Ulrike Wohlwender

Remembrance of the Music Physiologist Christoph Wagner (1931-2013)

Life, Life's Work and Concept of Research

Lecture at the European Piano Teachers Association, Section Germany, Fulda, May 2014

We know Christoph Wagner as the "father of Music Physiology and Musicians´ Medicine" in Germany.[1] In 1974, after 10 years of basis research at the Max Planck Institute for Occupational Physiology in Dortmund, he was appointed as professor at the Hanover University of Music and Drama. By founding the *Institute of Experimental Music Pedagogy*, which he renamed *Institute of Music Physiology* in 1979, he succeeded for the first time in establishing music-physiological research and teachings in a European university of music. In almost 20 years of his work, Hanover became a drop-in centre for musicians from all over the world, international "reference centre"[2] of music physiology and starting point for multiple connections to practice: EPTA, ESTA, discussion circle Saarbrücken Talks for Piano Pedagogy, working group Doctors for Musicians Hanover, International Hand-Surgery and many more. Christoph Wagner became the "trailblazer of today's landscape of music physiology and musicians' medicine in Germany", which "without his many years work of convincing, solid research, excellent teachings and lecturing would not have reached the current level of its development."[3]

After retiring, he became founding president of the *German Association for Music Physiology and Musicians' Medicine* (DGfMM) in 1994. He was appointed honorary member in 2001. In music physiology and instrumental pedagogy[4] he is widely known for his book *Hand und Instrument – Musikphysiologische Grundlagen. Praktische Konsequenzen*, published by Breitkopf & Härtel in 2005 – consciously at a music publishing company.[5] Since 2009, his worldwide singular research on the individuality of the musician´s hand is being continued at the *Zurich Centre for Musicians' Hands* (ZZM) at the Zurich University of the Arts.[6] Furthermore his lifework includes studies on selected parameters of musical excellence and a concept of scientific foundation of music physiology, skilled music performance and instrumental pedagogy which is still ground-breaking today.

It is an expression of a lifelong closeness that the EPTA wished to commemorate Christoph Wagner. He was a founding member in 1979. His lectures from the 1980s already reveal empathy and practical relevance:

---

[1] Blum/Schuppert/Wohlwender2013, p 97

[2] Blum 2014, p 141

[3] Maria Schuppert in Blum/Schuppert/Wohlwende 2013, p 96

[4] Christoph Wagner used the term „music pedagogy" what included musical and instrumental ability. In order to differentiate from "classroom music pedagogy" I use the two terms „skilled music performance and instrumental pedagogy".

[5] Wagner 2005, overview and reviews see www.musikerhand.de

[6] Margulies/Hildebrandt 2011; Neuhaus/Scudeletti 2012; Wagner 2012; Margulies/Hildebrandt 2014; Margulies 2014; www.zzm.ch

1981 *The Nature of the Hand as Cause of Playing-related Problems at the Piano* (Würzburg, written in German)[7]
1986 *Piano Methodology – and the unhappy Love between Science and Art* (Münster, in German)[8]
1987 *Welke eisen stelt het instrumentale spel aan de meselijke hand?* (in Dutch)[9]

After the first International Symposium of Musicians and Physicians in Germany *Medical Problems of Instrumentalists – Causes and Prevention* in 1992 in Hanover, he documented the talks and discussions in a publication of the same title[10]. Due to breaks caused by illness, Christoph Wagner only started working on *Hand und Instrument* in the late 1990s. As already mentioned, it appeared in 2005. Again, the EPTA set impulses: an introduction to *Hand und Instrument* 2004 in Jena[11] sparked lectures in Hamburg, Basel (EPTA Switzerland), Nunspeet (EPTA Netherlands)[12] and Linz (EPTA Austria) i.e. – about the individuality of the pianists' hand, about connections with overuse-syndromes and as an introduction to the Pragmatic Hand Evaluation (PHE).

Now, Fulda 2014: Remembrance of Christoph Wagner. – It is beautiful, that long-time friends and colleagues are here, also from the discussion circle Saarbrücken Talks, even Jutta Schwarting from the founding period.

It is based on my more than 14-year cooperation and friendship with Christoph Wagner, from 1999 to the last moment, that the EPTA asked me to speak today. We met 1995, when I was invited to present the piano method book *1 2 3 Klavier*[13] in the discussion circle Saarbrücken Talks, which had just been published a few months earlier. Christoph Wagner held a lecture about "evenness in playing piano".[14] Even then I was impressed by his vision, his clear way of thinking, his fine and at the same time refreshing nature. Soon after we met a second time in 1999 he entrusted me to read his manuscript from the perspective of the pianistic and piano pedagogical practice. Our work led to lectures and workshops at EPTA, DGfMM, Congress of the Association of German Music Schools and to numerous universities of music (for the last time in 2012 at the Music Academy of Wiesbaden), in an ongoing exchange about various aspects of music physiology, skilled music performance and instrumental pedagogy – and the luck to share far more.

To avoid repeating what is already written in the appreciations to Christoph Wagner's 80th birthday in *Üben und Musizieren*[15] and in *Music Physiology and Musicians' Medicine*[16] (closely discussed with him at that time) and in the obituary of the DGfMM[17], I selected some photos that describe ways of and ways with Christoph Wagner. Furthermore, I want to sketch his concept of experimental research in music pedagogy from the 1960s.[18] Christoph Wagner has referred to it again and again, also in the last years.[19] The understanding of his scientific thinking meant a lot to him.

* * * * *

[7] Wagner 1981
[8] Wagner 1987b
[9] Wagner 1987a
[10] Wagner 1995
[11] Wohlwender 2006
[12] Wohlwender 2008; Wagner/Wohlwender 2008; Wagner/Wohlwender 2009
[13] Ehrenpreis/Wohlwender 1995
[14] Minutes of the 20th Saarbrücken Talks from 12./13.10.1996 (SBG-archive)
[15] Wohlwender 2011a
[16] Wohlwender 2011b
[17] Blum/Schuppert/Wohlwender 2013
[18] Wagner 1964; Wagner 1965; Wagner 1972
[19] Wagner 2005, p 16, p 21, p 144, p 234; Wagner 2006; Wagner 2009

Born on the 20th May 1931 in Marburg/Germany, Christoph Wagner grew up in Weilburg/Lahn in a diversely stimulating family.[20] The boy soprano developed into a subtle pianist, who discovered the great works of the piano and violin literature, despite only sporadical piano lessons because of the war. Already early on in his youth he was an empathetic chamber music partner and lieder accompanist.[21] From an early age improvising was natural for him too. During his whole life, it remained a part of his inner balance. His musical language sometimes alluded to Bach, Brahms or Schumann.

Christoph Wagner, 25 years old

Christoph Wagner's longing for music was so persistent, that in 1958, after finishing his studies in medicine and subsequent doctoral work he started to study music with conducting as main subject. He enjoyed a musically fulfilling time in Detmold – otherwise doubts were creeping in: "The idea for systematical research of the physiological basis of music practice arose during my studies of music, which followed my medical studies. With the intellectual background of natural science with its endeavour to secure insights and decisions as objectively as possible, it appears strange that the musical education refers only to subjective experience, despite obvious contradictions in methods and results. Success was admired, failure mostly declared with a lack of giftedness, without any investigation of causes. Increasing cases of tenosynovitis and similar troubles were consequently concealed. It could not be overlooked that lots of my fellow students didn't feel confident and suffered from self-doubts. Whilst studying it became more and more clear to me that the dilemma could be changed if the work of the musicians and its physiological (pre-)conditions were investigated with scientific methods."[22]

In 1963, at the end of his studies in Detmold, while walking along with Renate Kretschmar-Fischer, his piano teacher at that time, he predicted: "There will be an institute, which will take care full-time of these tasks and problems."[23] – Eleven years later this goal was reached.

[20] His father was specialist in German studies, his mother wrote i.e. about craftsmanship.

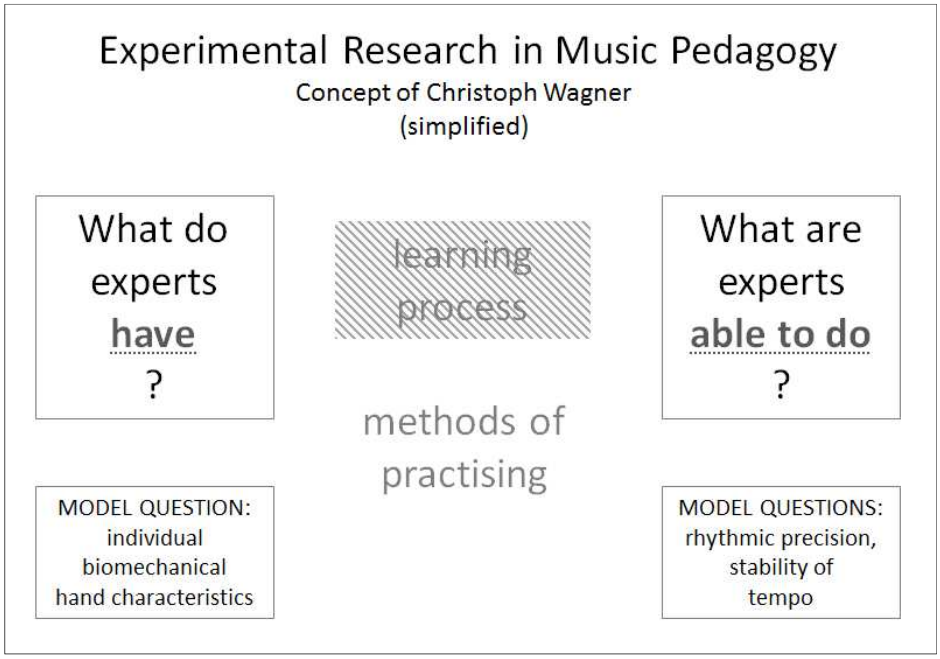
[21] Helche Sommer, *1921, violinist i.a. in the Munich Chamber Orchestra, September 2013 about her brother

[22] Wagner 1993

[23] Wagner 2011

First he had to find a place, where such a research activity could start. After discovering the occupational physiology as basically related discipline, he spoke to Gunther Lehmann, director of the "Max Planck Institute for Occupational Physiology" at that time. With the positive vote of the "Working group of the Directors of the State Universities of Music in Germany incl. West Berlin"[24] in May of 1964 Lehmann paved the way for a one-decade experimental basis research in music pedagogy at the MPI, mostly financed by research funds of the Fritz Thyssen Foundation and the Volkswagenwerk Foundation.

In the beginning, there was a concept of experimental research in music pedagogy[25], which is still striking in its relevance and clarity today. Christoph Wagner´s concept is based on two questions: **1) What do experts have? 2) What are experts able to do?** The skills of experts act as orientation for what can be reached. The (pre)conditions of experts act as orientation for factors of success and for understanding individual limitations or problems. The question "What are experts doing?" (e.g. in playing technique) is to locate between these two poles – and in relation to both.



Christoph Wagner chose the individual biomechanical hand characteristics as model question for (1): "How significant is the nature of the hand for pianistic skills?" Model question for (2) was rhythmic precision: "Which timing-precision do experts reach on the piano?" (two/three/five note exercises, scales[26]) and tempo modification (study with Herbert v. Karajan[27]). Based on such results the question about the effectiveness of (practice) methods can be answered.

First, the selected model questions served Christoph Wagner in providing evidence on the importance of the new field of research. Even though these questions stayed in the focus of his activities his whole life long, he regarded them only as the beginning of a comprehensive scientific foundation of music physiology, skilled music performance and instrumental pedagogy.[28]

[24] today: German Rector's Conference (HRK)

[25] see footnote 4 and Wagner 1964; Wagner 1965; Wagner 1972; Wagner 2006; Wagner 2009

[26] Wagner 1968a; Wagner 1968b; Wagner 1971; Wagner 1973; Wagner 2005, pp 72ff. and pp 144ff.

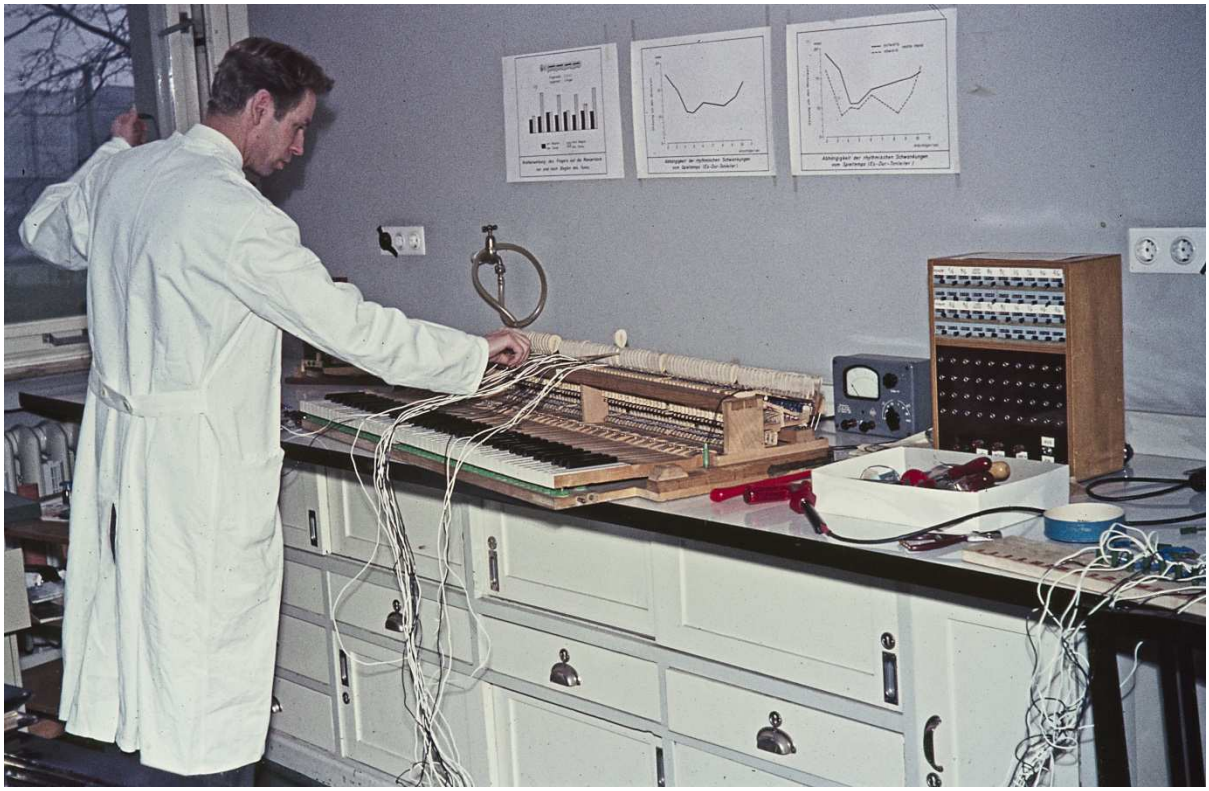
[27] Wagner 1974 (Mozart: Sinfonia g minor KV 550, Beethoven: Sinfonia Nr. 3 op. 55)

[28] Wagner 2009

The learning process in the sense of neuro physiology is not of primary importance here. Even in the medium term, Christoph Wagner expected the investigation of the "black box" to have only little effect in regards to the applicability in the artistic-pedagogical practice. Again and again, he pointed out the difference between knowledge that is only instructive or knowledge that is (also) really helpful.[29]

Consequently, he thought more in music physiology than in musicians' medicine.[30] Besides prevention and therapy, Christoph Wagner aimed to support success in all levels of musical and instrumental learning. His intention was to give investments of time and energy more prospect of success, to back up practice methods, to contribute to healthy and skilled music performance.

Hence, Christoph Wagner's experimental research in the field of music physiology and skilled music performance began in Dortmund:



The photo shows Christoph Wagner in 1966, fixing cables to the measuring grand piano (Bechstein)[31] in the "Max Planck Institute for Occupational Physiology". Hammers were brushed with silver, just as fine that a circuit was closed with the impact of the respective string, while otherwise sound and touch feeling remained unchanged. Audible and even slighter differences in the rhythmic precision of professional pianists and of amateurs (two/three/five note exercises, scales, Haydn Sonata No. 48 C major Hob. XVI/35) can clearly be read off the diagrams of the studies[32] – at a measuring accuracy of 1,25 milliseconds(!).[33]

[29] Wagner 2005, p 16

[30] Wagner 2009

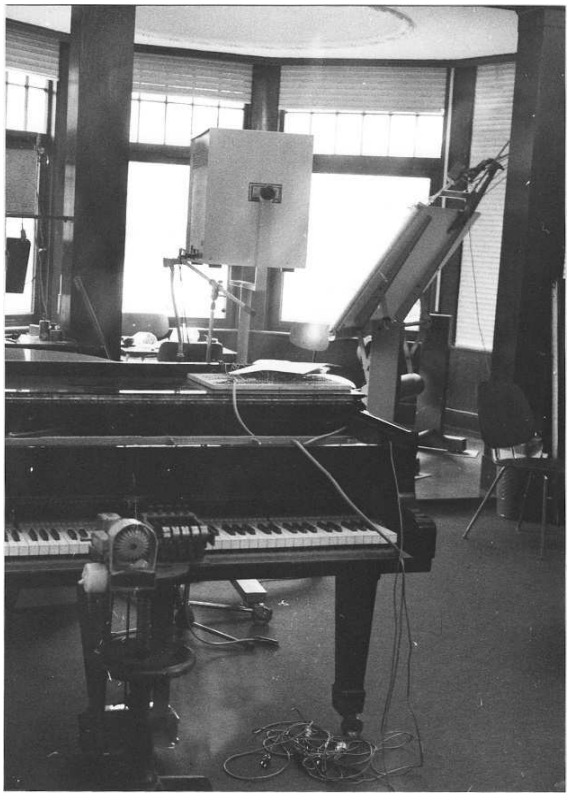
[31] Wagner 1966, p 5

[32] Wagner 1968a; Wagner 1968b

[33] Wagner 1966, pp 2ff.; Wagner 1967b, Wagner 1977, p 2; Wagner 1983, p 12

Christoph Wagner travelled through Germany to measure the hands of professional musicians in up to 40 hand characteristics, i.e. piano professors and students with main subject piano at the universities of music Detmold, Hamburg, Munich, Freiburg, Cologne (1965-67), string players of the Berliner Philharmoniker and further professional orchestras (1972/73) and participants of the ARD International Music Competition (1972).[34] He used the equipment for biomechanical hand measurement (BHM, i.e. for all hand spans, supination, pronation, wrist abduction, hyperextension of the metacarpo-phalangeal joints – active and passive) that he had developed in Dortmund. The measuring results from that time are part of the data background for individual hand profiles at the *Zurich Centre for Musicians' Hands* or by Pragmatic Hand Evaluation to date.[35] The photo above shows Christoph Wagner measuring the passive lateral flexibility of the index finger of a subject.

After being appointed professor in Hanover Christoph Wagner had to do development work once more. The *Institute for Experimental Music Pedagogy* found its first domicile in a Jugendstil villa in Löwenstraße 10, in immediate proximity to the university of music at the Emmichplatz. Wagner introduced music physiology as a compulsory subject in the curriculum, established the consultation for musicians, installed and enlarged the hand laboratory from Dortmund, installed a Steinway & Sons Model B grand piano as measuring piano with improved computer evaluation[36], continued the



[34] Wagner 1967a, p 2; Wagner 1968a, p 23; booklets with original data for violin, viola, cello, double bass 1972/73

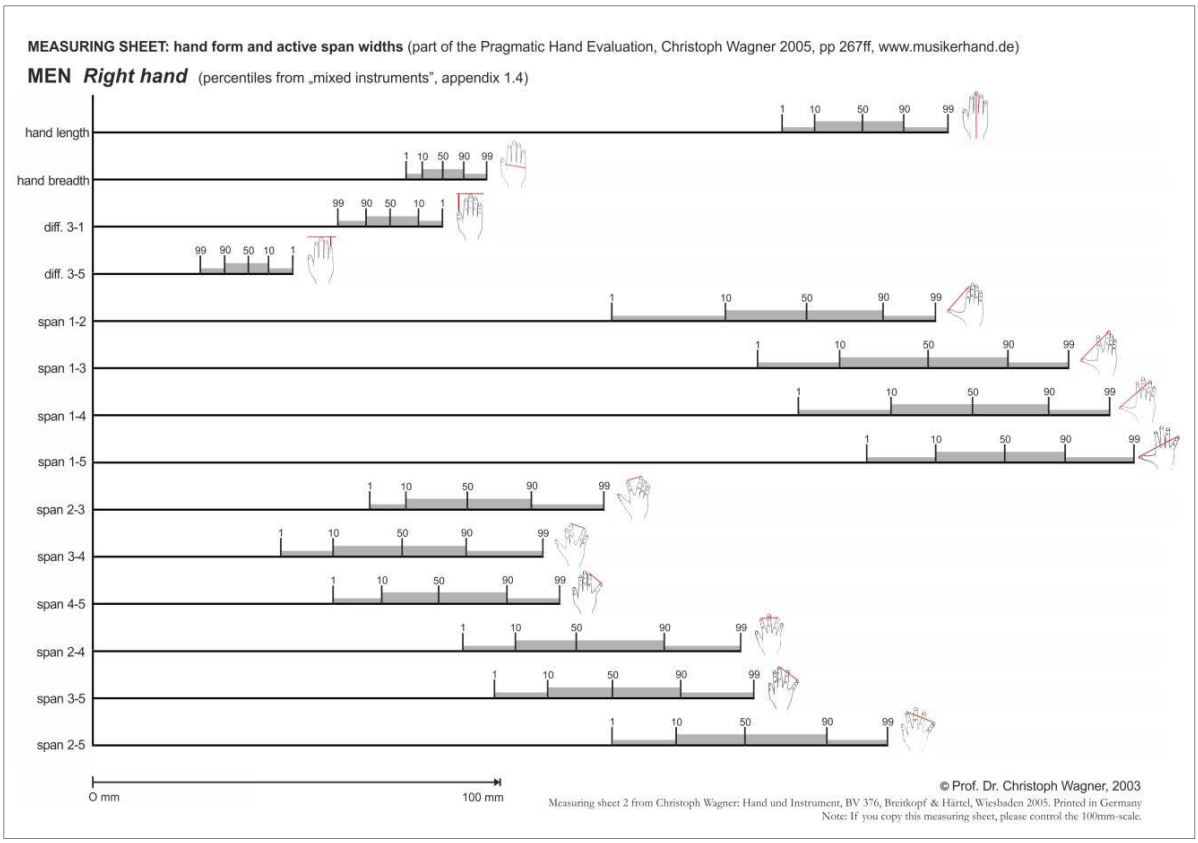
[35] Wagner 2005, S. 263-270; Wohlwender 2009b; Wohlwender 2014; Wohlwender 2015a; Wohlwender 2015b

[36] Wagner 1983, pp 11f. (photo with calibration instrument)

studies of rhythmic precision and agogics with selected piano literature (i.e. Bach Prelude/Fugue a minor WTC II, Fugue cis minor WTC I, Schumann Fantasy op. 17, Henze Sonata per pianoforte) and widened the focus with pilot studies of dynamics and touch intensity[37] – permanently in lively exchange with professors, lecturers and students, most notably Karl-Heinz Kämmerling and Konrad Meister.

In 1984, at the invitation of Frank Wilson, Christoph Wagner presented the results of his research on the pianists' and the violinists' hand at the first Denver Conference *The Biology of Music Making*. The subsequent articles[38] with data tables for more than 40 hand characteristics and individual hand profiles from successful musicians as well as musicians with PRMD (also focal dystonia) are still a worldwide unique basis for further research[39] although the English articles show only an excerpt of his research (*Hand und Instrument* is not yet translated …). His last publication is in English again: 2012, at the invitation of MPPA, Christoph Wagner discussed the existing research on the individuality of the musicians' hands in a review.[40]

How seriously Christoph Wagner took the practical relevance can still be seen from the measuring sheets of the Pragmatic Hand Evaluation (PHE).[41] Not only is the reference data accessible to everyone – the measuring sheets even show, at one glance, the range of individuality (with 10cm-scale at the lower edge on the left): the difference in the span 3-4 e.g. between the 1st and the 99th percentile amounts among men (mixed instruments, right hand) to considerable 6,5 cm (2,56 inch),



[37] Measurement protocols and diagrams are not published TMK.
[38] Wagner 1988a, Wagner 1988b, Wilson/Wagner/Hömberg 1993
[39] Wristen 2000, Yoshimura et al. 2006, Sakai 2008, Boyle/Boyle/Booker 2015
[40] Wagner 2012
[41] Wagner 2005, data appendix pp 277-336 and measuring sheets for men and women, right and left hand

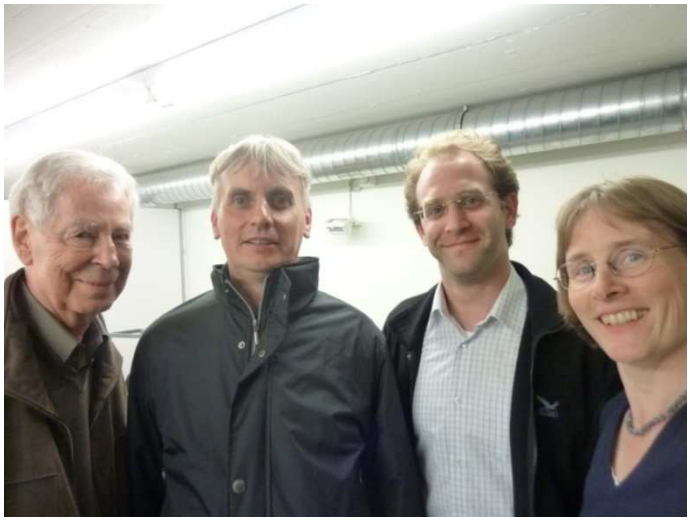
in the span width 2-5 to 6,8 cm (2,68 inch), in the span width 1-5 to 6,6 cm (2,60 inch).[42] When including the minimum and maximum values provided in the data tables, the differences in the three hand characteristics increase to 8,3-8,6 cm (3,26-3,38 inch).

It must be said that Christoph Wagner has never discouraged anyone from playing a certain instrument, even if a musician had many extremely low values – out of respect for the various ways of compensation, as he once said. However, he has encouraged to trust one's perception and to be very attentive on limits of range of motion in joints and conspicuous fatigue – and to decide individually when it comes to fingering, movements, practice methods, choice of repertoire, instrument modifications etc.[43]

In 2011, in advance of Christoph Wagner's 80th birthday, I set up a website[44], which gives an overview of his lifework and his thinking. Moreover, selected publications are provided for download. This way, the music physiological legacy of Christoph Wagner is accessible to those who want to trace back or to continue his practice related research in music physiology, skilled music performance and instrumental pedagogy. Today, in 2014 – after 50 years of music physiology in Germany – there are forward-looking approaches worldwide, also with alternatively sized keyboards (15/16, 7/8)[45] and in research on skilled performance with modern computer-based player pianos. Let us hope that questions will be taken up from which musical abilities, daily practicing and teaching will really benefit. There is a concept ...

One week before his death Christoph Wagner once again summarized his aim in one sentence: "Music-making should be possible for all people".[46] His guiding principle was always science *for* musicians (not *on* musicians).

Christoph Wagner died on the 30th of August 2013 at the age of 82 in Isernhagen/Germany.



Christoph Wagner at the hand laboratory of the *Zurich Centre for Musicians' Hands* of the Zurich University of the Arts (ZHdK) together with Prof. Dr. med. Horst Hildebrandt, MA/MAS Oliver Margulies, Prof. Ulrike Wohlwender (September 2010, Zurich)

[42] Wagner 2005, p 307, p 309, comparison group men, mixed instruments, right hand
[43] Wagner 2005, chapter H
[44] www.christoph-wagner-musikphysiologie.de
[45] www.steinbuhler.com (Steinbuhler & Company); www.paskpiano.org; www.smallpianokeyboards.org
[46] transcript Ulrike Wohlwender, 23th August 2013

Ulrike Wohlwender, born and grown up in Schopfheim/Southern Black Forest, graduated as a pianist and music pedagogue in Mannheim. Since 2010 professor of piano pedagogy at the State University of Music and the Performing Arts Stuttgart. Since 1999, working together with Christoph Wagner. For more than 20 years head of the piano department at the Music School Lampertheim. (Co-)author of piano teaching material (www.1-2-3-klavier.de). Since 2009, when the *Zurich Centre for Musicians' Hands* (ZZM) was founded, part of the team.

Article first published in German in 2015: *Erinnerung an den Musikphysiologen Christoph Wagner (1931-2013). Lebensweg, Lebenswerk und Forschungskonzept*; in: EPTA-Dokumentation 2013/14, *Aller Anfang ist …*, Düsseldorf 2015, pp 7-20 – translated and shortened by the author in 2017

Literature

Blum, Jochen (2014): *20 Jahre Deutsche Gesellschaft für Musikphysiologie und Musikermedizin – Entstehung und Entwicklung einer neuen Fachgesellschaft*, in: Musikphysiologie & Musikermedizin 2014, 21. Jg., Nr. 3, pp 140-143

Blum, J. / Schuppert, M. / Wohlwender, U. (2013): *Zum Tod von Christoph Wagner. Pionier und Vater der deutschen Musikphysiologie,* in: Musikphysiologie & Musikermedizin 2013, 20. Jg., Nr. 3, pp 94-97

Boyle/Boyle/Booker (2015): *Pianist Hand Spans: Gender and Ethnic Differences and Implications for Piano Playing*, Australasian Piano Pedagogy Conference, Melbourne July 2015, published online: http://www.appca.com.au/2015proceedings.php (downloaded 2016-09-16)

Ehrenpreis, C. / Wohlwender, U. (1995): *1 2 3 Klavier – Klavierschule für 2-8 Hände*, Heft 1 und Lehrerkommentar 1, Breitkopf & Härtel, Wiesbaden 1995

Margulies, Oliver (2014): *Spielhände im objektiven Vergleich*, in: Schweizer Musikzeitung, Nr. 5/2014, p 38

Margulies, O. / Hildebrandt, H. (2011): *Das Zürcher Zentrum Musikerhand (ZZM). Hände verstehen – Instrumentalspiel erleichtern*, in: Musikphysiologie & Musikermedizin 18 (3/2011), pp 101-102

Margulies, O. / Hildebrandt, H. (2014): *Musikerhände erforschen und behandeln*, in: promanu 25 (2/2014), pp 8-10

Margulies, O. / Wohlwender, U. (2011): *Beratung und Forschung am Zürcher Zentrum Musikerhand. Christoph Wagner im Gespräch*, in: neue musikzeitung, 6-2011, p 15

Neuhaus, G. / Scudeletti, A. (2012): *Hände von Musikern unter der Lupe*, Bericht in 3sat.nano vom 27.2.2012, 6:03 min., http://www.3sat.de/mediathek/mediathek.php?obj=29645

Wagner, Christoph (1964): *Zur Frage einer Wissenschaft von der Musikausübung und Musikerziehung*, 1964, S. 1-8; erweiterte Fassung eines Referates, gehalten anl. der Tagung der AG der Direktoren der Staatlichen Musikhochschulen der BRD einschl. Westberlins am 29. Mai 1964 in Detmold (unpublished)

Sakai, Naotaka: *Keyboard span in old musical instruments*; in: Med Probl Perform Art 2008, 23(4), pp 169-171

Wagner, Christoph (1965): *Konzept zur Eingrenzung der experimentellen Untersuchungen*, 1965 (unpublished)

Wagner, Christoph (1966): *Untersuchungen zur Ergonomie der Musikausübung*, Arbeitsbericht 1965 vom 27.4.1966 (unpublished)

Wagner, Christoph (1967a): *Untersuchungen zur Ergonomie der Musikausübung*, Arbeitsbericht 1966 vom 18.5.1967 (unpublished)

Wagner, Christoph (1967b): *Lernen in der Musikerziehung* (Oktober 1967, unpublished), 14 pp

Wagner, Christoph (1968a): *Untersuchungen zur Ergonomie der Musikausübung*, Arbeitsbericht 1967 vom März 1968 (unpublished)

Wagner, Christoph (1968b): *Zum Problem des Übens in der Musik*, in: Musik im Unterricht (Allgemeine Ausgabe) 59 (1968), pp 3-8

Wagner, Christoph (1971): *The Influence of the Tempo of Playing on the Rhythmic Structure Studied at Pianists's Playing Scales*, in: Vredenbregt J, Wartenweiler J (eds), Medicine and Sport, vol 6: Biomechanics II. Karger, Basel 1971, pp 129-132

Wagner, Christoph (1972): Projektbeschreibung *„Institut für Experimentelle Musikpädagogik“*, 31.1.1972 (unpublished)

Wagner, Ch. / Piontek, E. / Teckhaus, L. (1973): *Piano learning and programed instruction*, in: Journal of Research in Music Education 21 (1973), pp 106-122

Wagner, Christoph (1974): *Experimentelle Untersuchungen über das Tempo*, in: Österreichische Musikzeitschrift 29 (1974), pp 589-604

Wagner, Christoph (1977): *Entwicklung quantitativer Methoden zur Beurteilung der Leistungsfähigkeit der Hand.* Bericht 1975-1976 vom 15.4.1977 (unpublished), 4 pp

Wagner, Christoph (1981): *Die Natur der Hand als Ursache spieltechnischer Probleme am Klavier*, in: EPTA-Dokumentation 1981, pp 16-36

Wagner, Christoph (1983): *Entwicklung quantitativer Methoden zur Beurteilung der Leistungsfähigkeit der Hand*. Abschlussbericht Stiftung Volkswagenwerk vom 19.12.1983 (unpublished), 15 pp

Wagner, Christoph (1987a): *Welke eisen stelt het instrumentale spel aan de menselijke hand?*, in: Piano Bulletin EPTA Nederland, 5/3 (1987), pp 48-57

Wagner, Christoph (1987b): *Klaviermethodik – und die unglückliche Liebe zwischen Wissenschaft und Kunst*, in: EPTA-Dokumentation 1987, pp 139-149

Wagner, Christoph (1988a): *Success and failure in musical performance: Biomechanics of the hand*, in: Roehmann FL, Wilson FR (eds), The Biology of Music Making, Proceedings of the 1984 Denver Conference. MMB Music, Inc., St. Louis 1988, pp 154-179

Wagner, Christoph (1988b): *The pianist's hand: anthropometry and biomechanics*, in: Ergonomics 31 (1988) pp 97-131

Wagner, Christoph (1993): *Zur Vorgeschichte des Instituts* (Schautafel im Institut für Musikphysiologie und Musikermedizin der Hochschule für Musik, Theater und Medien Hannover), 1993

Wagner, Christoph (Hg.) (1995): *Medizinische Probleme bei Instrumentalisten - Ursachen und Prävention*, Bericht vom Internationalen Symposion, Hannover 1992. Laaber, Laaber 1995.

Wagner, Christoph (2005): *Hand und Instrument – Musikphysiologische Grundlagen, Praktische Konsequenzen*, Breitkopf & Härtel, Wiesbaden 2005.

Wagner, Christoph (2006): *Entwicklung der Musikphysiologie am Beispiel der Hochschule für Musik und Theater Hannover.* Festvortrag beim DGfMM-Symposium in Worms, 1.9.2006 (unpublished)

Wagner, Christoph (2009): *Musikphysiologie. Blick zurück – Blick nach vorne.* Vortrag an der Zürcher Hochschule der Künste und Tafeln I/II, 16.10.2009 (unpublished)

Wagner, Christoph (2011): Autobiographische Notizen, 2011 von Ulrike Wohlwender mitgeschrieben (unpublished)

Wagner, Christoph (2012): *Musicians‘ Hand Problems: Looking at Individuality. A Review of Points of Departure*, in: Medical Problems of Performing Artists, Vol. 27, No. 2, June 2012, pp 57-64

Wagner, Ch. / Wohlwender, U. (2008): *Die Hand am Klavier – Manuelle Voraussetzungen verstehen und beurteilen*, in: www.epta.ch/archiv/liste-referate/liste-referate, 2008

Wagner, Ch. / Wohlwender, U. (2009): *De hand op de toetsen – Fysieke voorwaarden begrijpen en beoordelen*, in: Piano Bulletin EPTA Nederland 2009/1, pp 24-29

Wilson, Fr. / Wagner, Ch., Hömberg, V. (1993): *Biomechanical abnormalities in musicians with occupational cramp/focal dystonia*, in: *Journal of Hand Therapy 6/4 (1993) 298-307*

Wohlwender, Ulrike (2006): *Buchvorstellung: Christoph Wagner: Hand und Instrument*, in: Dokumentation EPTA 2004/05, Düsseldorf 2006, pp 109-117

Wohlwender, Ulrike (2008b): *Hand und Instrument – praktisch*, in: Dokumentation EPTA 2006/07, Düsseldorf 2008, pp 76-83

Wohlwender, Ulrike (2009b): *Was heißt hier „kleine Hand“? – Spannweiten und andere Handeigenschaften realistisch einschätzen*; in: Üben & Musizieren 2/2009, Mainz, pp 30-35

Wohlwender, Ulrike (2011a): *Ein Pionier der Musikphysiologie – Christoph Wagner zum 80. Geburtstag*, in: Üben & Musizieren, 3-2011, pp 40-41

Wohlwender, Ulrike (2011b): *Neuland Musikphysiologie – Christoph Wagner zum 80. Geburtstag* in: Musikphysiologie & Musikermedizin 2011, 18. Jg., Nr. 2, pp 37-38

Wohlwender, Ulrike (2014): *Die Individualität der Musikerhand. Grenzbereiche (in) der Wahrnehmung*; in: Knickenberg, R.J. (Hg.): *Der Musiker und sein Körper. Ein Resonanzraum für Wahrnehmung, Sinnlichkeit und Erleben*, Dokumentation der 6. Tagung zur Musikermedizin, Bad Neustadt 2014, pp 98-111

Wohlwender, Ulrike (2015a): *„… seit 3 Jahren einschlafende Finger auf der Bühne" – Overuse-Syndrom eines Pianisten im Spiegel der Individualität seiner Hand*; in: Kruse-Weber/Borovnjak (Hg.): *Gesund und motiviert musizieren – Ein Leben lang. Musikergesundheit zwischen Traum und Wirklichkeit*, Mainz 2015, pp 67-76

Wohlwender, Ulrike (2015b): *„Ich dachte immer, ich muss mich mehr anstrengen." – Wie ein Handprofil die Wahrnehmung verändert*; in: Schweizer Musikzeitung, Mai 2015, p 42

Wristen, Brenda G. (2000): *Avoiding Piano-related Injury: A Proposed Theoretical Procedure for Biomechanical Analysis of Piano Technique*, in: Med Probl Perform Art, June 2000, pp 55-64

Yoshimura, Eri / Paul, Pamela M. / Aerts, Cyriel / Chesky, Kris (2006): *Risk factors for piano-related pain among college students*, in: Med Probl Perform Art, September 2006, pp 118-125