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AN APPROACH TO RECREATING HISTORICAL SOUND[1]: PART I

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After an initial period of taking inspiration from the techniques of modern piano making, resulting in the Revival harpsichord (Pleyels, Neuperts, Sperrhakes, etc., of the early twentieth century), modern harpsichord making became increasingly centred on creating replicas of extant historical instruments.[2] Many people, myself included, believe that the historical approach to harpsichords has resulted in more satisfactory instruments than those of the Revival approach. These latter instruments, however, provided the first harpsichord experience for many people, and their tight, steely sound naturally established an expectation of what harpsichords should sound like. However, I believe that significant evidence exists to indicate that even the more satisfactory sound from the typical historical-replica harpsichord has not yet moved far enough away from the legacy of the bright Revival sound for it to be considered a reasonable replica of historical sound.

The expectation implicit in the scrupulous, physical[3] copying of an historical keyboard instrument seems to be that the result will be the sound of the original instrument. Observations made by many people over the years, however, call into question the likelihood of achieving this expected result:

1. It is impossible ever to know what the instruments sounded like originally.
2. Various copies of the same historical model often sound quite different from each other,[4] and from the restored original.[5]
3. Restored historical instruments sound different depending on who restored them, so it is difficult to know the true sound of the instrument with any certainty.[6]
4. Newer wood reacts differently than old wood, and so changes the sound.
5. Overlooked details and relationships can dramatically affect the resulting sound.

Given these considerations, it would seem over optimistic to expect to achieve an exact sonic reproduction of a particular antique instrument's sound through detailed copying of the dimensions and materials of the original antique. A more reasonable aim might be for the reproduction to produce a good musical sound that fulfils its role for the written repertoire and the known performance usage, similar to matching the characteristics of a particular voice to specific vocal literature, or vice versa.

To judge whether success has been achieved in producing a musically successful historical sound in a new replica harpsichord or in a restored antique, I propose asking three basic questions. The order is such that if any question generates a negative response, there is no purpose in asking the next question.

1. *Is the sound musical? In other words, does it share the sonic characteristics of high quality examples of other musical instruments? Does it provide listeners and players with a desire to hear more of it?*
2. *Is it an historically appropriate musical sound? Do its musical characteristics share family characteristics with other instruments that would have been used within its own time? Does its sound successfully fulfil its role for the music of its place, time and purpose (solo, continuo, small ensemble, chamber, opera, orchestral, etc.)?*
3. *Does the sound encourage a player to use the instrument in the way it was used historically?*

As criteria for the answers to these questions I propose comparing how well the attribute being examined in each question fits the evidence of the historical instruments themselves, the information in historical documents, and the information gathered by organologists and acoustics researchers, as well as the observations provided by the experiences of makers, players, and listeners. Any single piece of information gathered from these various sources could have several different plausible explanations. By collecting and examining many pieces-of-the-

whole at one time, various of the pieces may help to confirm or eliminate these explanations, allowing a pattern to emerge that can lead to more pieces and ideas that can be tested for fit, as is done in all manner of subjects archaeological. As in most endeavours, certainty can never be attained. But a desire to move towards more certainty from our present position of recently inherited customs and habits will allow testing of current assumptions. The ideas that I propose throughout this paper fit a pattern I perceive in the historical and modern evidence: a pattern that should itself be tested while we search for better fitting patterns.

Although the order of the questions above is deliberate, they are discussed in reverse order when examining a particular sound.

INSTRUMENT USAGE

The particular sound and playing characteristics of any musical instrument encourage a particular way of playing to exploit fully its musical potential. For instance, the sound and physical responses of a baroque-model violin naturally elicit a different approach to playing than those of a modern violin. This interaction is also true of the playing techniques of a lute, a guitar, a mandolin, and a banjo even though the essential format of plucked, fretted strings is the same for all of them. It seems perfectly natural that players will find ways to get the most musical use from their instruments by responding to what those instruments have to offer. Modern harpsichord players, if not audiences, have apparently accepted the reproductions that have been produced. I believe, however, as will be described below, that *historically-based harpsichord copies, and even many restored antiques, are utilised much differently now than when harpsichords were used historically*, as evidenced both by contemporary documents and the physical specifications of the harpsichords themselves.

First I will describe the usage that I have observed in more than thirty years of making, servicing and concert tuning of harpsichords, and compare it to the historical evidence. After also examining various characteristics of sound, I will propose a reason for the usage differences, and the probable changes needed in order to satisfy the criteria listed earlier for a reasonably historical musical sound.

Solo 8' Stops

My own experience suggests that when there is a choice between two 8' stops for solo work, *the overwhelming majority of modern players choose the back 8' register* most of the time. The reason seems to be that it is perceived as sounding "fuller, rounder, mellower, gentler", while the front 8' is perceived as being "too bright, forward, harsh, sharp," — assessments that seem perfectly reasonable with most modern harpsichords. The historical usage and evolution of harpsichord design, however, appear to show that the front 8' sound was often the only 8' sound in iron-strung singles, and was the only 8' sound given its own keyboard in almost all double manual harpsichords.

The instruments built by the Ruckers dynasty were the departure point for most of the designs of the later, and often-copied, 18th century French, German, and English harpsichords. Ruckers singles, for instance, were built for over one hundred years with only one 8' register and it was definitely in the closer plucking position. The Ruckers could easily have exchanged the 8' and 4' register locations, or shifted the gap back slightly and put the 8' behind the usual plucking location of the 4' in order to give the 8' a more distant plucking position, but they seemed to have *preferred the closer plucking position for over a century.*[7]

There are a few extant antique double manual harpsichords that have the 4' on the upper manual and two 8' registers on the lower manual.[8] It is also quite possible to configure a double manual to have an 8' and a 4' on the upper manual (all the Ruckers doubles did), and it is also possible to place the back 8' by itself on the lower manual to make an easily accessible back 8' solo sound, but the fact is that *in virtually all historical double-manuals it was the front 8' register that was given its own keyboard*, which permitted instant solo use without the need of moving register levers or uncoupling keyboards. Two manual organs, historic or modern, do not appear to put little-used ranks on the upper manual so that they are mainly heard when coupled to the lower manual. By its positioning the front 8' register would thus appear to be historically regarded as a highly useful sound, and not one to be avoided as often as it is now.

Since the upper manual harpsichord keys are significantly shorter than the lower manual keys and also usually only have the weight of one set of jacks on them with only the resistance of one set of plectra to overcome, *the touch of the upper manual can often be more direct and sensitive than the lower manual*, qualities beneficial for a solo stop. The lower manual keys are significantly longer, carry at least two jacks each, and often have coupler dogs that together add significant mass,

inertia and momentum to their feel (even when not coupled to the upper manual), and many present day players report preferring the feel of the lower manual to the upper. The somewhat crisper touch of the upper manual might be more comfortable and familiar to players who also play organ, as I suspect a higher percentage of historical harpsichord players did, than to those who primarily play harpsichord and/or piano.

So, in both the benchmark Ruckers singles and in most historical doubles, *the front plucking 8' appears to have been deliberately positioned to be used more than current usage reflects*. This difference was brought home to me recently when, having only fifteen minutes to touch up the tuning of two double manual harpsichords during intermissions at the opera, I asked the well trained harpsichordist (and organist) if he was playing coupled or uncoupled. He replied, "I know I should be using the lower 8' during the recitatives, but I just love the way this upper manual responds to gesture with the singer." I realized that his instincts were exactly right, but somehow since historical times solo accompaniment with a double's most easily accessed solo voice had become wrong.

On many copies of Ruckers' singles my impression is that most current solo 8' playing is done on the rear 8', a register the original Ruckers singles did not have.

Double usage

All things being equal, *the plucking position of the front 8' makes it a louder register than the back 8'*, but a consequence of the modern impression of the relative sound qualities of the front and back 8' stops is that many makers (often at the insistence of players) voice the front/upper 8' as equal to or, more usually, quieter than the back/lower 8'. Unfortunately, *as a plectrum is made weaker by thinning it, the proportion of lower partials from the instrument decreases, while the proportion of higher partials increase*[9], making the note stand out more because of its brighter voice. Consequently, a bright note has to be weakened considerably to make it quiet enough to be less obvious.

Most of the replica doubles produced currently have the two 8's separated by a 4' register between them. This is used in virtually all the French models as well as some German and early English models. In these cases the modern front 8' sound is often reduced enough in volume to balance equally with the solo back 8' or, more often, is voiced more quietly than the back 8' so that it can serve as a sort of echo to it. This practice is contrary to the apparently important historical solo role of the front 8' discussed above, and contrary to various historical sources, for French harpsichords at least. [10] *If a modern front/upper 8' voice is weakened sufficiently to reduce a perceived overly-bright character, it will have virtually no role played against the full harpsichord*, except as a very weak echo that isn't often needed in the music. Thus, the starting default registration for most harpsichords currently seems to be with the keyboards uncoupled and the 4' usually turned off so that the back/lower 8' sound is readily available. Subsequent changes add to this back 8' sound, while historically the custom may have been to start with the full harpsichord and subtract from that for variety.

Most 18th century instruments outside France placed the 4' register behind two closely spaced 8's. This disposition of the 8's increases their ability to blend, due to the reduced tonal differences between the two registers, although it can also reduce the apparent increase in volume when played together (compared to the effect of more separated registers). On many doubles of this type of instrument (particularly English) there was no keyboard coupling system and they could not contrast and dialog the two 8's with each other because the front/upper 8' jacks were doglegged and, if the front 8' register were turned on, the upper 8' jacks would always sound when the lower manual keys were played. The many possible voices available on the lower manual would make it musically advantageous for the upper manual 8' to be strong enough for useful contrast and dialog with the lower manual voices. A front 8' with a voice weakened in an attempt to reduce its brightness would have little musical use. [11]

4' usage

The 4' sound was very familiar to historical ears, as evidenced by

a) The number of octave virginals, harpsichords and organs still in existence, and those listed in various historical inventories.

b) Many mother-and-child virginals were made by Ruckers and their colleagues; these provided a 4' octave virginal which could be played separately, or placed on top of the 8' mother virginal and coupled to its action.

c) The positioning of the 4' alone on the upper manual of the four doubles noted earlier *reveals an apparent intention for the 4' to be played as a solo stop*, since if it were not played solo there would be no reason to give it a separate keyboard.

d) If the 4' had not been used by historical players as a solo stop there would have been no need for makers to go to the extra work of extending the 8' register outside the cheek in single-manual

Ruckers-type instruments or to fit levers to the lower/back 8' registers of doubles since there would be no need for the player to turn these registers off. Servicing of the 4' without the 8' sounding could be accomplished by pushing on the 8' jacks to move that register aside, as was often done with 2 x 8' Italian harpsichords. These were not usually fitted with levers or knobs, and were intended to be played with both registers always on. In fact, when 16th century 1x 8', 1 x 4', iron-strung harpsichords with stop knobs were converted later to 2 x 8', brass-strung configurations, the stop knobs were usually removed. Very few 17th and 18th century Italian makers provided any means of changing registration. Apparently the makers, and re-makers, saw no reason to provide a handy way of changing stops when the player wouldn't need it. Thus, *it would seem that where the means to change stops were made available they were expected to be used.*[12]

e) Organ playing of the time used 4' ranks as solo voices.

It is also interesting to note that although the conversion of 16th century 1x8', 1x4', iron-strung Italian harpsichords to brass stringing in the seventeenth century (with a concomitant drop in pitch and shift of keyboard range) did not necessitate any repositioning of the bridges, makers, rather than substitute brass strings on the 4' choir, added a second set of brass strings to the 8' bridge, and removed the 4' bridge and nut.[13] To me, the most likely explanation for doing this extra work is that *an historic brass 8' was bright enough without a 4'*, and adding one was not musically useful or desirable. This idea, along with the example of the typical Ruckers registration, *also implies that an historical iron 8' sound was significantly less bright than the brass sound, and was heard as needing a 4'* for adequate musical versatility. This does not seem to be the assessment for most current iron-strung harpsichords encountered today. However, there does appear to be current agreement with historical brass-strung practice, judging by the rarity of finding 4's on modern brass-strung instruments now.

Despite the historical examples, *many modern Ruckers copies are built with two 8' stops and no 4' because of the current assessment that two 8's are more useful since the modern 4' doesn't sound very good* ("too bright, shrill, stands out with the 8') and it goes out of tune easily. It is difficult to imagine how the Ruckers, and other historical makers, overlooked these perceived 4' liabilities for a hundred years *if* their 4' sounded and acted as ours does.

Throughout the history of the iron-strung harpsichord we can see that the 4' was often considered worth the work of making an extra bridge and nut; it was included in double manuals, was played as a solo stop (as the custom on the organ), played jointly with the back 8' and (in harpsichords of later makers) probably played with the front 8' also. The 4' layout on the soundboard makes it a very efficient producer of sound but, like the front 8', its overly bright sound in most modern harpsichords is usually tamed by voicing it much under what it can do so that it stands out less, even to the point of virtual inaudibility in full ensemble, thus reducing both its own potential utility as well as the total output of the whole instrument still further. *The use of the 4' may represent the largest disparity between historical and modern usage practice.*

Buff stop

Another feature found on all Ruckers, and many other historical makes of harpsichords (and on many copies) is a buff stop. But it is currently used in performance so seldom as to call into question why it was ever seen to be worth the extra work to make, install and regulate. My impression is that *many people hear most of them as being too dry and pizzicato-like in effect* to have many useful applications. Nor can the sound quality of the typical modern buff stop satisfactorily explain why this stop was sometimes called a "lute" stop or a harp stop. [14]

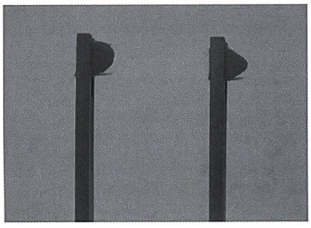
Double dampers

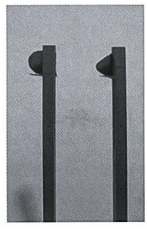
A feature frequently not making it off the drawing page to the "copy" is the jack with two dampers, as found on all Ruckers 8' jacks, on quite a few Italian harpsichords[15], and on other historical harpsichords. (See figure 1).

The historical makers must have had a compelling reason to go to the extra hand work of cutting extra damper slots in the jacks, and making, installing and regulating an extra set of dampers. This reason for double damping does not seem to be present very often anymore on our harpsichords or this feature would be used now with at least historical frequency; and it isn't, even in most copies of the originals that used them. Some feature of the sound would seem to be missing.

Historically shaped dampers

There is no historical physical or documentary evidence, of which I am aware, that justifies the use of modern rectangular flag-shaped dampers as currently used in most replica harpsichords and restored antiques. Except for Ruckers and their colleagues (discussed below) harpsichord dampers were pieces of cloth held in place in vertical slots sawn into the wooden jack bodies. Virtually no historical damper has ever been discovered with a rectangular shape as used in the modern flag damper. [16] Plate XIV in "Lutherie", second suite of the 18th century Encyclopédie (This can be seen in Plate XL of Frank Hubbard's *Three Centuries of Harpsichord Building*) shows two jacks with dampers installed; one damper is quite round and the other has sloped top and bottom edges. See figure 2 and 3.





These shapes more completely, quietly and quickly silence a vibrating string by simultaneously wedging both the up-and-down and side-to-side motion of the vibrating string to a stop. A modern flag-shaped damper works by dropping down on top of the up-and-down motion of a string, which only indirectly and eventually stops the side-to-side motion; this can allow the energy of a strongly vibrating bass string to shake back into the jack, especially with a stiff cloth, causing it to rattle in its guide. Also, a sloped damper does not remain on the string when the register is in the off position, as a modern flag damper does, and so is less fussy to keep in adjustment, and allows the undamped strings to add sympathetic resonance, as available historically. The sloped or curved shape also permits a stronger initial pluck of an 8' string with much less chance that the increased displacement of the string will put it into contact with the damper of a facing 8' jack and distort its sound.[17] *Surprisingly few makers copy this historical feature, despite the improved performance, increased colour possibilities, longer sustain, and reduced maintenance resulting from using the historical approach.*

Mouse-ear dampers

Very few modern makers copy Ruckers oval damper holes for use with "mouse-ear" dampers,[18] which is an area where I can quite sympathise: the holes are quite exacting to make and I haven't discovered any significant advantage of the mouse-ear damper over the more usual shape of damper used by all other historical makers. However, it is possible that *the sound of historical Ruckers harpsichords was so robust that it needed the extra cloth contact area* afforded by this configuration to damp the sound and to stand up to the forces involved.

Part II of this article, which will be published in the next issue, discusses the characteristics of high quality sound, family sound, and proposed changes and their consequences.

1 This article is a much revised and expanded version of an article first published in the *Midwestern Historical Keyboard Society Newsletter* 24/2: 16, 17, 26-32. It, in turn, was an extraction from a lecture given at the April 2007 MHKS conference in St. Paul, Minnesota.

2 But certainly not entirely, some makers continued to design completely original models, while others, with good reasons, focused their making on using historical making principles without trying to copy any particular historical model. [See Skowroneck, M., *Cembalobau: Harpsichord Construction* (Bergkirchen, Edition Bochinsky, 2003), 267-268.]

3 Copying can have several approaches including visual, dimensional, material, and functional. It is necessary to know which approaches are being used before any assessment of degree of success can be made. *Visual* obviously deals with appearance, which can be as simple as copying the form, or as involved as copying ornate decorative elements. *Dimensional* refers to careful attention to replicating all the parts to the same size as the original. *Material* refers to carefully using the same species of wood and other materials as the model used. *Functional* refers to reproducing the same function as the original. For example, work has been done on making violins using aluminium and, more recently, graphite epoxy resins in order to try to overcome various disadvantages of wood. In such projects there is generally no attempt to make the new material look like wood. The primary purpose is to create an instrument with the new material that produces a sound which can match or better the model's sound in various qualities.

4 As witness, a) the sounds of different makers' purported copies of the same antique model such as the 1769 Taskin or the 1640 Ruckers, b) the comment by William Dowd, the American pioneer (along with Frank Hubbard) of the return to the historical harpsichord, and a maker of superb, accurate craftsmanship, at an informal gathering of chattering makers at a conference, "Copy? Copy? I can't even copy myself!"

5 One year when attending a conference at an institution with an antique keyboard collection, attendees several buildings away from where one of the sessions was to be held discovered a copy of an instrument in the collection. This copy had been made by a well known maker with excellent craftsmanship in order to save wear and tear on the original and allow it

to be heard outside of the climate controlled environment where the original had to be kept. One person after another quietly stepped up to the instrument and raised the lid, played a few notes, raised their eyebrows in surprise and put the lid back down. Its very bright sound was not at all close to the sound of the much-recorded original model, and in fact was such that no one appeared motivated to play more than a few test notes on it.

6 In 1985 I spent six weeks inspecting keyboard instruments in collections in Europe and the UK. At that time I had not yet heard an antique German harpsichord firsthand and was looking forward to it with the intention of probably eventually copying one. With permission, I approached one in a collection, played one note, and then a few more and then stopped playing, and stopped being interested in German harpsichords. It had far too much of the sound qualities that I identified with revival harpsichords. It wasn't until several years later that I found out that it had been restored by a maker of Revival harpsichords.

7 Sixteenth century iron-strung Italian harpsichords do not have the closer the closer plucking register for their 8′ register, but this appearance may be due to the placing of the 8' and 4' nuts next to each other on the wrestplank, and the closer placement of the nuts to the gap because of the narrow pinblocks. In fact, using the 1531 Trasuntino's original disposition as an example, even with the 4' being in the front register position, its plucking point percentages are slightly more distant than a typical Ruckers harpsichord's rear positioned 4', and the Italian's rear positioned 8′ plucking points are more similar to the plucking points of the Ruckers front 8' register than to an 8′ placed behind its 4'.

8 A 1693 Blanchet, a 1690 Cristofori and a 1650 anonymous Italian, and the anonymous French/German(?) restored by Chris Nobbs and now in the Wurtembergisches Landesmuseum in Stuttgart, Germany has a 4' register on the upper manual and two 8' registers on the lower. [See Stanley Sadie, ed. *Early Keyboard Instruments.* The New Grove Musical Instruments Series. (New York: W.W. Norton & Co., 1989), 63, 70]. There can be little doubt that the 4′ was on the upper manual since the vertical positioning of the three sets of strings does not allow the 4' set of strings to be plucked from either of the other two (8') registers. Mr. Nobbs notes that the sonic qualities of the 4' are such that when alternated with the 8' registers, the 4's, " . . . strongest element of contrast felt is not one of pitch, but of timbre." See Chris Nobbs, "A Seventeenth Century French Harpsichord," *Harpsichord and Fortepiano Magazine* (October 1987): 102.

9 Although it may seem that all the partials should become weaker when the plectrum is thinned, a thinner plectrum does not displace the string in the same way that a stronger plectrum does. It helps to understand that the soundboard has vertical and horizontal modes of vibration. The vertical direction of vibration is the more flexible and has lower frequencies associated with its modes than do the modes of the much stiffer horizontal direction of vibration. All other things being equal, when a thinner plectrum plucks it flexes more and tries to get around the string more than lifting it. This causes the string to be deflected more horizontally, and upon release an increased proportion of the higher frequency horizontal soundboard vibration modes are excited than before the plectrum was thinned. While even on very resonant soundboards this effect varies somewhat from bass to treble, it can be demonstrated by carefully plucking a harpsichord string with a fingernail as vertically as possible, and then as horizontally as possible with reasonably equivalent force. Varying the angle of the pluck release will change the tone colour of the transient sound (just as it does on a guitar). The character of this very brief initial transient sound is a major piece of information that the brain uses, on a largely subconscious level, to identify what type of instrument is generating a sound, and also provides a very important first impression on a conscious level of the sound quality.

10 François Couperin, for instance, notes in one of his pieces croisées ("Les Bagatelles", Ordre 10, p. 62 of the original edition [*Pieces de clavecin*, second livre, Paris 1716-1717]) that for this piece the manuals should be uncoupled and the 4' turned off. [This implies that the normal situation is with them on and engaged.] So at least for most of the other pieces in this body of work, and quite possibly other French repertoire, it would have been important for the upper 8′ to be strong enough to carry reasonably well with the lower manual usually playing coupled and with the 4' on. If this is so, then the lower manual with three registers playing would naturally be the "Grand/Forte clavier", and the upper manual with only one register would be the "petit/piano clavier"; there would be no need to weaken the voicing of the front/upper 8′ since this terminology is one of keyboard resources and not of 8′ strengths. [See also Harald Hoeren, "Remarks on Harpsichord Building and Harpsichord Repertoire in France from 1650 to 1780." In *The Harpsichord and Its Repertoire: Proceedings of the International Harpsichord Symposium, Utrecht 1990,* edited by Pieter Dirksen. (Utrecht: STIMU Foundation for Historical Performance Practice, 1992), 87-95.

11 Additionally, it is interesting to note that in many of these models the front/upper 8′ plucks the longer set of strings (contrary to French custom). All things being equal, these higher tension strings would consequently make the front 8′ slightly louder than otherwise. Having received that natural advantage from the harpsichord designer, it would seem puzzling to then voice that register down enough to match or be quieter than the back 8′.

12 There is another advantage to be gained by being able to turn off the 8′ register that deals with resonance, which will be covered later in this article, but it is doubtful that this particular reason was the only reason that register extensions, or levers, were fitted to the 8′ registers historically.

13 Edward L. Kottick, *A History of the Harpsichord* (Bloomington, IN: Indiana University Press, 2003), 133.

14 There are three features of Ruckers buff stops which are not frequently copied. The first is separate bass and treble sections which can be turned on and off separately; its rarity today may be due to this feature only working with a single 8′ register present, and to an uncertainty of how to exploit it, particularly in music of other times and places. The other two features seem to imply a functioning different from that usually produced today. Ruckers made their buff battens lower than most makers appear to do now, and they also used stop blocks to limit the "on" movement of the buff battens. These features would seem to imply that there was a more yielding touch of the pad against the string. Most makers now use a higher batten that brings the base of the pad closer to the string and makes it feel rather stiff. The cumulative stiffness of these pads offers enough resistance to the "on" movement of the buff batten that most makers don't find a stop block necessary.

15 Sadie, 11.

16 "Virtually all seventeenth and eighteenth century harpsichords that I have seen with apparently original jacks have dampers with sloping sides." Grant O'Brien, *Ruckers: A Harpsichord and Virginal Building Tradition;* (Cambridge: Cambridge University Press, 1990), 222.

17 For a more complete discussion see my article. Paul Irvin, "Harpsichord Dampers: Historic vs. Modern." *Continuo* 17/6 (December 1993): 2-4, 19, or still available on my website www.pyirvin.com