

ALTERNATIVELY SIZED PIANO KEYBOARDS

BIBLIOGRAPHY

History

Manchester, R. (2006). Musical instrument ergonomics (editorial). *Medical Problems of Performing Artists*, 21 (4), 157-158.

Parakilas, J. & others. (1999). *Piano Roles: Three Hundred Years of Life with the Piano*. Yale University Press, New Haven and London.

Sakai N. (2008) Keyboard span in old musical instruments. *Medical Problems of Performing Artists*, 23, (4), 16 -171.

Wagner, Ch. (2005) *Hand und Instrument*. Breitkopf & Härtel, Wiesbaden-Leipzig-Paris, p. 228-240.

Experiences of pianists, attitudes and general articles/books

Booker, E. (2010). Pianos: One size fits all...big adults. *Tempo, Suzuki Talent Education Association of Australia (NSW) Inc., Autumn* 8-9.

Boyle, R., & Boyle, R. (2009). Hand size and the piano keyboard. Literature review and a survey of the technical and musical benefits for pianists using reduced-size keyboards in North America. *Proceedings of the 9th Australasian Piano Pedagogy Conference, Sydney, Australia*. <http://www.appca.com.au/proceedings/>

Boyle, R. (2012). The experience of playing reduced-size piano keyboards. A survey of pianists. *MTNA e-Journal, April*.

Booker, E., & Boyle, R. (2011). Piano keyboards – one size does not fit all! Pianistic health for the next generation. *Proceedings of the 10th Australasian Piano Pedagogy Conference: Leading Notes to Effective Teaching: Resolving the past - Exploring the future*. Charles Sturt University, Wagga Wagga, 4-8 July 2011. <http://www.appca.com.au/proceedings/>

Boyle, R., Boyle, R., & Booker, E. (2017). Narrower Keyboards for Larger Hands. *Readers' Letters, Pianist*, UK, January.

Chi, J-Y., Halaki, M., Booker, E., Boyle, R. & Ackermann, B.J. (2021). Interaction between Hand Span and Different Sizes of Keyboards on EMG Activity in Pianists: An Observational Study. *Applied Ergonomics*, 97, November.

Coates, S. (2017). Goldilocks and the Three Pianos - Ergonomics in Pianists. *The Piano Teacher*, November, Hal Leonard Australia. <http://smallpianokeyboards.org/wp-content/uploads/2019/02/Goldilocks-and-the-Three-Pianos-Ergonomics-in-pianists-The-Piano-Teacher.pdf>

Deahl, L. & Wristen, B. (2003). Strategies for small-handed pianists. *American Music Teacher*, 52 (6), 21-25.

Donison, C. (1998). Small hands? Try this keyboard, you'll like it. *Piano & Keyboard, July-August*, 41-43.

Donison, C. (2000). Hand size versus the standard piano keyboard. *Medical Problems of Performing Artists*, 15, 111-114.

Jutras, P. (2015). *Editorial, Clavier Companion*, Frances Clark Center for Keyboard Pedagogy, USA, September/October.

Leone, C. (2015). Ergonomic Keyboards: Size does Matter. *Piano Professional*, EPTA (UK), Summer. <http://www.carolleone.com/ergonomic-keyboards/>

Leone, C. (2015). Size is Key. *Clavier Companion*, Frances Clark Center for Keyboard Pedagogy, USA, September/October.

Leone, C. (2016). Personal Touch. *International Piano*, UK, January-February 2017.

McLachlan, M. (2010), *Editorial, Piano Professional*, EPTA (UK), Spring.

Perez, Caroline Criado. (2019), *Invisible Women: Data Bias in a World Designed for Men*. Penguin, London. (pp 157-159.)

Son, Y., & Chesky, K. (2014). Awareness and attitude of professional keyboard players towards small size keyboards. *Poster paper presented at seminar, University of North Texas*.

Son, Y. (2018). Assessing perception and attitude of pianists toward ergonomically scaled piano keyboards (ESPK): Raising awareness about ESPK and evaluating changes of attitude through an educational survey. *DMA dissertation, University of North Texas*.

<https://digital.library.unt.edu/ark:/67531/metadc1248515/m1/1/>

<http://dsstandardfoundation.org/the-standards/>

Hand spans of pianists

Boyle, R., Boyle, R. & Booker, E. (2015). Pianist Hand Spans: Gender and Ethnic Differences and Implications for Piano Playing, *Proceedings of the 12th Australasian Piano Pedagogy Conference, Beyond the Black and White*, Melbourne, July 2015. <http://www.appca.com.au/proceedings/>

Wagner, C.H. (1984). Success and failure in musical performance: Biomechanics of the hand. In Roehmann F.L., & Wilson F.R. (Eds): *The Biology of Music Making, Proceedings of the 1984 Denver Conference, St Louis, Missouri*, MMB Music Inc., 1988, 154-179.

Wagner, C.H. (1988). The pianist's hand: anthropometry and biomechanics. *Ergonomics* 31, 97-131.

Wagner, C.H. (2012). Musicians' hand problems: looking at individuality. *Medical Problems of Performing Artists*, 27, (2), 57-64.

For further information about Christoph Wagner's work, see: <http://www.hand-und-instrument.de>

<http://dsstandardfoundation.org/the-standards/>

Pedagogy

Leone, C. (2003). Goldilocks had a choice. *American Music Teacher*, June-July, 26-29.

<http://dsstandardfoundation.org/wp-content/uploads/2021/06/GoldilocksFeature.pdf>

Sahin, C.S. & Saputro, A.I. (2022) Pedagogical Benefits of the Alternatively Sized Keyboards, *MTNA e-Journal*, September.

Anthropometry

Donelson, S.M. & Gordon, C.C. (1996). 1995 *Matched Anthropometric Database of US Marine Corps Personnel: Summary Statistics*. <http://www.humanics-es.com/ADA316646.pdf>

Driscoll, T. & Ackermann, B. (2012). Applied musculoskeletal assessment: Results from a standardised physical assessment in a national population of professional orchestral musicians. *Rheumatology: Current Research*, vol. S2, 1-7. <http://omicsonline.org/applied-musculoskeletal-assessment-results-from-a-standardised-physical-assessment-2161-1149.S2-005.pdf>

Garrett, J.W. (1968). *Clearance and Performance Values for the Bare-Handed and the Pressure-Gloved Operator*. Report No. AMRL-TR-68-24, Aerospace Medical Research Laboratories, Wright-Patterson, AFB, Ohio, USA.

Garrett, J.W. (1971). The adult human hand: some anthropometric and biomechanical considerations. *Human Factors*, 13, 117-131.

Greiner, T.M. (1991). *Hand Anthropometry of US Army Personnel. Technical Report. TR-92/011*.

Mandahawi, N., Imrhan, S., Al-Shobaki, S., Sarder, B. (2008), Hand anthropometry survey for the

Jordanian population. *International Journal of Industrial Ergonomics*, 38, 966-976.

Matzdorff, I. (1968). Anthropometrische probleme in der industrie. *Internationale Zeitschrift für Angewandte Physiologie, Einschliesslich Arbeitsphysiologie*, 25, 151-161.

Motmans, R. (2005). DINBelg, Ergonomie RC. <http://www.dinbelg.be/adultswomen.htm>,
<http://www.dinbelg.be/adultsmen.htm>

Nag, A., Nag, P.K., & Desai, H. (2003). Hand anthropometry of Indian women. *Indian Journal of Medical Research*, 117, 260-269.

Saengchaiya, N. & Bunternghit, Y. (2004), Hand anthropometry of Thai female industrial workers. *The Journal of KMITNB*, 14 (1), 16-19.

Hand size as a risk factor in pain and injury among pianists

Allsop, L., & Ackland, T. (2010). The prevalence of playing-related musculoskeletal disorders in relation to piano players' playing techniques and practising strategies. *Royal Northern College of Music, Music and Health*, 3 (1), 61-78.

Blackie, H., Stone, R., & Tiernan, A. (1999). An investigation of injury prevention among university piano students. *Medical Problems of Performing Artists*, 14, 141-149.

Boyle, R., & Boyle, R. (2009). Hand size and the piano keyboard. Literature review and a survey of the technical and musical benefits for pianists using reduced-size keyboards in North America. *Proceedings of the 9th Australasian Piano Pedagogy Conference: Expanding Musical Thinking*. Sydney, Australia. <http://www.appca.com.au/2009proceedings.php>

Bragge P., Bialocerkowski, A., & McMeeken, J. (2006). A systematic review of prevalence and risk factors associated with playing-related musculoskeletal disorders in pianists. *Occupational Medicine*, 56 (1), 18-27.

Bragge P., Bialocerkowski, A., Holtham, I., & McMeeken, J. (2006). Piano teachers' perceptions of risk factors associated with injuries in elite pianists. *Australian Journal of Music Education*, 1, 70-81.

Bragge P., Bialocerkowski, A., & McMeeken, J. (2006). Understanding playing-related musculoskeletal disorders in elite pianists. *Medical Problems of Performing Artists* 21 (2), 71-79.

Bruno, S., Lorusso, A., & L'Abbate, N. (2008). Playing-related musculoskeletal disorders in young and adult classical piano students. *International Archives of Occupational and Environmental Health*, 81 (7), 855-860.

Cayea, D., & Manchester, R. (1998). Instrument-specific rates of upper-extremity injuries in music students. *Medical Problems of Performing Artists*, 13 (1), 19-25.

Chesky, K., Yoshimura, E. & Furuya, S. (2007). Hand size and PRMDs in Japanese female pianists. (Letter to editor). *Medical Problems of Performing Artists*, 22 (1), 39-40.

Chorea, L.T., dos Santos, L.T., Paranhos, E.N.N., Albertini, A.I.M, Parreira, P.C.S and Nogueira, L.A.C. (2018). Prevalence and risk factors for musculoskeletal pain in keyboard musicians: A systematic review. *PM&R Journal*, 10, 942-950.

De Smet, L., Ghyselen, H., & Lysens, R. (1998). Incidence of overuse syndromes of the upper limb in young pianists and its correlation with hand size, hypermobility and playing habits. *Chirurgie de la Main*, 17 (4), 309-313.

Farias, J., Ordonez, F.J., Rosety-Rodriguez, M., Carrasco, C., Ribelles, A., Rosety, M., Rosety, J.M., & Gomez del Valle, M. (2002). Anthropometrical analysis of the hand as a Repetitive Strain Injury (RSI) predictive method in pianists. *Italian Journal of Anatomy and Embryology*, 107 (4), 225-231.

- Fry, H.J.H. (1986). Prevalence of overuse (injury) syndrome in Australian music schools. *British Journal of Industrial Medicine*, 44, 35-40.
- Furuya, S., Nakahara, H., Aoki, T., & Kinoshita, H. (2006). Prevalence and causal factors of playing-related musculoskeletal disorders of the upper extremity and trunk among Japanese pianists and piano students. *Medical Problems of Performing Artists*, 21 (3), 112-118.
- Kaufman-Cohen, Y., Portnoy, S., Sopher, R., Mashiach, L., Baruch-Halaf, L. & Ratzon, N. (2018). The correlation between upper extremity musculoskeletal symptoms and joint kinematics, playing habits and hand span during playing among piano students. *PLOS ONE* 13 (12).
<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0208788>
- Lai, K.-Y., Wu, S.-K., Jou, I. M., Hsu, H.-M., Chen Sea, M.-J., & Kuo, L.-C. (2015). Effects of hand span size and right-left hand side on the piano playing performances: Exploration of the potential risk factors with regard to piano-related musculoskeletal disorders. *International Journal of Industrial Ergonomics*, 50, 97-104.
- Manchester, R.A., & Flieder, D. (1991). Further observations on the epidemiology of hand injuries in music students. *Medical Problems of Performing Artists*, 6, 11-14.
- Pak, C.H. & Chesky, K. (2001). Prevalence of hand, finger, and wrist musculoskeletal problems in keyboard instrumentalists. The University of North Texas Musician Health Survey. *Medical Problems of Performing Artists*, 16 (1), 17- 23.
- Quarrier, N.F. (1995). Survey of music teachers: perceptions about music-related injuries. *Medical Problems of Performing Artists*, 10, 106-110.
- Ranelli, S., Straker, L. & Smith, A. (2011). Playing-related musculoskeletal problems in children learning instrumental music. *Medical Problems of Performing Artists*, 26 (3), 123-139.
- Sakai, N. (1992). Hand pain related to keyboard techniques in pianists. *Medical Problems of Performing Artists*, 7, 63-65.
- Sakai, N. (2002). Hand pain attributed to overuse among professional pianists: a study of 200 cases. *Medical Problems of Performing Artists*, 17(4), 178-180.
- Sakai, N., Liu, M., Su, F., Bishop, A. & An, K. (2006). Hand span and digital motion on the keyboard: concerns of overuse syndrome in musicians. *The Journal of Hand Surgery*, 31 (5), 830-835.
- Sakai, N., & Shimawaki, S. (2010). Measurement of a number of indices of hand and movement angles in pianists with overuse disorders. *The Journal of Hand Surgery*, 35 (6), 494-8.
- Shields, N. & Dockrell, S. (2000). The prevalence of injuries among pianists in music schools in Ireland. *Medical Problems of Performing Artists*, 15 (4), 155-160.
- Wood, G.C. (2014). Prevalence, risk factors and effects of performance-related medical disorders (PRMD) among tertiary-trained jazz pianists in Australia and the United States. *Medical Problems of Performing Artists*, 29 (1), 37-45.
- Yoshimura, E., Paul, P.M., Aerts, C. & Chesky, K. (2006). Risk factors for piano-related pain among college students. *Medical Problems of Performing Artists*, 21 (3), 118-125.
- Yoshimura, E., Fjellman-Wiklund, RPT, Paul, P.M., Aerts, C. & Chesky, K. (2008). Risk factors for piano-related pain among piano teachers. *Medical Problems of Performing Artists*, 23 (3), 107-113.
- Zaza, C. & Farewell, V.T. (1997). Musicians' playing-related musculoskeletal disorders: an examination of risk factors. *American Journal of Industrial Medicine*, 32, 292-300.
- Zaza, C. (1998). Playing-related musculoskeletal disorders in musicians: a systematic review of incidence and prevalence. *Canadian Medical Association Journal*, 158 (8), 1019-1025.

Ergonomics and biomechanics

Boyle, R. (2013). The benefits of reduced-size keyboards for smaller-handed pianists: An exploration of biomechanical and physiological factors. *Proceedings of the 11th Australasian Piano Pedagogy Conference: Opening Doors: The Complete Musician in a Digital Age*. University of Southern Queensland, Toowoomba, 2-6 July 2013. <http://www.appca.com.au/proceedings/>

Chi, Ju-Yang, Halaki, M. & Ackermann, B.J. (2020). Ergonomics in violin and piano playing. A systematic review. *Applied Ergonomics* 88, 1031-43.

Chong, T. (2021). Pianism for small hands: Strategies and solutions to optimize performance and minimize chances of injury. *DMA thesis submitted to Indiana University Jacobs School of Music*. <https://scholarworks.iu.edu/dspace/bitstream/handle/2022/26412/Chong%2C%20Tina%20%28DM%20Piano%29.pdf?sequence=1&isAllowed=y>

Deahl, L. & Wristen, B. (2003). Strategies for small-handed pianists. *American Music Teacher*, 52 (6), 21-25.

Grieco, A. Occhipinti, E., Colombini, D., Menoni, O., Bulgheroni, M. Frigo, C., & Boccardi, S. (1989). Muscular effort and musculoskeletal disorders in piano students: electromyographic, clinical and preventive aspects. *Ergonomics*, 32 (7), 697-716.

Kochevitsky, G. (1967). *The Art of Piano Playing*. Summy-Birchard Music Inc., USA.

Meinke, W.B. (1995). The work of piano virtuosity: An ergonomic analysis. *Medical Problems of Performing Artists*, 10 (2), 48-61.

Neuhaus, H. (1973). *The Art of Piano Playing*, Barrie & Jenkins, London.

Ortmann, O. (1929). *The Physiological Mechanics of Piano Technique*. Kegan Paul, Trench, Trubner & Co., London, and E.P. Dutton & Co., Inc., New York.

Turner, D., Visentin, P. & Shan, G. (2021). Wrist internal loading and tempo-dependent, effort-reducing motor behaviour strategies for two elite pianists. *Medical Problems of Performing Artists*, 36 (3), 141-149.

Wagner, C.H. (1984). Success and failure in musical performance: Biomechanics of the hand. In Roehmann F.L., & Wilson F.R. (Eds): *The Biology of Music Making, Proceedings of the 1984 Denver Conference*, St Louis, Missouri, MMB Music Inc., 1988, 154-179.

Wagner, C.H. (2012). Musicians' hand problems: looking at individuality. *Medical Problems of Performing Artists*, 27, (2), 57-64.

Wristen, B. (2000). Avoiding piano-related injury: a proposed theoretical procedure for biomechanical analysis of piano technique. *Medical Problems of Performing Artists*, 15 (2), 55-64.

Wristen, B. & Deahl, L. (2002). Small hands SOS! Circumventing injury and succeeding at the piano. *Music Teachers' National Association, Cincinnati, Ohio*. <http://digitalcommons.unl.edu/musicpresentations/1/>

Comparative studies using alternatively sized keyboards

Chi, J-Y., Halaki, M., Booker, E., Boyle, R. & Ackermann, B.J. (2021). Interaction between Hand Span and Different Sizes of Keyboards on EMG Activity in Pianists: An Observational Study. *Applied Ergonomics*, 97, November.

Coates, S. (2017). Goldilocks and the Three Pianos – Ergonomics in Pianists. *The Piano Teacher*, November, Hal Leonard Australia.

Davis, P., & Evans, S. (2007). Pianists' adaptability to smaller keyboards. *Poster Paper Presented at the Music Teachers National Association 2007 National Conference, Chicago, Illinois.*

Wristen, B., Jung, M.C., Wismer, A.K.G., & Hallbeck, M.S. (2006). Assessment of muscle activity and joint angles in small-handed pianists. *Medical Problems of Performing Artists, 21 (1)*, 3-9.
<http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1007&context=musicfacpub>

Yoshimura, E. & Chesky, K. (2009). The application of an ergonomically modified keyboard to reduce piano-related pain. *MTNA e-Journal, November.*

Performance quality

Goebel, W. & Palmer, C.F. (2013). Temporal control and hand movement efficiency in skilled music performance. *PLOS ONE, 8 (1)*.
www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0050901

Lee, S-H. (1990). Pianists' hand ergonomics and touch control. *Medical Problems of Performing Artists, 5 (2)*, 72-78.

MacRitchie, J. (2015). The art and science behind piano touch: A review connecting multi-disciplinary literature. *Musicae Scientiae, 19 (2)*, 171-190.

Impacts of aging

Ranganathan, V. K., Siemionow, V., Sahgai, V. & Yue, G. H. (2001). Effects of aging on hand function, *Journal of the American Geriatrics Society, 49*, pp 1478-1484.

Wagner, Ch. (1984). Success and failure in musical performance: Biomechanics of the hand. In Roehmann F.L., & Wilson F.R. (Eds): *The Biology of Music Making, Proceedings of the 1984 Denver Conference, St Louis, Missouri, MMB Music Inc., 1988*, 154-179.

Stretching exercises

Berenson G. et al (2002). *A Symposium for Pianists and Teachers: Strategies to Develop the Mind and Body for Optimal Performance.* Heritage Music Press, Dayton OH, pp 219-220.

Boyle, Boyle & Booker (2015). Pianist hand spans: Gender and ethnic differences and implications for piano playing. *Proceedings of the 12th Australasian Piano Pedagogy Conference, Beyond the Black and White*, Melbourne, July 2015. <https://www.appca.com.au/proceedings/>

Deah, L. & Wristen, B. (2017). *Adaptive Strategies for Small-Handed Pianists.* Oxford University Press, UK.

Driscoll, T. & Ackermann, B. (2012). Applied musculoskeletal assessment: Results from a standardised physical assessment in a national population of professional orchestral musicians. *Rheumatology: Current Research*, vol. S2, 1-7. <http://omicsonline.org/applied-musculoskeletal-assessment-results-from-a-standardised-physical-assessment-2161-1149.S2-005.pdf>.

Kloepfel, R. (2000). Do the "spreadability" and finger length of cellists and guitarists change due to practice? *Medical Problems of Performing Artists, 15 (1)*, 23-30.

Ortmann, O. (1929). *The Physiological Mechanics of Piano Technique.* Kegan Paul, Trench, Trubner & Co., Ltd., London, and E.P. Dutton & Co., Inc., New York.

Wagner, C.H. (1984). Success and failure in musical performance: Biomechanics of the hand. In Roehmann F.L., & Wilson F.R. (Eds): *The Biology of Music Making, Proceedings of the 1984 Denver Conference, St Louis, Missouri, MMB Music Inc., 1988*, 154-179.

<https://www.nytimes.com/1981/06/14/arts/when-a-pianist-s-fingers-fail-to-obey.html>

Websites and blogs

Pianists for Alternatively Sized Keyboards (PASK): <http://paskpiano.org>

PASK on Facebook: <http://www.facebook.com/pask.piano>

Closed group: <https://www.facebook.com/groups/PASK.Action/>

YouTube channel: <https://www.youtube.com/channel/UCdiQ0iwCWFsGjZ1QI41KSBg/playlists>

Steinbuhler & Company, US manufacturer of acoustic piano keyboards with narrow keys, was converted to a non-profit Foundation during 2018, called the DS Standard Foundation Inc.

<http://dsstandardfoundation.org/>. On Facebook: www.facebook.com/dsstandardfoundation/.

Technicians for Alternatively Sized Keyboards (TASK) Facebook pages: community page:

www.facebook.com/TASKPiano/

A closed group for piano technicians: www.facebook.com/groups/TASKPiano/

Stretto concerts and International Stretto Piano Festival: <https://www.strettopianoconcerts.org/>

Dr Carol Leone from Dallas, Texas – Chair of Keyboard Studies at SMU Meadows School of the Arts in Dallas: www.carolleone.com/ergonomic-keyboards/

Pianist Tiffany Goff, from Cleveland Ohio:

www.skinnykeys.tumblr.com

A history of attempts to gain support for alternatively sized keyboards in Japan:

<http://littlehands782.blogspot.jp/2014/01/the-history-and-attitudes-to-smaller.html>

Pianist Renata Bittencourt, from Paris, (in French):

<http://www.lespetitsclaviers.sitew.fr/#ACCUEIL.A>

Pianist Grace Choi has written this personal story: *Thoughts for Pianists with Small Hands: A Testimonial by Grace Choi*. It is the second blog on this page:

<http://www.thehealthymusicianproject.com/blog>

Jess Johnson, Professor of Piano and Piano Pedagogy at the University of Madison-Wisconsin:

<http://feelingthesound.org/2015/07/21/small-hands-big-heart/>

Pianist Eliana Yi, from Seattle, USA, shares her insights about playing Steinbuhler keyboards while studying at SMU Meadows School of the Arts in Dallas. <http://www.elianayipiano.com/single-post/2016/1/31/Making-things-easier-for-the-first-time-in-forever>

Sydney teacher and Suzuki teacher trainer, Erica Booker, has pianos with alternatively sized keyboards in her studio. <https://ericabookerpiano.com/>

A group of academics in Germany and Switzerland is continuing with important research of the late Dr Christoph Wagner relating to the hands of pianists and violinists. Three websites describe this work: http://www.hand-und-instrument.de/E_index.html; http://www.hand-und-instrument.de/E_pragm-handeinschaetzung.html; <http://www.christoph-wagner-musikphysiologie.de/Links.html>. For further information, contact Professor Ulrike Wohlwender from the University of Music and the Performing Arts in Stuttgart: u.wohlwender@online.de. See [Earlier hand span studies](#) for some of Wagner's summary statistics.