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HARPSICHORD REGULATION

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Originally written for the Harpsichord Magazine in 1976 but somewhat revised in 2005.

This article is intended to be of help to the many people who own or look after modern traditionally-based instruments. It is biased towards the kit-builder, who doesn't always have experience in understanding "instruction-book language" which can be misleading when it comes to the finer points of voicing and regulation. Since the subject is very important, a few words on what a good harpsichord action ought to be, and how to attain and then maintain it, should be useful to many people.

Firstly then, the action as it should be. The keys should be light, very free, with little or no side-play. Lead in the keys is therefore avoided as far as possible. The back touch (i.e. where the rear end of the keys rest) should be made up of thin layers of woollen cloth sewn together, not a lump of felt glued in place. The top rear surface should be covered with doeskin rough side up (or a close-woven cloth) stapled, not glued in position, for the bottoms of the jacks to rest upon. There is then no lost motion due to masses of thick soft felt compressing. Coupler dogs should touch similar leather under the upper manual key-end. Many keys from old instruments were very light to start with, and were often tapered and cut away underneath to balance them. This is possible now only when the wood used is of a high enough quality. If two jacks are removed from a key end, the key should be at balance. This gives a nice playing weight. Kits are usually heavier to make regulation simpler –the action is thus positive when no jacks are fitted. It is also easier to level the key-fronts when the keys "lie back" without jacks being present.

The jacks themselves should be a close fit in the guide or register, and yet be absolutely free to move up and down even if they lean five degrees or so to the right or left of vertical. The key dip should be 7mm on the lower manual, but only 6mm on the upper (measured at the front of the naturals). A coupler mechanism should have 1.5mm free play in the engaged position, measured at the key cover - it's very much less at the coupler dog. This means that the jacks on the upper manual move the same distance vertically if either upper or lower keys are fully depressed. Short keys on a single-manual instrument are best given a key dip of 6mm.

Rather larger key dip is set initially, while the keys are levelled and the back-touch is set. The final key dip must be set by adjusting the position of the jack cover rail, or the number of layers of cloth under it, so that the jacks are stopped by contact with the padded rail. This is very important - it's the last thing one does, and it can transform the action of any instrument. The jack cover rail should be securely fastened, preferably in a manner that allows for easy removal. Assuming that the instrument is strung and tuned roughly to the pitch for which it is designed, the next stage in setting the action prior to voicing is to fit all the jacks into their respective positions. This is best done before fitting the plectra (or the tongues where these can be easily fitted later).

When quilling a new instrument with wooden jacks and real feathers, the operation of quilling is done before the jacks are fitted to the guides: the quills are cut off against a block to leave about 12mm protruding, and the order of the jacks in the row is then determined by feeling the strength of the quills with the fingers: the strongest quills are in the bass. When re-quilling an older instrument, the jacks are already numbered and so the quilling requires much greater care and experience.

The jack guides must now be set in an "off" position. If a row of jacks plucks to the left, it is "backed off" by moving the guide to the right until the jacks miss touching the nearest string to their right by as little as 0.5mm, such that if you pluck the string it can vibrate but does not touch the jack. Set both 8' rows in this fashion, one backed off to the left, (close to the 4' strings if the instrument has any), the other row backed off to the right. Then look hard at all the string positions relative to the jacks: make sure that there are no glaringly wrong string positions. If there are, alter them by moving the pins at the nut. Don't allow the close pair of strings to sit too closely together in the bass, as this will allow the strings to jangle against each other –you may like this interesting

noise, but it's not required. When the geometry looks right, check the guide positions again, since some more space may now be available each side of the jacks. Jam the guide into this position so that it won't move during the next few operations, using a small wedge of wood.

If plastic jacks are used, now is the time to complete their assembly and to check each jack to see that the spring pressure is only just enough to hold the tongue forward against its stop, and that the tongue itself is absolutely free to move (sometimes a tongue must be shaved a little, or "flash" may need to be removed). If the jacks are fitted with a top adjusting screw, beware. The screw is there for setting the tongue position and thus the spring tension, not for adjusting the plectrum setting and the sound it makes. It is set now, and not touched again. The original reason for using such a device was to help when voicing plectra of modern hard leather (in which case it is a godsend), but it is not used in this fashion with Delrin or quill, as a reliable action needs each of the plectra to sit under the string by the same amount. *All adjustment of the sound is done by cutting and scraping the underside of the plectra.*

Spring tension is set by gently bending the spring if it is made of hog's hair or wire, or by actually changing it. Plastic moulded springs are supposed to be adjusted in this way, but it is not very effective. It is often best to reshape the spring gently and smoothly with a sharp scalpel to make it less massive. This makes a more reliable light spring than just bending it. Light spring tensions are required, so the physical size of the spring is important. There is however a limit to the injection moulding technique used, hence the size of some springs. If spring tension is too light however, repetition will suffer.

Don't forget that the more care and patient work is put into eliminating possible faults before voicing, the easier that operation becomes. The best tool for shaping plastic springs and for voicing both Delrin and quill plectra is a Swann-Morton No. 3 scalpel using No. 11 blades. You need other tools; a nice quality pair of 5 inch pliers to push plectra into the tongues and a very good pair of needlework scissors for dampers, at the very least.

The next stage is to "set for silence." In order that the action of a harpsichord should feel light to play, the plectra must be fairly long. Short plectra will be more difficult to voice and will not last as long, as there is less material to do the same amount of work. Coupled with this, the plectra must sit under the string by a reasonable amount, a little more than the thickness of the strings in the low tenor region. The more loosely the jack fits the guide, the more of the plectrum must show on the other side of the string it is plucking, in order that the note can repeat properly. Since it is clear that the amount the plectrum moves the string from rest will affect both volume and tone, it should be clear that this "tip under" distance must be fairly even throughout. So, with the guides in the "off" position, firmly wedged, cut all the plectra to *just miss* the strings they should be plucking. Use a very sharp scalpel blade, and preferably cut on a block, as left-hand thumbnails only last for one instrument in any given month. This operation is best judged by eye, then checked by ear. You should end up with an absolutely silent instrument; this is well worth the trouble as later it makes the actual voicing much easier. The cuts at the end of the plectra are made at 45° to help the plectra return past the string easily.

The next step is to un-jam one guide. Adjust its position (without altering the "off" position capstan screw) so that the plectra protrude the correct amount past the strings. This is done most easily by looking at the extreme bass where the strings are thickest, vertically from above. It should be just possible to see the tip of the plectra. Then adjust all of the jack heights by means of the screw or threaded weight usually provided at the bottom of the jack, so that the plectra are all roughly the same distance below the strings. An old instruction suggested that in the bass the plectrum should protrude by the thickness of the string, 0.5 - 0.6 mm, which leaves rather more of the treble plectra showing; it seems to work well if the jacks are a good fit in the registers.

Accurate adjustment should be left until all the voicing is done, and just before the dampers are fitted and cut. It should perhaps be pointed out that the more the plectrum protrudes under the string, the greater the vertical distance between string and plectrum must be, to allow the plectrum room enough to pass the string on its return journey. Also, plectra of a 4' row will ideally protrude less far past the string, and thus be capable of a closer vertical setting than any 8' row. However if an instrument is fitted with a lute stop in its own gap running close to the nut, the settings are of necessity as close as for any 4' row, since the jacks move only a short vertical distance due to the reduced leverage available from the keys.

When all this is done, the row of jacks should play from the keyboard fairly evenly. The sound will be rather loud, and the touch heavy, but this is an excellent starting point for voicing. Tune the instrument as best you can now, as this will help too. Make sure that the C's are

in tune with one another. Remember that it is no good voicing at one pitch, then altering it to play, since the quality of the notes will alter when the pitch does, but maybe not so evenly.

Voicing and Regulating

Recently, "prevoiced" plectra in Delrin have become available from Adam Swainson, who makes fine jacks. These plectra are made in four strengths, and theoretically need only to be cut to length. They do need to be voiced after fitting, but they are much easier for the amateur to use, they are fast and there's much less chance of making mistakes. Most of the voicing can be done using scraping rather than cutting. They should be in every harpsichordists' toolkit.

Voicing can now be started. Use a new blade for each row at the very least; the blades don't stay sharp very long. The length of the plectrum is not altered during voicing, tone and volume being controlled by shaping the underside only. When correct the plectrum should bend evenly during the plucking action, in a parabolic curve. Its shape should be evenly tapered in both width and thickness. The width at the tip should change progressively from widest (maybe only a little narrower than at the root where it leaves the tongue) in the bass to maybe half the root width in the extreme treble. Some makers leave their plectra much narrower than this; the overall sound of the instrument will be quite different in this case, with far stronger high harmonics.

If you pluck a wire with a wide plectrum certain harmonics will be inhibited; as an extreme, a piano is struck with a very wide soft felt to inhibit purposely all but a few harmonics. The thickness of the plectrum also varies progressively: plectra should not be cut too thin as this will shorten their life. A happy medium between width and thickness is desirable. The 4′ plectra will be smaller than the 8′ ones, but in proportion to them. All the plectra will end at the tip with the 45° cut which was made when "setting the silence". The top surface is left untouched. The bottom surface of the plectrum is rounded by scraping. This should be the operation whereby the sound quality and volume are made even throughout the entire row. Quill is easier to voice than Delrin since it has a grain to help you: cutting straight through a Delrin plectrum is remarkably easy until you gain confidence in the knife that you are using.

Now sound all the C's and tune them if necessary. Cutting very carefully and looking at the plectrum shapes, balance the sounds so that all the C's sound nice individually, and together no one note is more evident than the others. The best way of checking this is to sound four C's together, then leave one out, then another and so on. It is much easier, for some reason, to hear that a note is missing than to hear which one is loudest. Any note not sounding is going to leave a big gap in the harmonic structure of the whole unison sound. Be very careful to apply this to the bass, as it is easy to voice the bass too loud, so that when the instrument is completed the tenor is overpowered. Now listen to the sound. If it is clear and pure and you like it, well and good: if it sounds forced and the pitch is higher at the beginning of a note than when the note has started to die away, then the plectra are plucking too hard and should probably be scraped to be a little thinner. When you are satisfied, starting from middle C, I voice the naturals for one octave upwards, checking all the time that no one note sounds more loudly than the others (an interval of one tone between two notes played together can sound nice when you are used to it). Then do the next octave of naturals using the C's as a guide, and continue until you run out of notes. Now work down to middle C, voicing the accidentals. Next, repeat in reverse down to the bass and back to middle C. Now the row of strings should be tuned fairly accurately, so that you can hear what chords sound like. The row should sound beautiful.

If any odd notes sound dead, lacking in upper harmonics, check that the pins in both bridges are both tight and clean of fluff or oil. A note that warbles and produces beats all on its own may be due to a twisted or kinked string: such a string must be changed. Making the plectra less wide will sometimes bring out more upper partials; this is how to make the bass more reedy in quality. What must be borne in mind is that all the possible variations in tone and volume are made within a fairly small range: the basic sound quality is built into the soundboard design at birth, as is the possible volume. All that voicing can do is bring out the best from what is already there. A bad instrument can often sound better voiced more quietly, when the soundboard has less work to do. A well-voiced row feels right: all the notes seem to require the same pressure on the keys to make them play. It is often easier to feel loud notes than to hear them at this stage.

With one row voiced, the rest becomes easier. Set the back 8′ row in the "on" position and set the C's as before, but also matching them to the front row. Then repeat the whole procedure. When you do the 4′ row, you

will find it needs to be a little quieter than you would think. This is because it will "speak" or "fire" before the other notes on that key and will thus be more apparent.

Part II, in our next issue, will deal with firing order of jacks, and regulation of dampers, as well as sticking notes, the problem of registers binding and non-repeating notes.