The portable harpsichord: past and present

This study began as a search for a harpsichord that could be transported easily for rehearsals and informal performances. It examines both historical solutions to the problem of portability and the modern digital approaches now available.

The clavecin brisé

The *clavecin brisé* is a folding form of the harpsichord, devised to make the instrument easier to transport. More than a dozen survive from various makers, showing that the problem of portability was already being addressed in the early eighteenth century. The clavecin brisé is essentially three mini-harpsichords connected by hinges. Clever handiwork allows the instrument to be deployed in such a way that the keys form a continuous compass. Kottick mentions that the instrument's physical compromises have harmed its chances of adoption[1]. Likewise, builder Paul Y. Irvin emphasises "I have become acutely aware of how much trial and error is needed to create a truly acoustically resonant design. I doubt that any successful extant instrument is a one-off achievement."

Figure 1: Claude Drezet, copy after Jean Marius's clavecin brisé (1700). Photo by the builder, used with permission.

Jean Marius's folding harpsichord represents the epitome of a full-featured instrument that is still portable. He spared no expense in terms of engineering, craftsmanship, and features. Unlike the slightly smaller and lighter folding harpsichord by Grimaldi, Marius's features a storage compartment under the wrestplank, allowing the keyboard to slide into the instrument for transportation. The instrument features two 8' registers and a 4'. Notably unique to this instrument's operation is that each of these registers is controllable for each of the three sections of the harpsichord; enabling or disabling a complete set of jacks requires three operations instead of one. This instrument offers a wide variety of colours on a single manual, since the player can engage or disengage each register independently in the bass, middle, and soprano sections.

Smaller harpsichords

Instead of an ultra-portable folding harpsichord such as the Grimaldi or Marius models, any discussion of harpsichords in a world with automobiles should also consider the many smaller, non-folding instruments. While modern harpsichords often default to a French-inspired template—with a five-octave compass, coupled double manuals, and a length approaching 2.3 meters—numerous historical models offer excellent sound in far more compact dimensions. Early Italian harpsichords in particular are markedly lighter and shorter, and their reduced footprint can make a significant difference in everyday portability, but their noticeably smaller compass is an issue for works from the late Baroque.

Digital harpsichords

A pianist's contact with the harpsichord often begins and ends with pressing the "harpsichord" button on a digital piano, trying a few measures of Bach, muttering "well, that's peculiar—and rather harsh," and promptly switching back to the default sound. The irony, of course, is that seasoned harpsichordists share the same reaction when trying a harpsichord sound on a digital piano.

Motivation

A modern digital instrument opens new practical possibilities. The two main features are portability and freedom from maintenance. Its relative lightness and modular design facilitate travel between rehearsal spaces, classrooms, and performance venues—settings where a full-sized historical harpsichord would be prohibitively cumbersome to move. At the same time, tuning stability is guaranteed.

The digital harpsichord functions as a historical music laboratory. Whereas an acoustic instrument requires time-consuming tuning adjustments before any change of temperament can be explored, a digital model allows such variations to be tried instantly. Players can assess the suitability of different temperaments for a forthcoming programme within seconds, and—when performing on a digital instrument—can select a temperament for each work that reflects the practice of its historical context.

Digital harpsichords also open possibilities for contemporary repertoire. In mixed instrumental settings, particularly those involving winds, amplified instruments or larger ensembles, the acoustic harpsichord's limited projection can restrict its use. A digital instrument allows its sound to be reinforced, preserving clarity while enabling composers and performers to place the harpsichord within textures that might otherwise overwhelm it. Some contemporary and avant-garde works call for amplified or heavily processed harpsichord sounds, often involving close microphones and unconventional playing techniques. A digital harpsichord can serve as a practical stand-in for these situations, allowing performers to realise such effects without the use of microphones.

These creative uses highlight the growing role of digital instruments in modern performance. These musical and practical affordances did not appear overnight. A brief look at the development of dedicated digital harpsichords helps clarify how today's solutions came about.

A brief history of digital harpsichords

Dedicated digital harpsichords

Roland broke new ground in 1998 with the C-80, the first dedicated digital harpsichord, priced at $4,495 (about £6,000 in 2026 inflation-adjusted sterling)[2]. Its successor, the C-30

(sold from 2008 to 2022 at $3,600, roughly £3,950 in 2026), featured a custom 61-key F-scale "click-action" keyboard, four harpsichord stops (8', 4', buff, and lute), baroque-pitch support (392 Hz and 415 Hz), and five temperaments (Werckmeister, Kirnberger, Vallotti, Meantone, and equal)[3]. At 38 kilograms each, 23 kilograms for the instrument and 15 kilograms for the stand, these instruments are also noticeably heavier than a typical stage piano, limiting portability. Despite their acclaimed touch and sound, neither Roland nor any other manufacturer offers a modern successor.

Meanwhile, many stage and digital pianos—such as Yamaha's Clavinova series and Roland's LX line—include sampled harpsichord voices. However, most digital pianos don't offer control over harpsichord stops and tuning.

Mechanisms of sound production

These Roland digital harpsichords—as well as nearly all digital pianos—are *sampled* instruments. In a sample-based system, every note and dynamic level is captured in a library of prerecorded sounds (samples) from a real instrument. When a key is depressed, the controller selects the appropriate sample (based on instrument, pitch, and velocity), applies post-processing effects such as equalisation and reverb, and then routes the result to the speakers. When multiple notes are played at once, their sounds are summed in a mixer to be played together. Advanced modern digital pianos include additional piano effects added to the chain to give a more realistic piano sound; these include sympathetic resonance simulation, resonance (e.g. sustain pedal pressed), and mechanical noises.

In 2006, Modartt released the first *physically modelled* piano software [4]. Physically modelled keyboard instruments generate sound by solving, in real time, the mechanical equations governing each component. The model incorporates string parameters (length, diameter, tension, material), the excitation mechanism (hammer or plectrum mass and stiffness, strike point), the soundboard's geometry and wood properties, and the cabinet's resonant behaviour. When a key is depressed, the virtual action excites the selected string(s), whose vibration is transmitted via the bridge to the soundboard and radiated by the enclosure. Virtual microphones capture the resulting waveform, which may then undergo digital post-processing such as reverb before playback through speakers.

In 2009, Roland introduced the V-Piano—the first 88-key digital piano to generate sound entirely via a hardware physical-modelling engine[5]. Since then, only a few pure physical-modelling instruments have appeared, most notably Viscount's Physis Piano[6] and Roland's PureAcoustic LX700 series[7]. These models occupy the premium end of their respective product lines and are marketed primarily to professional users. By contrast, the broader digital-piano market remains dominated by sample-based instruments: major manufacturers such as Yamaha, Kawai, Casio, Korg, and Nord do not offer pure physical-modelling pianos. As a result, physical modelling represents only a small niche within the overall market.

Physical modelling of historical instruments

Building on this modelling framework, Modartt gradually introduced physically modelled *historical* keyboards—first fortepianos, then clavichords, and, finally, a series of reconstructed harpsichords. This development is especially significant because historic keyboard instruments inevitably deteriorate without regular maintenance, yet conservators increasingly prefer to avoid intervention on fragile originals. By providing high-fidelity virtual counterparts, Pianoteq enables musicians and researchers to "play" these instruments without handling the physical artefacts. The following historical keyboards are especially notable. It also offers a range of 20th-century pianos and electric-piano models:
Harpsichords: Hans Ruckers II (c. 1624); Carlo Grimaldi (1697); François Étienne Blanchet (1733).
Fortepianos: Johann Schantz (1790); Johann Evangelist Schmidt (1790); Anton Walter (c. 1800); Donat Schöffstoss (1812); Conrad Graf (1826); Sébastien Erard (1922); Pleyel (1926)
Clavichord: Neupert "Modell Philipp Emanuel Bach" (1941).

A technological turning point for the digital harpsichord

> "... the acoustic behavior of the harpsichord is so complex that unrealistically large amounts of computer memory and extremely fast microchips would be necessary to accurately mimic an 'acoustic' instrument, with its tonal distinctions between registers, its combinations of 8' and 4' stops, lute stops, buff stops, and the complex transients of the pluck and release. There is also the problem of duplicating the unique touch of the harpsichord, not to mention the replication of the sounds of the various Flemish, French, German, English, and other varieties of the instrument. Nevertheless, while an absolutely convincing electronic harpsichord—or piano or organ, for that matter—may never be achieved, it is certain that advances in electronics and microchip technology will enable manufacturers to get closer to that goal."
>
> Edward L. Kottick
> *A History of the Harpsichord* (2003), pp. 457–458

The continued interest in historical keyboard instruments aligns perfectly with rapid advances in consumer electronics. Today, the most affordable single-board computers like the Raspberry Pi cost less than £100 yet are capable of producing high-fidelity sound in real time. An off-the-shelf MIDI keyboard is paired with a computer running specialised historical-keyboard software, allowing musicians to approximate many qualities of 18th- and 19th-century instruments. This affordability, with systems costing hundreds of pounds rather than thousands, allows students, researchers, and community musicians to experiment with historically informed keyboard timbres in ways that were previously inaccessible.

Try-out using hardware you already own

Most users can begin with equipment they already own. Any MIDI keyboard with USB or Bluetooth can connect directly to an iPhone, iPad, or laptop, with audio routed to speakers or headphones. Most digital pianos sold since around 2010 include USB-MIDI. The main complication for iOS users is the single USB-C port, which often necessitates a small USB hub and a USB-to-headphone adapter so that MIDI and audio can operate simultaneously. In most cases a USB-C-to-USB-B or USB-A-to-USB-B cable is required, while older iPhones and iPads may also need a Lightning-to-USB adapter.

Audio output: choosing speakers or headphones

Modern compact speakers offer performance improvements over earlier generations. Newer models are designed to sound clear and balanced no matter where you stand—not just directly in front of them. They spread sound evenly through the room and avoid the "boxy" or muffled character that older speakers often have. For playing a digital harpsichord or any digital instrument, the most important thing is low latency. Using speakers or headphones over Bluetooth adds a noticeable delay between pressing a key and hearing the sound—often just a fraction of a second, but enough to feel frustrating. A speaker with a wired (AUX) input avoids this delay completely and makes the instrument feel immediate and responsive.

The keyboard as the limiting factor

For harpsichordists, the keyboard itself remains the single largest limitation of any digital setup. The physical feel of any digital harpsichord depends entirely on the MIDI keyboard to which it is attached. With the exception of Roland's dedicated digital harpsichords, no five-octave MIDI keyboards follow the historical *FF–f3* compass; nearly all adopt the modern *C–c3* layout. Harpsichord and fortepiano players must therefore either use an 88-key instrument or shift octaves while playing. The touch and key dimensions of most MIDI controllers also differ markedly from those of a harpsichord, further limiting the realism of the playing experience. Roland's C-80 and C-30 offered a proprietary click-action mechanism intended to reproduce the tactile response of a harpsichord, but no comparable action is available today.

In practice, the choice for builders lies between synthesiser-action and digital-piano-action keyboards. Many musicians find a semi-weighted action to be a workable compromise—lighter and more responsive than digital-piano actions, yet offering more feedback than unweighted synthesiser keys. MIDI controllers can also be combined as needed: there is no requirement to buy a keyboard with integrated knobs or sliders, since a separate controller with pads, faders, or switches can be placed alongside the main keyboard to handle stop changes and other parameters.

Feedback from artists and teachers

Several conservatory professors and students have tested this digital harpsichord. At first, these experts are uninterested in a digital instrument that they expect to deliver a sound that is far inferior to the real instruments that they play daily. Many were surprised and called the instrument "the best-sounding digital instrument they have ever heard." For what the instrument delivers in sound, it does not deliver in physical touch. These professionals claim that it cannot be used to build technique, as the touch and responsiveness are counter to developing the feel for an instrument.

Technical setup and configuration

Bill of materials

Note: In addition to the parts listed above, this setup assumes access to a standard desktop or laptop computer (PC, Mac, or Linux) equipped with an SD-card reader, a USB mouse and keyboard, and Internet connectivity (Ethernet or Wi-Fi). The Internet connection is required for flashing the OS, installing and updating Pianoteq, and downloading any software; once the instrument is configured, it will run offline.

Component	£	Explanation
Raspberry Pi 5	62.00	Single-board computer running Pianoteq
64 GB microSD card	10.89	System storage (high-endurance type)
HiFiBerry Steel Case for Pi 5	25.50	Protective enclosure
Micro-HDMI to HDMI cable	5.99	Temporary monitor connection during setup
20 000 mAh power bank	22.37	Battery supply for portable use
USB-C power supply	12.00	External power (5 V, ≥3 A)
HiFiBerry DAC2 Pro	54.46	High-quality stereo audio output
RCA–3.5 mm cable	9.03	Connection from DAC to speaker
Kilburn III speaker	292.40	Portable powered loudspeaker
Nektar Impact LX61+	153.85	USB-MIDI keyboard controller
Music stand	10.19	Stand for sheet music or tablet
QEES keyboard bag	28.89	Carrying case for 61-key keyboard
Pianoteq Stage	228.65	Harpsichord and Fortepiano software
Grand Total	**916.22**	

Table 1: Bill of materials (prices converted at £1 = €1.17).

Raspberry Pi hardware and software setup: overview

This section is not intended as a comprehensive manual; rather, it outlines the principal steps required to assemble a functioning historical keyboard from the constituent hardware. Most practical difficulties are easily resolved through an internet search or by asking a contemporary AI assistant for step-by-step help.

The Raspberry Pi Imager[1] is available to write the 64-bit Raspberry Pi OS to your microSD card. When the imaging is finished, eject the card and insert it into the slot on the underside of the Raspberry Pi board. Assembling the Raspberry Pi and DAC requires no specialist skills. After completing the case assembly, connect a keyboard, mouse, and display, and then power on the Pi.

Pianoteq

Download Pianoteq[2]. You can use the trial for free, or log in if you have already purchased it. Download the latest version for *Linux: 64-bit ARM* as well as the *KiVIR.PTQ* file. Extract the installation to the desktop, and open the application. Install the Keyboard Instruments Virtual Restoration (KiVIR.PTQ) file onto the application. Finally, configure Pianoteq automatically when the Raspberry Pi is booted.

Now, the Pianoteq app should be installed and activated. Ensure that the MIDI keyboard is connected to the Raspberry Pi via a USB cable, and that the speakers or headphones are connected to the HiFiBerry DAC. In Pianoteq's audio settings, select the HiFiBerry DAC as the output device; this step is essential, as the DAC must be explicitly enabled in software.[3] Finally, confirm in

[1] https://www.raspberrypi.com/software/
[2] https://www.modartt.com/home
[3] https://www.hifiberry.com/hifiberry-dac-software/

the MIDI menu that Pianoteq is listening to all available MIDI inputs.

Pianoteq offers flexible control mapping, allowing functions such as the buff stop or register changes to be assigned to any button, pad, or fader on a MIDI controller. Mapping is done directly within Pianoteq's interface, and once saved in the MIDI settings, the configuration loads automatically each time the instrument starts.

Conclusion

This article surveys the rare historical and modern attempts to create portable harpsichords, from folding clavecins brisés to compact Italian instruments, and shows that acoustic designs inevitably face a trade-off between portability and sound. With no dedicated digital harpsichord currently on the market, musicians must turn to DIY solutions built from modern modelling software and MIDI keyboards. These digital setups, while limited in touch, offer a practical and musically convincing alternative for rehearsals, teaching, and small-venue performance.

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Notes

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