknowledge physical limits in the quest for volume and speed may result in such a war. Even worse, it may invoke a "no pain, no gain" mentality, attributing physical suffering to achievement. Instead, the small-handed pianist must be inventive when looking at a score, prioritizing expression over athletics.

This may take on the form of expressive interpretations that support slower tempos and lower volumes. Directives that support this may sound like, mysterious and dark vs. furious and bombastic. Figure 20 provides such an example, where more moderate volumes and taking advantage of the "poco" in the poco più animato will aid in conserving resources.

Figure 20. Liszt, Etude No. 2 in E-Flat Major from Grandes études de Paganini, S. 141 mm. 23-25



[23] Robert Mayerovitch, "Mind Over Muscle," *A Symposium for Pianists and Teachers: Strategies to Develop the Mind and Body for Optimal Performance,* ed. Kris Kropf (Dayton: Heritage Music Press, 2002), 82.

In addition, subtle dynamic changes within loud volumes ease discomfort.[24] This supports the type of music-making that gives priority to aspects of phrasing rather than decibel levels. The left hand of Figure 20 shows such shaping marked in red.

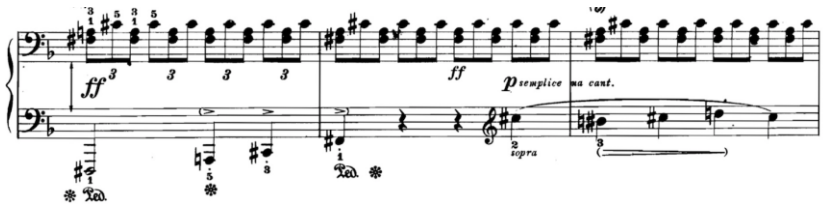
A wide dynamic range will create the illusion of larger sound, for instance in a crescendo built in an exponential fashion, waiting for the last possible moment to peak. In other words, loud volumes are contextual; one must place more importance on the hierarchy of volumes, or the shape of the phrase. With this strategy, the peaks and climaxes of phrases will appear to have more volume due to the decibel levels of the surrounding notes. Figure 18 provides such an example leading up to the sforzando in mm. 25, with an exponential crescendo marked in red.

Another strategy to conserve energy is to find interpretive justifications to rest, using breaths, rubato, ritardando, and rests. In Figure 20, a natural resting point is the sforzando in mm. 25. One can add to this downtime by slowing down into the sforzando and taking time getting back to tempo, as marked in pink.

Voicing bass lines may contribute to the fullness and depth of sound. While this is most suggestive of chordal playing, this technique can also affect independent melodies and accompaniment patterns. While limiting choices of texture, this strategy points to using the acoustics of the piano to a pianist's advantage, as bass strings resonate longer than treble strings. Thus, in terms of volume, low notes stay louder for a longer period of time than treble notes. Figure 21 shows an example where the editor, Artur Schnabel, suggests a relentless fortissimo texture in the RH. A small-handed pianist desiring to conserve energy may ignore such an editorial suggestion and keep a relatively light right hand while focusing on creating a thundering left hand. Schnabel suggests starting mm. 99 with the thumb, an efficient use of the strongest

finger. This author suggests following the F-sharp with fingers 3, 2, and 1, again staying in neutral position and taking advantage of stronger fingers.

Figure 21. Beethoven, Piano Sonata in D Minor, Op. 31 No. 2, i, mm. 99-101

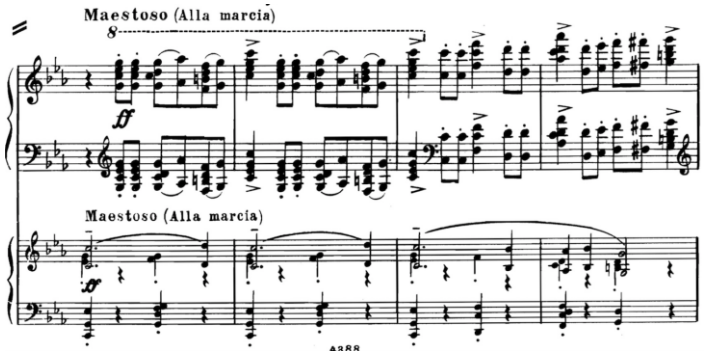


Ears AND Eyes

Musical interpretation of the listener is guided by perception of sonic and visual gesture.[25] Although consideration in gesture of sound reigns supreme, the conveying the performer's musical intentions can be enhanced through physical intensity. In instances of piano concertos, there may be certain sections overpowered by the forces of the orchestra where a pianist's efforts to rise above are moot. Dramatic physical intensity may aid in the perception of larger sound. In such cases, it may be in a small-handed pianist's best interests to conserve energy in sound production while seemingly producing a large sound visually. In other words, the physical gesture may not have a direct correlation to the sound. For example, in the piano part of Figure 22, this author has been advised in numerous occasions from esteemed pianists and pedagogues to "look big". Thus, small-handed pianists are reminded that musical gesture is perceived through the ears AND eyes of the listener.

[25] Elaine King, et. al., "Gestures in Music-making: Action, Information and Perception", in *New Perspectives on Music and Gesture*, ed. Anthony Gritten (Abingdon: Taylor & Francis Group, 2011), 60-63. ProQuest Ebook Central (Accessed March 1, 2021).

Figure 22. Rachmaninov, Piano Concerto No. 2 in C Minor, Op. 18, i, mm. 245-248



Catch it Early

With the prevalence of musculoskeletal disorders in small-handed pianists, it is of utmost importance for players and teachers to catch fatigue early. The act of going outside of the normal range of motion, as in extreme stretching to reach a chord, may lead to injury of the muscles, tendons, and/or nerves.[26] "What starts out as an ache or tenderness can develop into persistent pain, fatigue, and/or physical weakness. Over time, the injury becomes chronic and requires more and more intense treatment – it can even lead to surgery. In the most extreme cases, [musculoskeletal disorders] disable the person from being able to do work".[27]

Acts of ignoring or denying the pain, pushing through the pain, and hiding symptoms from others were all too common in this author's early musical journey. It is of utmost importance that small-handed pianists not only gain awareness of coping strategies, but also of boundaries of the body and mind that will protect one's health. Teachers must also pay special attention to small-handed players, fostering an open culture of addressing health.

In conclusion, the coping strategies discussed in this paper aim to spark a process of evaluation and adaptation to the individual's unique needs. Pedagogues and pianists with small

[26] https://www.workplacetesting.com/2-common-at-work-postures-that-lead-to-musculoskeletal-problems-and-why/2/5307

[27] Ibid.

hands must continue to refine appropriate technical formulas that reflect research on the interface between the pianist and the piano. Combined with a culture of empathy and openness, small-handed pianists may be empowered to break down the many barriers to musical fulfillment and self-actualization.

None of these tactics of efficiency and strategy address permanent solutions in playing large-handed repertoire. Donison points to a comparison of trying to have an entire population fit the same sized shoe, while carving out the best methods of adapting for those who find it too large. The road to adaptation can be grueling, but it doesn't need to be.

Chapter 3: In Search of Permanent Solutions

Progress and the Piano

A Short History

The evolution of the piano has always been nourished by a desire for progress combined with special consideration for market needs.[1] Its inception was triggered by discontent with its precursors, the clavichord and harpsichord. The use of the clavichord was restricted to intimate spaces due to its small sound, albeit its expressive tone quality. The harpsichord's sound could fill any venue of its time, but its plucking mechanism was constricted by limited dynamic range and frequent need of tuning. The piano, invented by Bartolomeo Cristofori in 1700, was initially described as the "harpsichord with soft and loud".[2] It's groundbreaking single escapement design and hammer action became the muse for piano makers across Western Europe.[3]

Spurred by a thriving concert industry and growing performance halls, manufacturers sought more power, stability of tuning, and a greater expressive range in their pianos. Two-foot pedals were added, consisting of the una corda and sustaining pedals. The 5-octave range of the harpsichord began expanding in 1800, eventually arriving at the 7 $^{1/3}$ octaves of the modern piano. Erard's double escapement invention of 1824 paved the way for quickly repeating notes. Steel stringing and bass cross-stringing increased the power of the piano, also bringing about sympathetic vibrations. The hammers and dampers became bigger and heavier to accommodate these changes, while also changing its materials from leather to the more durable felt material.

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[1] James, Parakilis, *Piano Roles: Three Hundred Years of Life with the Piano*, (New Haven: Yale University Press, 2000), 26.

[2] Edward M. Ripin, et al. "Pianoforte." *Grove Music Online* (2001). http://www.oxfordmusiconline.com/subscriber/article/grove/music/21631 (accessed March 1, 2021).

[3] Ibid.

Builders began using metal frames to support an increase in string tension, as well as a stronger wooden case structure to house the heavier frames. Americans Dodds & Claus used an iron one-piece frame and treated the wood to withstand changes in climate, resulting in longer-lasting tunings. Even with the growing strength of the piano, Liszt, known as the "holy terror" amongst piano makers, was famous for breaking hammers, strings, and keys concert after concert.[4] He played instruments created by over 100 makers, giving less favor to softer pianos built by manufacturers like Camille Pleyel.[5] For virtuosos and audiences alike, manufacturers sought to create sturdy, brilliant, and powerful pianos.[6]

Performers were not the only ones benefitting from a more reliable product and the booming manufacturing industry. The heyday of piano lessons fueled the increased manufacturing of the upright piano, meant to save space in the home. The purchase price was catered to middle class amateurs and teachers, and pianos sold aggressively.[7] Piano teachers, in partnership with manufacturing companies, began to accept commissions and discounts for such sales.[8]

In a study of 120 keyboard instruments from 1559 to 1929, the period of time between 1784 and 1850 produced keyboards that had an octave span of 3-6 mm smaller on average than the current standard of 188mm.[9] Keyboard sizes in the same study ranged from 125 to 188 mm,

[4] Keeling, Geraldine. "Liszt and J. B. Streicher, a Viennese Piano Maker." *Studia Musicologica Academiae Scientiarum Hungaricae* 28, no. 1/4 (1986): 40. doi:10.2307/902408 (Accessed March 14, 2021).

[5] Ibid., 36.

[6] Deahl, *Adaptive Strategies for Small-Handed Pianists, 9.*

[7] James, Parakilis, *Piano Roles: Three Hundred Years of Life with the Piano*, 52-56.

[8] Ibid., 33.

[9] Sakai, "Keyboard Span in Old Musical Instruments", 170.

suggesting a great deal of customization to fit buyers. The 1850's brought about the standardization of piano keys at 188 mm to the octave. Whereas previous piano makers were largely craftsmen that carried out construction from beginning to end, standardization brought about a piano parts industry in which manufacturers specialized in the production of specific parts. Industrial manufacturing in the late 19th century laid out the infrastructure for the start of such an industry. Machinery created the precision needed in standardized parts, and traditional Viennese craftsmanship in piano production retreated, along with a range of keyboard sizes.[10]

Statistics

While this evolution of keyboard size may have suited pianists from Franz Liszt to Van Cliburn, it is not indicative of a population of peoples who pursue concert careers, not even considering the broad population who play the piano. According to a survey conducted by Donison, universities in North America have a ratio of 8 females for every 1 male piano student (2000).[11] Modern research on anthropometry shows us that the female hand is 15% smaller than male on average. [12] The piano has adapted to the large concert hall, the traveling piano virtuoso, the new concert public, the amateur musician, and the rise of music lessons. The piano world must bend to finally make way for the female professional.

The statistics paint a glaring portrait of gender inequality in the piano field. Donison observes that in a 50-year period of major international piano competitions, excluding those with a focus on Bach, Mozart, and Chopin, females represent 15-26% of prizewinners and only 0-18% of first prizewinners despite females outnumbering males in the collegiate music schools.[13]

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[10] Parakilis, Piano Roles: Three Hundred Years of Life with the Piano, 26-57.

[49] Naotaka Sakai, "Keyboard span in old musical instruments", 169.

[13] Christopher Donison, "Small Hands? Try This Keyboard." *Piano & Keyboard, July-August,* 41-43

Meanwhile, in those competitions focusing on Bach, Mozart, and Chopin females represent between 39-63% of prizewinners and up to 70% of first prize winners.[14] These statistics imply that females are at a disadvantage to males in the majority of piano repertoire, with the exceptions being composers who typically require a shorter reach. The defining feature appears to be hand size. Data from US MTNA competitions between 1963-2020 show first prize winners in piano between Junior (ages 11-14), Senior (15-18), and Young Artist (19-26). While the junior category has been most often won by females, the subsequent age categories show a progressive, severe decline in female winners. Whereas, in the string competitions, the ratio of female winners is consistently higher through all three categories.[15] The painful question must be asked: how much talent and artistry has been lost or unrealized in our communities simply because the piano keys are too large for a significant segment of our population? Given the above data and the demographics of piano players, keyboards sized for smaller hands should be offered at institutions of learning and competitions.

The standard keyboard size is also a contributor to racial inequality as hand size is very much related to race. For instance, Sakai shows that the hand span of German pianists is significantly larger than that of Japanese pianists, and Nag et al. (2003) shows that on average, Indian women's hand span is 0.92 inches smaller than British women's hand span.[16] In this time of increased awareness of social justice and racial and gender disparity, it is the perfect time for institutions of music learning and performing to begin providing instruments that accommodate

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[14] Ibid.

[15] Ibid.

[16] Naotaka Sakai, "Keyboard span in old musical instruments"; Anjali Nag, P.K. Nag, and Hina Desai, "Hand anthropometry of Indian women." *Indian Journal of Medical Research* 117 (2003): 260-269.

women and people of color in addition to those instruments standardized for the bodies of European males in the 1850s. The institutions which seriously commit to the adoption of reduced-size keyboards will reap the rewards of the richness that comes from diversity, bringing new perspectives that benefit the entire field. They may also become a magnet for a wider pool of talent that otherwise may not realize its potential.

A Call for Change in Universal Standards

The piano is one of the few instruments that cannot feasibly be transported by its player, unlike a string, wind, or brass player. Therefore, the pianist is subject to the idiosyncrasies of the instrument at hand. In a professional environment, the piano should therefore be subject to standards of occupational health and safety. When assessing a product for use in a workplace, one is generally subject to a list of standards. The standards are related to the relationship between the product and the people that use the product. There is a consideration for efficiency and usability of the product in direct relationship to its users. Factors of size and strength are key components of such studies.[17]

Are the standards for universal key size indicative of the changed and changing demographic of pianists? The concert stage has welcomed female musicians and people of color long after exceptions like Clara Schumann and Mitsuko Uchida, but what standards have changed to allow for women, and people of color, specifically Asians? This decision-making is in the hands of the piano makers and the models they offer. Smaller keyboard sizing is an issue

[17] International Organization for Standardization, "Occupational Health and Safety," https://www.iso.org/publication/PUB100427.html (accessed March 1, 2021).

that continues to be hard-fought by individuals, resulting in petitions to manufacturing companies.[18]

Standards exist everywhere in the world of piano playing: the technical and repertoire standards of certificate programs, collegiate programs of study, and unspoken standards of perfection on the concert stage. None of these standards accommodate pianists with small hands. Arenas in which adjusting to pianos hold the most weight in determining career success, such as auditions and competitions, must allow for such standards. What would the demographic of the concert stage look like if there was a standard for universal key size that reflected the demographic of its users?

Ergonomically Scaled Piano Keyboards (ESPK)

ESPK's are currently in production and offer a solution to the large population of pianists whose hand size is smaller than the standard keyboard size was designed to accommodate. The Steinbuhler company has been manufacturing ESPK's since 1994, offering two sizes of keyboards that are 7/8 and 15/16 the size of a standard keyboard. The 7/8 size corresponds with the anthropometry figures, as it is 15% smaller than the standard keyboard. They are customized and sold separately to fit inside of any grand piano without any compromise in sound or response. In 2021, the cost of such a keyboard is $14,800, or $9800 with the original action stack of a piano. One may also purchase a Walter or Hailun upright piano already fitted with smaller keyboards[19], as well as choose from a variety of custom builders.

[18] Pianists for Alternatively-Sized Keyboards, "Need Piano Keyboards that Fit our Hands," https://www.gopetition.com/petitions/need-piano-keyboards-that-fit-our-hands.html (Accessed March 1, 2021).

[19] http://paskpiano.org/manufacturers-technicians/

Research confirms the increased ease and enjoyment experienced by small-handed pianists while using the ESPK, as well as the immediacy or near-immediacy of adapting to its size.[20]

Although this technology has been available for many years, it remains non-existent in most educational and professional settings. Donison points to a "cult" mentality in the field of pianists[21], barring any ideas that may seem unconventional or threatening. It is perhaps hindered by the costs of offering such options. It may also stem from doubts about the quality and abilities of ESPK's themselves.

Interview with Stephen Shaver, Jacobs School of Music Head Piano Technician

In an effort to answer questions that pianists have about ESPK's, I interviewed Mr. Stephen Shaver[22], a piano technician who worked at Indiana University for 33 years providing care for the hundreds of instruments in Jacobs School of Music's concert halls and practice rooms. He has clocked thousands of hours catering to the musical tastes of world-class musicians. I contacted him to inquire about the logistics of installing and working on a reduced-size keyboard, as well as any flaws he could see in its construction.

"Pianists are conservative." was his initial reaction to my short explanation on ESPK's. This was in reference to the attitudes of the overwhelming majority of pianists he has come into contact with, regarding technological developments or even just piano brand options, supporting Donison's "piano cult" mentality. Mr. Shaver has heavily advocated for the Bösendorfer and

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[20] Boyle, Rhonda, "The Experience of Playing the Reduced-Size Piano Keyboards", *MTNA E-Journal*, 3 (2012): 2-20. The Experience Of Playing Reduced-size Piano Keyboards: A Survey Of Pianists - ProQuest (iu.edu) (Accessed Feb 21, 2021).

[22] Stephen Shaver, interview by author, Bloomington, IN, April 17, 2014.

Yamaha concert grands to be housed in IU's performing spaces, in support of their comparable if not superior sound quality to the Steinway Model D. He says that regardless of quality or what may suit a particular pianist, faculty and students consistently choose to work on the traditional pianos that are offered at international competitions and major concert venues, the Steinway Model D. What Mr. Shaver says is not often considered is which instrument is best for a particular artist, and as a result, he believes it will be very difficult for a reduced-size keyboard to be accepted at any major music school.

As for the process of installing a reduced-size keyboard in a piano, Mr. Shaver predicts that it would be the same amount of work as fitting a standard keyboard into a piano. He explains that factory-finished keyboards still need about 10-15 hours of technician work to make the piano sound decent. Mr. Shaver has little concern about making the action of a reduced-size keyboard sound good. He states that capable technicians can cater any keyboard action to the tastes, strengths, and abilities of any pianist.

In terms of potential problems with the ESPK, Mr. Shaver is wary of the longevity of these actions, due to the extreme angle of the wood in order to accommodate the narrower keys. He states that the strength of the wood would be compromised when the wood is cut against the grain, and the relatively low chance of breaking a key on a standard keyboard would rise on a reduced-sized one. Warping is another issue Mr. Shaver foresees, as the keys are smaller and therefore more susceptible to humidity changes. Mr. Shaver also predicts increased wear in the bushings because of the increased angles of the keys, which is about a $500-600 replacement cost every 3 years on a standard keyboard.

Following up on Mr. Shaver's concerns, I contacted the Steinbuhler company and gathered information available on their website. In reference to longevity and the strength of the

wood, Steinbuhler uses maple wood, stronger than the standard spruce wood used by a majority of piano builders. They also rotate the keys prior to being cut to ensure strength in the grain. Although the company can't guarantee against warping, they have had no customer complaints on this issue during the existence of their company. As for key bushings, Steinbuhler states that their bushings will undergo normal wear and tear comparable to any standard keyboard. They also pointed out that the part of the key where the bushing is housed runs straight, not angled as Mr. Shaver originally thought.

According to Mr. Steinbuhler and Mr. Shaver, there will be no compromise of sound or power when using an ESPK. The touch and response of the keys can be adjusted to the user, quelling my own doubts about key weight and repeating notes quickly. Any piano technician can work on a reduced-size keyboard without additional training. This interview supports the dependability of the Steinbuhler action, and confirms that pianists will not need to make any musical concessions with use of the reduced-size keyboard. Ultimately, in the choice for a piano, Mr. Shaver asks, "Can the piano speak to your soul?" Certainly, size must be a factor.

ESPK's in Academia

The support for ESPK's must begin in academic and institutional settings where such instruments will influence huge populations of pianists and future teachers. In these environments, ESPK's can be used for further research studies; provide availability for competitions, auditions, conferences, and the general population; and most importantly, develop widespread acceptance that will infiltrate concert halls and homes. If the goal of our institutions is to nurture a field that enables the maximum amount of talent, perspective, and artistry to bloom, the adoption of ESPK's is essential. Greater inclusion and diversity will be of benefit to the field at large.

In conclusion, the piano is undisputed in its holistic development of musicianship skills. Therefore, universal accessibility without compromising health amongst its users is of utmost importance. Discontent with the standardized keyboard size has forged a new option for smaller hands that has been available for two decades, yet its presence in homes, music schools, and concert stages remains infinitesimal. The world of piano performance cannot continue to be a Eurocentric, male-dominated vestige when permanent, viable solutions for the small-handed pianist exist. It is the responsibility of performers and teachers to educate pianists on their freedom of choice, and to foster a smoother path to meaningful musical experiences. People cannot change their size. But the piano can.

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