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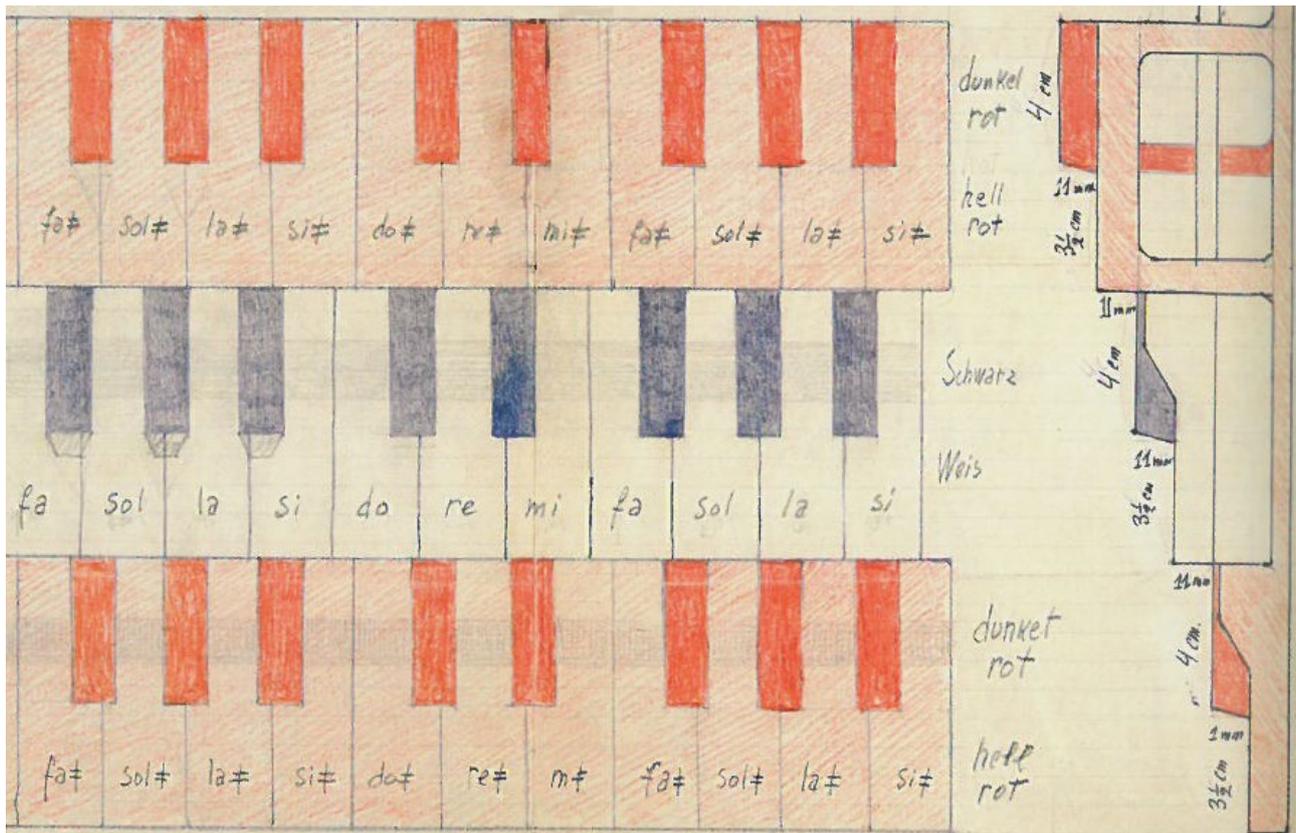
The text has been published in a book ‘MikroTöne: Small is Beautiful’ (Järvi 2019a, 23–30). A corresponding article in the Finnish language has been published in a book entitled ‘The History of Piano Playing in Finland’, edited by the DocMus Doctoral School in Helsinki, Finland (Järvi 2019b, 170–183).

The Keyboard Expands - Working on the New Quarter-Tone Piano

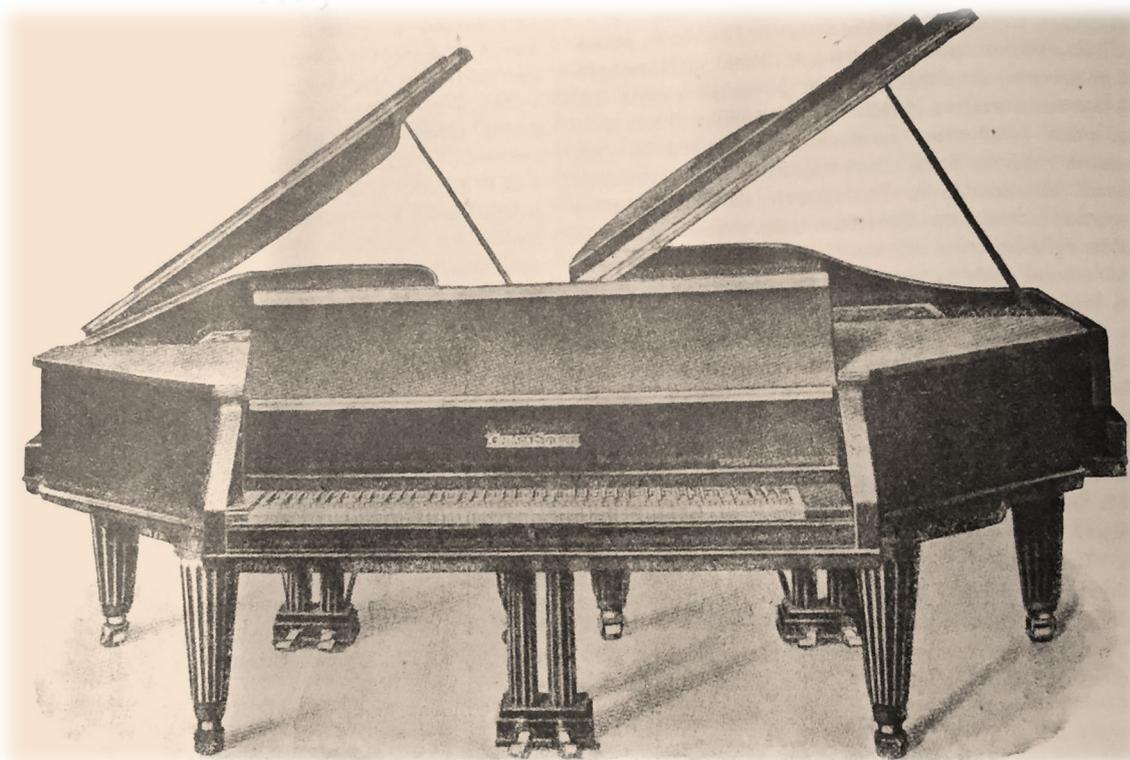
The new kind of quarter-tone piano was recently developed in Finland, and is an example of an approach to meet specific needs of contemporary music: namely producing quarter-tones on a full-range keyboard. This article presents some historical facts about the quarter-tone piano. Furthermore, the author discusses the ideas behind a new kind of quarter-tone keyboard from a performer’s point of view.

The Quarter-Tone Piano is Born

The pioneers of the first European quarter-tone piano were Russian-born composer Ivan Wyschnegradsky (1893–1979) and his Czech colleague Alois Hába (1893–1973). Wyschnegradsky emigrated to France, and there created sketches for a quarter-tone piano keyboard. These sketches are on display in the Wyschnegradsky archives at the Paul Sacher Foundation in Basel, complete with precise dimensions. The quarter-tone keyboard consists of three keyboards: a middle keyboard with ordinary black and white keys, and an upper and a lower keyboard, both red in colour and tuned one quarter-tone higher than the ordinary keyboard (Ex. 1). Wyschnegradsky took his innovation one step further: his sketches reveal designs for keyboards capable of producing even smaller intervals than a quarter tone, and he wrote musicological essays on the subject of “ultrachromaticism”. (PSS.)



Ex. 1. Ivan Wyschnegradsky's sketch for a quarter-tone piano keyboard from 1922. The white (*weis[s]*) keys are "do, re, mi, fa, sol, la, si" as on a traditional piano keyboard. The light red (*hell rot*) keys are quarter-tone sharp pitches. (PSS, Wyschnegradsky collection.)



Ex.2 Grotrian-Steinweg advertising a quarter-tone grand piano in 1924. (PSS.) This picture was also published in *Suomen Musiikkilehti* in Finland. (SM 1924, 122.)

In the spring of 1924 the German piano company Grotrian-Steinweg in Berlin advertised a new instrument which they called '*Vierteltonklavier*'. That instrument resembled two adjoined grand pianos (Ex. 2). According to the brochure this quarter-tone piano would have 176 keys, partly white and black, and partly red and brown in colour. The brochure also acknowledged the contribution of Alois Hába and Willi von Möllendorf. (PSS.) Unfortunately there is no evidence that the initiative of building this kind of 'double-grand piano' ever came to fruition. Although one octave prototype by Grotrian-Steinweg still exists. It has a unique layout with white, black and red-brown keys (Ex.3).



Ex.3. One-octave quarter-tone piano prototype by Grotrian-Steinweg. (GS 2018.)

Finally, the Förster piano company constructed a quarter-tone piano in cooperation with Hába, that was exhibited at the 1928 Autumn Fair in Leipzig. It has a similar kind of quarter-tone keyboard as seen in Wyschnegradsky's sketches, although with traditional black and white keys¹. A sample instrument was sent to Wyschnegradsky in Paris.

This Förster quarter-tone instrument has three keyboards: the upper and lower keyboards are tuned just like a traditional piano, with the octave divided into 12 pitches, and the middle keyboard was tuned like a normal piano but a quarter-tone higher. Alternating between the three keyboards it was

¹ According to Gayden (1973, 15) Förster was using Wyschnegradsky's keyboard design. But the the red-brown keyboard, designed by Möllendorf was impracticable.

possible to play all 24 quarter-tone steps within an octave. At that time, however, the two sets of 12 pitches or 12-tone scales were still mostly used separately.

Today this instrument is often referred to as the ‘Haba-piano’ by musicians. Förster constructed both upright and grand pianos according to this model, and some instruments are still in existence (Ex.4). However, although several composers of the time showed interest in producing works for the instrument, very few quarter-tone pianos were constructed by the piano manufacturer. Förster quarter-tone pianos can be viewed in music museums in Prague and in Cairo.



Ex.4. August Förster's quarter-tone grand piano. The middle keyboard is tuned a quarter-tone higher than a traditional piano. (Czech Museum of Music. Photo: Elisa Järvi.)

In the United States, German-born composer-pianist Hans Barth (1897–1956) designed an instrument that he called a quarter-tone piano. It had 176 keys on two separate keyboards and was built by George Weitz in 1928. Barth composed chamber music and even a quarter-tone piano concerto for this instrument. His own performance of a composition entitled *Shadows of a Cathedral* shows how his hands switch between the two keyboards. (USC.)

As microtones became a familiar part of many Western classical composers' toolbox, the quarter-tone piano was utilised in diverse ways. In addition to Haba and Wyschnegradsky, American pianist-composer Mildred Couper (1887–1974) wrote music for two pianos tuned a quarter-tone apart in the 1920s². The Mexican composer Julián Carillo (1875–1965) tuned pianos to different scales using a variety of regular intervals. In 1940 he even patented 15 different 'metamorphoser' pianos and co-operated with the Sauter piano company. Depending on the model, the pianos were tuned using scales divided into pitches ranging from whole tones to sixteenth-tones³. On the

² Charles Ives, John Corigliano, John Diercks and Friedrich Haas have also composed quarter-tone works for piano duo.

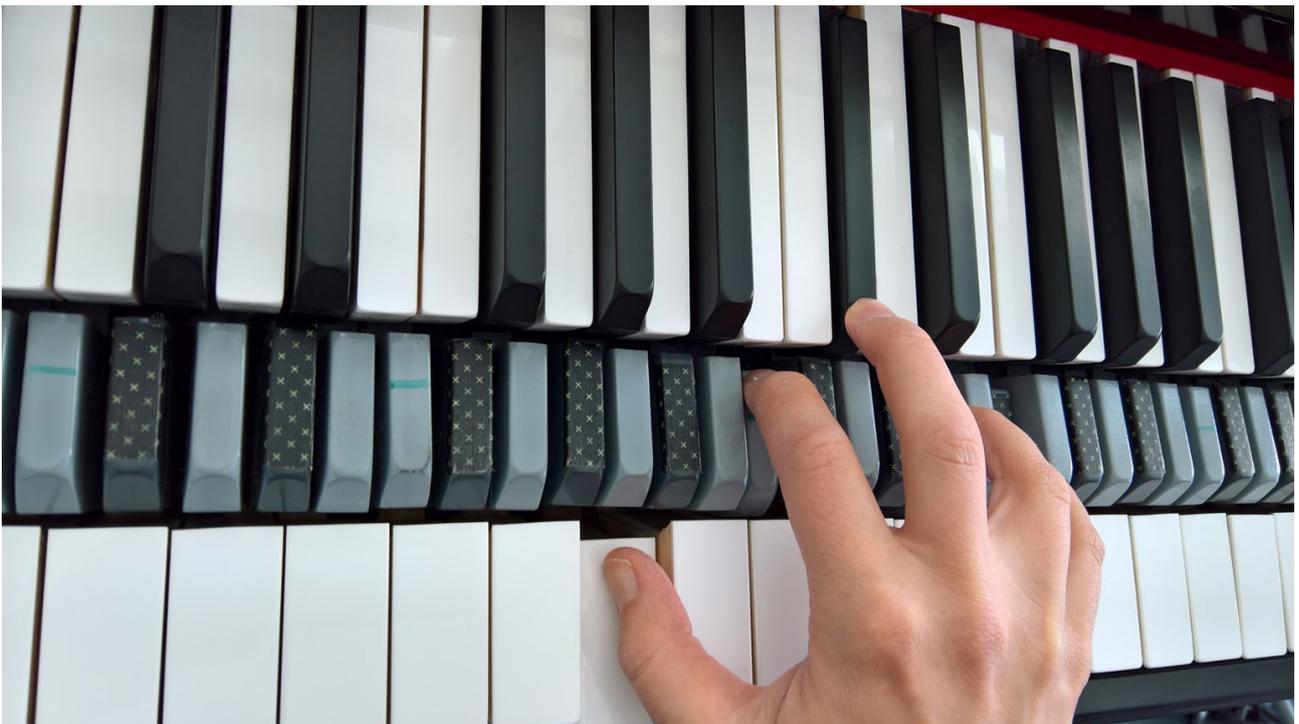
³ Sauter pianos with unusual tuning are still in use. (Sauter.)

sixteenth-tone piano constructed by Sauter, the distance between the lowest and the highest notes is exactly one octave.

Towards a new kind of Quarter-Tone Piano

The idea of a new kind of quarter-tone piano arose over ten years ago while the author was discussing the possibilities and limitations of the contemporary piano together with Finnish composer Sampo Haapamäki. Compared to many orchestral instruments, such as stringed instruments, the piano is far less flexible in regard to tuning. Indeed, most orchestral instruments can naturally produce microintervals with ease.

Outlined in the previous section are various twentieth century solutions enabling the production of quarter-tones on the piano. Förster's acoustic quarter-tone piano was a wonderful example of musical instrument craftsmanship during the first half of the 20th century. However, playing quarter-tones on two separate keyboards no longer meets the needs of contemporary music. Contemporary composers treat all pitches equally and not as two separate sets of 12 pitches. In other words, the instrument should enable the player to perform melodic lines and chords that include both traditional white and black keys, and quarter-tone intervals. Unfortunately, tuning a traditional piano keyboard in microtone intervals significantly restricts the ambitus of the instrument. Furthermore, the lack of synchronisation between pressing the keyboard and actually hearing the sound produced may take some getting used to.



Ex. 5. Quarter-tone keyboard design by Sampo Haapamäki and Elisa Järvi. The doubled white forekeys help to keep the hand position ergonomical when performing chords. (Photo: Elisa Järvi.)

The new quarter-tone piano, recently developed in Finland, is an example of an approach which meets the needs of contemporary quarter-tone performers and composers: the ability to produce

quarter-tones on a full-range keyboard⁴. The aim of our work group was to develop an acoustic quarter-tone instrument which takes pianistic, ergonomic, and compositional needs into account. Together with composer Sampo Haapamäki we sought to develop a keyboard with a realistic piano touch that enables the performer to play both quarter-tone scales and quarter-tone chords with one hand.

We have tried to maintain the familiarity of the traditional piano keyboard, so that any musician with a pianistic background can understand the keyboard layout. Due to ergonomical reasons the white keys are doubled: the white forekeys help to keep the hand position natural when performing quarter-tone chords⁵. (Ex. 5) Imagine a piano keyboard split in half depthwise at the point where the black keys appear: the grey quarter-tone keys emerge at the divide. The design for this quarter-tone keyboard is registered by the Finnish Patent and Registration Office (Ex.6).

(11) Rekisteri.n:o - Registrerings.nr 25879

(15) Rekisteröintipäivä - Registreringsdag. 26.09.2016

(21) Hak.n:o - Ans.nr: M20165009

(22) Hak.saap.pv - Ans.ing.d: 25.01.2016

(73) Haltija - Innehavare: 1 Elisa Maria Kristiina Järvi, Espoo, Esbo, FI, 2 Sampo Haapamäki, Helsinki, Helsingfors, FI

(72) Mallin luoja - Mönsterskapare: M1. Elisa Maria Kristiina Järvi, M1. Sampo Haapamäki

(54) Tuote - Produkt: Pianon koskettimisto. Klaviaturer för pianon

(51) Luokka - Klass: 17-01

(57) Kuvat - Bilderna: Värillinen, I färg



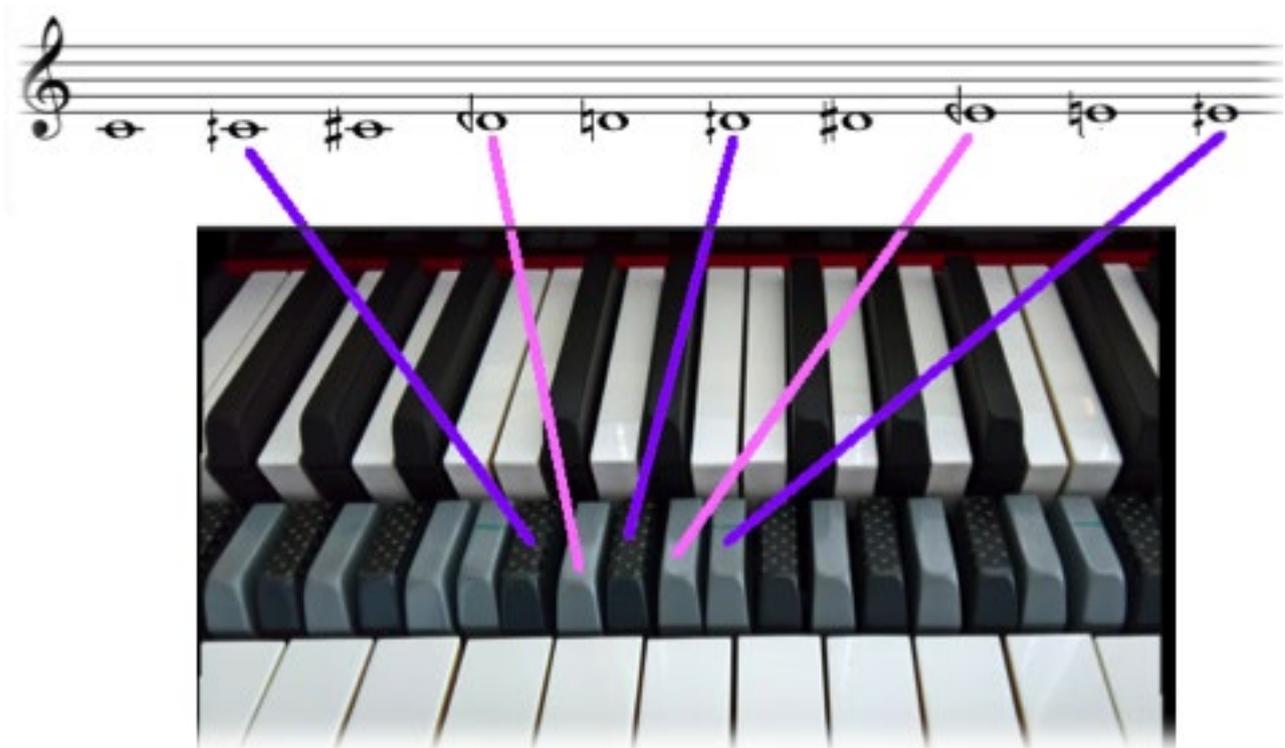
Ex. 6. The design for the quarter-tone keyboard as registered by the Finnish Patent and Registration Office (PRH 2016.)

The quarter-tone piano keyboard has a normal piano range of slightly over 7 octaves. The three keyboard levels contain a total of 227 keys. The raised backmost level has the usual 88 keys, the middle level has 87 grey keys and the foremost level has 52 white keys. (Ex. 7). The grey keys in the middle lie a couple of millimeters to the right compared to the other levels. Personally I perceive the word ‘sharp’ as darker in hue than the word ‘flat’ and therefore the dark grey keys correspond to ¼ sharps while the light grey keys correspond to ¼ flats. But this is naturally a matter of taste. Little

⁴ Microtones are playable with MIDI-keyboards like Terpstra, Linnstrument, Starr Labs, MicroZone U648, C-thru Music Axis, Opal Chameleon and Tonal Plexus.

⁵ The easiest fingering for the quarter-tone scale from C upwards would be: 1,2,3,4, 1,2,3,4, 1,2, 1,2,3,4 etc.

by little, I am becoming accustomed to visualising a dark grey piano key when seeing a $\frac{1}{4}$ sharp accidental sign.



Ex. 7. The dark-grey keys correspond to quarter-tone sharps and light grey coloured keys to quarter-tone flats.

The development of the new quarter-tone piano has been a multistage process. First, a single-octave prototype was built by piano tuner Matti Kyllönen in 2011. Finnish carpenter Otso Haapamäki created the prototype for a full-sized keyboard in Toholammi, and, in 2015, he built a keyboard for the Sibelius Academy.

Initially, the aim of our working group was to build an acoustic instrument. Unfortunately, this was not possible, as there are no longer any working piano factories in Finland. The final instrument is an extended version of the traditional piano, consisting of the new quarter-tone piano keyboard with midi-output. There is an optical sensor under every key that reacts to the pianist's touch and transfers information regarding pitch and dynamic level to the computer. Music technologist Libero Mureddu created the necessary software patches and worked as a consultant during the project. The keyboard is then connected to two Disklavier pianos which are tuned one quarter-tone apart, and the performer "remote controls" the acoustic pianos from the quarter-tone keyboard. In this way, the sound is produced acoustically, although there is a time delay of approximately 200–400ms depending on the piano model. This is naturally a challenge for the performer, who has to anticipate every beat when performing together with other musicians.

The keyboard can also be linked up to loudspeakers through computer and used like an e-piano. This option has no time delay. Sound reproduction computer software offers a variety of different piano sounds, ranging from fortepianos to modern instruments. In addition, it also provides alternative tuning options: the 31 keys within the octave (or 227 on this keyboard), can be tuned separately, not necessarily a quarter-tone apart. This also applies to the white fore and backkeys, which can be tuned independently of each other.

I was happy to discover that the old quarter-tone piano music composed by Wyschnegradsky is also playable on the new quarter-tone keyboard. I dearly hope that more quarter-tone music for solo piano will be composed in the future. The quarter-tone keyboard has already been showcased in a microtonal ensemble in Finland, together with microtonal flute, clarinet, accordion and guitar⁶. Sampo Haapamäki has composed a large concerto for this piano (HS 2017) performed by the author and Avanti! Chamber Orchestra in Helsinki 2017. Hopefully the instrument will inspire composers to explore the new possibilities of virtuosity and challenges for both future performers and listeners. In the future, an acoustic and an electronic version with this quarter-tone keyboard would be most welcome. Hopefully nobody will have to reawaken the quarter-tone piano in a hundred years!

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⁶ You can access MikroEnsemble' s concert recording with electric piano sound:
www.youtube.com/watch?v=amiPk0CsS0Q and microtonal instrument presentations with acoustic piano sound:
https://www.youtube.com/watch?time_continue=7&v=LJxi5d6burs

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