Historical Evidence for Historical Damper Qualities, with some other Historical Harpsichord Features and their Consequences for Sound and Performance

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Using dampers with historical properties, rather than the common stiffer, tightly-held rectangular "modern" dampers provides harpsichords with significant sonic, performance and maintenance benefits, as discussed in a previous article. In the following description of the inter-related historical factors that reveal the properties of historical dampers many frequently overlooked historical features and their consequences are discussed, such as string spacing, plectra length, sympathetic resonance, friction dampers, and plucking strengths, among others. Like the historical damper, these features were developed over a period of several centuries because of the sound and performance qualities they gave the harpsichords. Consequently it would seem that these features (as well as others to be discussed in separate articles) need to be understood and included both in harpsichords that are built as historical copies and in restored antiques in order that all the historical musical qualities are available for the player as well as audience.

Extant historical dampers Perhaps the strongest evidence for the general shape of historical dampers is the number of sloped or rounded antique dampers found, and the dearth of rectangular dampers of historical vintage. As Grant O'Brien, one of the most experienced researchers of historical keyboard instruments, has noted, "Virtually all 17th- and 18th-century harpsichords that I have seen with apparently original jacks have dampers with sloping sides."[1]

Illustrations of the shapes of historical dampers have been commonly available since 1965 in a classic text about harpsichords, but apparently they were largely dismissed. While reproducing the engraving from the French *Encyclopedie* that shows two dampers, one round and one sloped on top and bottom, Frank Hubbard

observed in his book, Three Centuries of Harpsichord Making, "I can see no reason for the curved shape of the damper . . . which would be difficult to make."[2] We can trust that Mr. Hubbard was correct in stating that he (or probably anybody else at the time) could not think of any reason for the curved shape, since 20th-century dampers of all sorts, as well as the current production processes, ubiquitously favored rectilinear shapes. He was also certainly correct to state that the curved shape is difficult to make (compared to the 20th -century rectangular shape). However, this appears to be a situation where Mr. Hubbard's two correct statements lead many people to the incorrect conclusion that the engraving could not be trusted; this conclusion, of course, also needs the tacit assumption that the various historical proofreaders would have been less familiar with what an historical harpsichord damper looked like than people in the mid-twentieth century. This tale can serve as a fair warning for all of us to stick with the known facts longer even, or especially, when they don't make immediate sense, before venturing any conclusions likely to emerge from modern ways of thinking.

Ruckers Dampers Ruckers double-manual harpsichords were originally built with both keyboards playing the same 8' and 4' strings. In order for one manual's dampers not to muffle the string when the other manual's jacks were playing, the Ruckers mouse-ear dampers had to be designed to not be in contact with their strings when their register was turned off. This feature would have contributed to sympathetic resonance of undamped strings being the norm for listeners and players, and also normal to hear in their single-manual harpsichords which also used the same type of dampers. In fact, the famous 1579 Theeuwes 2 x 8', 1 x 4' single-manual harpsichord portion of a claviorganum built in England was found with one original jack that had an oval damper hole like that used by Ruckers.[3] Albert Delin, who apparently built no doubles, used this style of damper until at least 1770, including in his 2 x 8' singles which, like the Theeuwes, would have produced significant sympathetic resonance when solo registers were played. So, for approximately two hundred years at least some listeners in several countries would have been accustomed to the sound of undamped strings. And some listeners, such as Gaspard Duarte writing to Huygens in 1648, apparently much preferred sympathetic resonance to a fully damped sound.[4]

String Spacing One significant clue to the shapes of historical dampers and their expected function lies in the spacing used historically between close pairs of strings. Most historical harpsichords with two 8' choirs of iron strings have the close-pairs spaced from about 2.0 mm/.08 inches apart (Kirkmans, Dulckens, various Blanchets, for example) to about 2.5mm/.010 inch apart (other Blanchets, Taskins). This close string spacing does not create a problem for the 17th and 18th-century Italian harpsichords, and some other types, which apparently were played with both registers on all the time. But for those harpsichords which did turn registers off and on, it is the amount of movement needed for a bass plectrum to clear its string that determines the minimum amount of movement the register needs between its on and off positions. With a bottom string of possibly 0.70mm/,027" thickness and a plectrum extension past the string for reliable plucking of about the same dimension, this means that the register needs to move approximately 1.4 mm/.06". A rectangular damper in its on position needs to be approximately 1 mm/.04" away from its neighbor string to be safely out of the way when that neighbor is vibrating. When the register moves 1.4/.06" mm to the off position the damper will now be about 2.4 mm/.095" from its neighbor string and have fallen off its own string in many historical harpsichords, or be just barely touching it if the string spacing is the wider 2.5 mm/.010" spacing. Even if the register movement and string/damper spacing can somehow be slightly reduced, this leaves, at best, only a very small amount of damper touching the string, thus placing a lot of force on a very small area of cloth which will limit its life, and also creates a need for very careful, and probably regular, damper maintenance to keep it performing dependably –not a feature that everyday players, historical or modern, would accept happily.

In instruments by the same historical maker, the presence of a 4' choir did not usually change their close spacing of the 8' pairs of strings. For instance, Dowd noticed that in the single-manual 2 x 8' 1736 Blanchet that the close-pair string spacing was only 2.0 mm.08", the same as several of his doubles. "If the pairs are this close, one can never play a solo 8', without the other one sounding sympathetically, a carillon effect which inhibits articulation. Obviously they either liked this effect or simply did not care, for in an instrument without a 4' choir there is no need to crowd the close pairs."[5] It is

interesting to note here that the “carillon effect”, which may seem to “inhibit articulation” to modern ears, would have been normal to most historical listeners, as discussed above. Also, the articulation is much less blurred when there is not excessive brightness in the harpsichord’s sound (but the explanation for that needs another article). The effect is also much less of a problem when the music is played slower than the often too-fast-for-expression speeds displayed nowadays. The dry sound produced by rectangular dampers along with the often unhistorically-short sustain (another article) of many harpsichords, encourages more speed to fill in the dryness. The sympathetic resonance that can be produced in single- and double-manual harpsichords with historical dampers provides more sustain of overall sound, which can permit a slower pace, or create a great wash of sound when useful for musical expression. A buff stop can be applied to a non-playing register to eliminate the sympathetic resonance from that choir of strings, thus providing an additional color choice for those registers that are playing. Harpsichords with historical dampers can also achieve a dry sound by turning on all the registers so that all the strings are damped when the keys are released, giving such instruments much more variety of musical color than harpsichords with rectangular dampers.

The 4’ strings are usually positioned approximately 1.0mm/.04 inch to the side of the 8’ strings above, and sometimes even lie almost underneath them. This close spacing makes it very difficult to fit a rectangular 4’ damper that, when in position to dampen its 4’ string, does not get in the way of the 8’ string above it, or limit how strongly the 8’ string can be plucked. Slanting or rounding the top of the 4’ damper increases the clearance for the 8’ string, and can also make the tip of the damper more compliant for a more smothering and less impactive engagement with the vibrating string. The 8’ dampers did not need this top shape because of clearance problems above them, but they were given this shape anyway. It seems likely that this extra shaping work was done to them because of the greater resilience it gave to their dampers.

These interferences between the 8’ and the 4’, and the micro-adjusting needed to get the 8’ dampers to work in both on and off positions, can easily be reduced by increasing the spacing between

the strings as many modern makers have done for many years. In retrospect, however, it is difficult to believe that the historical makers could not have also stumbled on this expedient, if they had had the same performance expectations as 20th-century makers.

Plectra length It might be thought that historical makers chose their rather tight spacing of close-pairs of string because they were interested in having plectra as long as possible for voicing. However, there exist several considerations that argue against this possibility.

For production efficiency it makes the most sense to use only one voicing approach for all models. Many makers made virginal and/or spinet forms as well as grand harpsichords. The maximum length of the plectra possible in the smaller form is significantly less than the maximum length possible in the grand form, but any extra time and care needed to voice the special shorter plectra would have worked against the intent of efficiently producing a cheaper model, all for the sake of saving only a couple of inches, or less, of case width.

In fact, possible support for this efficiency consideration has been observed in at least one famous dynasty of makers. Grant O'Brien noted in his book on Ruckers that the production marks found on all Ruckers registers indicate that the same 3.6mm/.14" (a bit more than 1/8") jacktongue-to-string spacing was used bass to treble in all of their models of virginals and grands, and for both 4' and 8' jacks.[6] Having plectra all the same length reduces the voicing variables to just considering where along the tapered bird shaft suits the strength needed for a particular string.

Another factor against thinking that makers tried to maximize plectra length is that plucking efficiency drops off significantly when a plectrum is longer than it needs to be, so there is no advantage to make it longer than necessary. (It can also be noted that spreading close-pair 8' string spacing apart too much in order to accommodate rectangular dampers results in a significant difference in 8' and 4' plectra lengths which works against this equal-length plectra principle.)

Register movement Of course, it seems perfectly reasonable that the historical makers might have wanted this tight close-pair string spacing in order to allow more space between the wide 8' string pairs,

thus allowing room for more distinct on and off positions of the registers. However, increased register movement argues against any intention for the dampers to remain on the strings when registers are turned off. Extra register movement makes sense, however, if it were needed to ensure that soft-cloth dampers would fully disengage from their strings in the off position in order to provide sympathetic resonance.

Depth of damper slots Another bit of evidence against historical use of rectangular dampers is that sawn damper slots would only need to be cut down to just above the level of the tips of the plectra since this is the lowest that the bottom edge of a rectangular damper needs to be placed in order to accomplish its job. Many historical damper slots, however, often went well below this, even as far as 3mm/ 1/8 inch below the plectrum's mortise, which itself was already below the plectrum's tip –since historical tongues were designed to provide 5-20 degrees (depending on the maker) of upwards angle to the plectra, a crucial feature often missing from modern jacks and historical copies. (This is another feature that is more difficult for the maker to construct than the common 20th-century 90-degree approach, so there must have been good reasons historically for slanting the plectra, but this also is another story.) Again, from a time and cost perspective, there seems no good reason for makers to cut slots lower than needed, so historical use of rectangular dampers would seem very doubtful on this evidence. (The oval damper holes in Ruckers jacks were made higher than the level of the plectra, but the horn-like flare of their mouse-ear damper would have made contact with the string below the level of that hole.)

Resilient cloth Mouse-ear dampers (used by Ruckers, Theeuwes, Delin, and others) were made by folding a triangular piece of cloth into a carefully carved oval hole (see Mouse Ear Hole Features below), rather than into an open-ended sawn slot. The cloth had to be able to fold easily around itself within this hole when it was inserted, and could not exert too much pressure in the hole since the sides next to the tongues in some jacks are almost paper-thin; if these sides were to bulge out from cloth pressure, they would bind the motion of the tongues. Therefore the cloth had to be quite supple, at least for these types of jacks.

The surviving historical damper cloth of at least some historical slot dampers also appears to be significantly more resilient than the modern cloth typically used. William Dowd noted in his survey of the Blanchet harpsichords that a closely woven scarlet flannel was used for the dampers by that maker.[7]

Double-damper cloth requirements Ruckers, various Italians, and other historical makers used two dampers in each 8' jack. This double-damping virtually guarantees that there will be no after-ringing of strong overtones whose nodes coincide with the location of a solo damper, so this double-damper feature gives a very complete silence when a note is released. If a stiff cloth is used for these two dampers, however, only the lower one will actually damp the string and then prevent the jack from dropping enough to allow the second damper to make contact with the string. This means that a stiff cloth damper will need a lot of attention to ensure that both dampers are set to exactly the same level in order for these to be effective and worth the extra work of making two per jack. Using a soft, resilient cloth instead of a firm fabric makes these double dampers far more reliable, a fully-developed "system think" typical of historical makers.

Friction bar Ruckers used only two (then very expensive) screws in an entire grand harpsichord. These located and adjusted the amount of friction that a small bar exerted on the treble end of the registers in order to eliminate any "springback" from their somewhat hook-shaped, mouse-ear dampers pushing or pulling against the strings when the registers were turned on or off, which would make for inconsistent voicing in their "on" positions Very few historical harpsichords that used single flag dampers were equipped with these friction bars, but when stiff modern cloth is used for the single dampers of these instruments, springback can become quite a problem, often addressed nowadays by trying to tighten the pivot screws on the register levers to create more friction in the lever movement. However, when a softer cloth is used in single, sloped dampers, springback is reduced or eliminated, and extra friction in the register movement is often not needed.

Mouse-ear hole features Since Ruckers-style mouse-ear dampers were apparently formed by pulling a triangle of cloth through the oval opening until it filled the hole, there was no apparent means of easily

adjusting the level of the damper up and down to regulate the timing of the damper's engagement with the string in relation to the timing of the plectra's pluck, as is usually done with flag dampers in slots in order to keep the jacks resting on the keys rather than being held in the air by dampers that are set too low. (The smoothly carved holes of these jacks along with the soft cloth used, discussed above, and the sometimes thin walls would not have provided enough friction for the cloth to stay vertically in place anyway.) The oval holes used for fitting mouse-ear dampers had parallel sides that held the dampers in position accurately side-to-side. The top and bottom ends of these holes, however, were not cut straight through, but carved to be taller and lower at their front and back edges, giving a smaller opening in the very middle of the jack thickness. This meant the folded damper cloth was held vertically by the middles of these two ends while the flaring of the hole front and back allowed the damper to pivot up and down somewhat vertically. (Rather like holding a pencil between two opposing fingers but it can still be pivoted up and down.) So, even though the vertical position of the damper could not be easily shifted in its hole, the feature of the vertically-flared hole shape would appear to allow the damper to adjust progressively to the forces it encountered with the string. Thus, a degree of self-regulation appears to have been built into the system, in addition to the resilience added by the qualities of the cloth

Damper slot surface The smoother that a damper slot is made, and/or the smoother and harder the cloth surface is, then the tighter the damper needs to fit into the slot in order to ensure enough friction to hold the damper in place. 20th-century plastic jacks were often provided with grooved damper slots to help hold the damper cloth. Unlike plastic jacks, wooden damper slots have a much lower limit of force that they can accept. A thick piece of hard cloth being pushed into the damper slot of a wooden jack has a real possibility of splitting the grain if the fit is too tight, making it very unlikely that this modern intention of a tight damper fit was an historical intention. However, as many historical makers recognized, if the wooden slot is cut to be somewhat rough in texture then the ends of the wood fibers will hold a soft cloth quite effectively and permit a range of adaptability of position, without placing any dangerous stresses on the wood grain of the jack body. The wood fibers offer resistance to both the up/down

as well as the in/out movement of the damper, while the horizontally grooved slots or teeth frequently found in modern jacks offer resistance primarily in the vertical direction.

Key-end cloth The cloth that the flat-bottomed historical wooden jacks rested on at the backs of their keys had a degree of resilience which helped to reduce excess noise from jacks dropping on the keys after the keys were released. This resilience also permitted the jack to drop a little deeper upon landing on it and then rise back up slightly as the cloth recovered from the impact. This slight extra jack drop allows the jack's damper to momentarily press against the string more fully to silence the string quickly and then to reduce the pressure on the damper when the jack rises slightly as the key-end cloth recovers from the compression. Thus while at rest the damper does not have the jack's full weight pressing it against the string and this reduces any tendency for the damper to distort and take a set, yet still ensures a complete damping of the string. This effect can be heard in harpsichords set up to take advantage of these factors since when a key is released the string is quickly silenced, but often when the string is stroked with a finger with the jack in rest position the string will vibrate quietly, which in turn provides extra sympathetic resonance for the other notes being played.

If this type of a soft jack bed is used with dampers with a hard rather than a resilient cloth, or with dampers that are held with a tight grip, the consequences will be dampers being knocked out of position from the momentary extra vertical drop of the jack, and/or dampers with accelerated wear of the cloth at the string contact area. Jacks that use bottom adjustment screws must generally use a firmer cloth than the layers of key end cloth typically used historically since the small area of the screw-head would otherwise sink into the cloth too much causing increased wear and noise, as well as allowing too much lost motion since when the string resists the rising plectra the resistance would push the jack's screw deeper into a resilient cloth causing a mushy feel, lost motion, and making it more difficult to stagger three jack plucks within a normal keydip distance. The firmer cloth needed for bottom screws, however, tends to conduct more noise and does not provide enough compression for the drop-and-

rebound effect described above to work.

Thus, the historical damper shape, resilient cloth, resilient damper grip, and resilient jack bed all work together as a system that provides more efficient damper performance, a more resonant sound to the harpsichord, and reduced maintenance by allowing dampers to damp well over a wider range of positions than can be achieved with the typical modern damper shape, cloth, and grip.

Other consequences of historical features An interesting consequence of having sympathetic resonance when one or two registers are turned off is that complete silence after the keys are released only occurs when all registers are turned on. And this condition can create an impression of a greater dynamic range when all the registers are engaged, since the quicker and more complete silence upon releasing the keys causes the loud range to seem even louder.

It is also interesting to note that the close historical string spacing, discussed above, also sets the maximum horizontal plucking force possible on an instrument without the strings buzzing against their neighbors, particularly in the bass. Similarly, the distance between the strings and the underlying features in the bass and tenor (4'bridge, bridge pins and hitchpins; or only the soundboard if there is no 4') determines the maximum vertical string release that can be used in voicing an instrument without the string hitting against anything below. Since the proportion of vertical to horizontal release is very important for determining the timbre, focus, and sustain of a note (another article), comparing these distances in various historical harpsichords could be revealing of the kind of sound and the amount of pluck historically intended in various types of harpsichords.

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[1] Grant O'Brien, Ruckers: A harpsichord and virginal building tradition. (Cambridge: Cambridge University Press, 1990), p. 222.

[2] Frank Hubbard, Three Centuries of Harpsichord Making. (Cambridge, Ma: Harvard University Press, 1965*),* Plate 40.

[3] O'Brien, p. 28.

[4] O'Brien, p. 305.

[5] William Dowd, "The Surviving Instruments of the Blanchet Workshop", in Reconstructing the Harpsichord, vol. 1, The Historical Harpsichord: a Monograph Series in Honor of Frank Hubbard, ed. Howard Schott (Hillsdale, NY: Pendragon Press, 1984), p. 65.

[6] O'Brien, p. 112.

[7] Dowd, p. 54.

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