Diatonic Conversions

Introduction

All autoharps available for sale today and any sold in recent history were designed to be fully chromatic instruments with at least 15 chord bars. The diatonic autoharp as we have come to know it is an adaptation. The instrument is not ideally suited to being diatonic, i.e. if designing a new instrument to be exclusively diatonic, it might differ dramatically from a chromatic autoharp. Therefore, the diatonic autoharp that we use is not necessarily great or inherently a good thing. All I can tell you is that to many players they are immensely amusing and satisfying and better suited to certain kinds of music and playing styles than a chromatic instrument.

We can totally avoid the debate about whether one should play either or both configurations or fret about the lack of versatility of one and the relatively unsatisfying sound of the other. Let's simply accept that people will play what they prefer and the tunes they need to cover and that we don't have to save them by projecting our own preferences and logic for them. We can, however, explain our own reasoning for doing what we like. If you belong in this session, you already embrace the diatonic concept or are open minded about it and want to learn more. Frankly, any comments undermining the diatonic concept are not welcome.

Terminology

I should cover some terminology right away, taking nothing for granted about how knowledgeable any of you might be about the diatonic autoharp and the jargon used by its aficionados. The topic is not easy to discuss without relying on special terms, so please stop me if you don't understand a particular usage.

Diatonic - an autoharp that can be played with only a single key's scale available. Since a chromatic can quickly become a diatonic using an Orthey bar, the definition is as simple as that. More typically though and distinctly characteristic of the majority of diatonic autoharps, strings that would be other notes on a chromatic are double tuned to notes that are needed in the diatonic scale (s) supported. This double string sound adds both tuning effects and volume. In addition, the chords will then have fewer damped strings with a greatly reduced occurrence and awareness of the scratch sound characteristic of the chromatic. Double tuned strings also give the melody picker a better shot at hitting notes accurately.

To design a note array for a diatonic conversion one must fully understand what a diatonic scale is or use charts from some other source. A diatonic scale is seven notes per octave. Starting on the root note for which the major key is named, a diatonic scale has two whole steps, a half step, three whole steps, and one half step. The familiar do-re-mi-fa-sol-la-ti is a diatonic major scale.

Lockbars - if an instrument supports more than one key (diatonic scale) AND the player uses an open noting style of playing, a mechanism that locks out unwanted notes is needed. This can be and has been accomplished in other ways but the typical multikey autoharp has lockbars. These are chord bars dedicated to damping out a few notes rather than to forming a chord. Some mechanism holds the bar down, i.e. locked, so that only a single, seven tone per octave, scale remains available.

Open noting (AKA open chording) is a style of playing which is best employed with a single diatonic scale. The player can pick out individual melody notes which occur between notes of the previous chord by simply lifting up on the chord bar. While a chromatic player might change chords to get the note and get a choppier effect, the diatonic player can much more smoothly and effortlessly pick out more of the melody in a scale with fewer notes that is more friendly to a lack of precision in picking. The diatonic scale strummed completely open is far less discordant than the 12 tone chromatic scale.

Open noting can effect the arrangement, i.e. chord selection. The ideal chord selection will yield three successive notes on the same chord bar, down-open-down or open-down-open. The player will not necessarily play the chord

but rather the individual notes in the chord. Thus the chord selection is not inherently right or wrong for the tune. It turns out though that such an approach is an excellent guide to chording a tune very nicely, sometimes yielding a result more pleasing than a traditional arrangement. One must decide whether to arrange for solo playing or for compatibility with the version commonly known by other players.

Chord voicing is a term referring to the need to consider on which note a chord should start and under what circumstances a note should be left out, even though it is present and available. This applies to the design for bass note support and cutting chord bar felts, as well as how to play a chord.

What key

One must decide not only what key to be supported but how many keys. A diatonic autoharp in its purest form is a single key instrument, divinely satisfying for vocal accompaniment but perhaps a bit muddy for intricate melody work, depending somewhat on how it is designed and how it is played. Generally though a single key design forces you to fill the open spots to where you really have too many doubled notes. You could also say you don't have enough doubles to achieve balance, but there aren't enough string positions.

There is no doubt that each design of autoharp favors certain keys with a high degree of predictability. That is true because the strongest key is determined primarily by the main air resonance. Since a given design has a consistent air volume, the principal resonance is consistent within a fraction of a semitone. A key's strength is heavily influenced by the string schedule, but by itself, the string design cannot overcome a harp's resistance to a specific key.

The Oscar Schmidt model B, with a few exceptions, is a Bb/F instrument. It, like any other, can be setup to be quite nice in another key, but it will sound special in Bb/F, especially F, a fifth above the principal resonance of Bb.

The model A Reissue is true to its name, resonating most strongly on A. This seems to make it much more satisfying in commonly used fiddle keys like G, D, and A. It is also very nice in F and E. It is perhaps less favored as a diatonic because, so far, it is not available with fine tuners.

Luthier designs vary, but Eb/E is pretty common among those with a body that is deeper than an Oscar Schmidt. Note that it isn't necessarily a good idea to design around that note exactly. You could find that the note is too enhanced to be in any kind of balance with the rest of the notes. If you move away from the note by a semitone or go a fifth above, the harp may sound much better balanced. There is a harmonic series associated with any note, so it follows that keys that make prominent use of notes in the series derived from the main resonance would be worth testing. As the series progresses away from the main note, the benefits may weaken.

There is still much mystery here, but in my opinion, a harp that is really grand in C or G is hard to come by. The vintage Phoenix model and the original Wildwood Flower are inherently G or D instruments with a main resonance around G.

The Goose Acres autoharp circa 1990 and beyond is around F# and seems to enhance G and D dramatically and with very nice balance. I had one in F#C# and thought it was outstanding. Unfortunately with those keys it rarely got played. My GD harp, formerly F#C#, is a Goose Acres, used exclusively for jamming. Those keys and that harp don't fill my sails at any other time. I don't prefer to play a powerful instrument by itself, but it does help to keep my left ear back from the strings and accept less of a monitor effect while I play. Using such an instrument on stage with monitor speakers works exceptionally well.

One cannot leave this topic without noting that the number of strings on the instrument is a key consideration in planning what key (s) to use on a given harp body. If you need a note array that ends on a high D or even higher, that is done best with a 37 string model as a base. Exceptions to this can and have been done, but I either don't recommend doing it or would acknowledge that the resulting design is not ideal. I would agree that the better choice for a G, D, or GD harp has 37 strings.

The vibrating length of a high D should be under 8" long in order to avoid chronic breakage. I find it to be true that use of an extra light string helps to inch up the tuning with less breakage. The stress on the string at that pitch is theoretically the same as for a heavier string, so let's assume that a bit more flexibility of the smaller size explains why this approach seems to be valid.

It is also useful to polish the bridge pin groove and lubricate it, because that will be the point where the overly stressed string is most likely to break.

Note that if you plan on giving the high finish note a priority in the design and force the schedule within 36 string positions, you will have to sacrifice a double and some volume/balance in the high strings. You may also be violating some other rules of thumb about moving notes away from standard positions and tuning strings up more than a half step from standard.

String schedule

A string schedule is really in two parts. There is a note array and a string size array or just *string array*. I will address those separately but let me stress that whatever notes are used should be fully dependent upon the availability of proper strings. One cannot just come up with a pet theory and implement it freely. Some compromises work nicely, but wholesale changes in tension could ruin the instrument or make the project a general disappointment.

The original Wildwood Flower model is a prime example of designing a note array without including a design for a string array and provision for a special string set. That model uses notes where the standard string is very poorly suited. The more recent reissue of the model includes 16 custom strings but they are not very good quality and no replacements are offered.

Note that the original Festival diatonic models from Oscar Schmidt had a note array that was designed around the standard string array. It was an ineffective and curious schedule that didn't really enhance the keys supported, but at least the designers appeared to be aware of the string size factor.

To work strictly with a single standard string set and existing models, all diatonics based upon Oscar Schmidt or ChromaHarp instruments would be F or C, or FCG; or a half step lower, yielding E, B, EB or EBF#. Beyond that, you have to deal with string array design and possibly custom strings.

Note array

The note array is the series of notes to which each of the string positions will be tuned. You have to know what notes are in the diatonic scale you have chosen. You have to know what notes are in each major and minor chord in the key you have chosen. You have to know which notes are not shared by those keys when the design is for a multikey instrument. You have to have some appreciation of the design of the standard chromatic so that you understand the reasons for such things as an incomplete scale in the bass.

In the [been there/done that/don't bother] category, it is a mistake to define a mission to setup a harp with a complete bass scale. If anything is a good idea, it is highly likely that it has already been tried. Some improvements over common practice are possible but they are subtle and subject to personal taste. Schedules in common use are very effective. I will cover some of the bass scale reasoning under Chord Voicing.

A common practice in note array design is to provide a fully doubled octave in the middle melody range. That works well on a single key harp but is not a good idea on a two key harp. It forces notes to be too far out of their standard position, where they sound best at a more suitable string length. A two key harp would also have two lockout notes both of which are doubled. The double note that is damped by a lockbar is just too easy to hit and there is too large a gap in the scale for accurate melody picking. One possible compromise is to double the lockout that serves as a fifth on the IV chord of one key. The other note is never a root or a fifth in a chord and has far less priority. For example,

a GD array would have lockouts of C and C#. It would be important for balance in the major chords to double the C, but no advantage would be achieved by doubling the C#. My personal preference is to double one lockout note at the bottom of or immediately below the melody range and just have single strings (side by side) on the lockouts in the melody range itself. This gives more equal spacing within the precision picking area yet gives the more important lockout note some power for chord balance in the key in which it is used (open).

The current, proven, endorsed, and accepted convention most widely used is to put doubled notes on at least do-re and fa-sol. This achieves major chords with doubled roots and fifths, and minor chords having at least a doubled minor third. The result is generally considered somewhat balanced and seems to provide power on the notes that matter the most to the majority of common music played on the diatonic autoharp. An instrument optimized for a minor key could use a different approach.

The designs for note arrays are influenced by chord voicing considerations and availability of suitable strings, discussions of which follow. Let's leave it for now that a useful rule of thumb would be to do a design with as many notes as possible in their standard position, where they sound best or at least familiar. You would also be surprised how much you have learned where to find a note. If you move it, your accuracy may suffer, unless you stick with that harp for a long time.

Lastly note that the note array should not include double notes on larger wound strings. The complex harmonics of this type of string will create a distracting hum when the strings are tuned to the same pitch. Doubling wound strings is not categorically a bad idea, however. It works well, sometimes with no option on a single key design, to have doubles in the smaller wound strings. These strings can sound very nice if tuned precisely together. Otherwise, they too can become very distracting. The wound strings are relatively powerful, so having low double notes should probably not be a priority.

Think freely.

> Note that an F chord sounds just fine without a low F. If the harp is not principally in F, you don't necessarily need a low F note in an F chord as long as C is still down there.
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> Note that a IV chord can sound grand without any root in the bass. The standard key of F has a Bb chord that starts as FDFBb, a sound which I really like, but not for the key of Bb when the chord is a I chord. Thus a G or G harp does not necessarily need a low C, instead benefiting greatly from either a low C# or a B to help out A major/F# minor or B minor respectively. Give yourself time to get used to unconventional changes in voicing.
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> As Mark Fackeldey suggests, you may think of dropping low notes instead of trying to add them. The autoharp is basically a treble instrument anyway, and if you want to play a lot of melody and have plenty of doubled notes, you will need to open up string positions to get in more notes. Extra notes, i.e. complete scales, work better if they aren't very low in pitch, starting in the second bass octave. Luthiers' emphasis on big bass strings was only started to counter criticisms that instruments had weak bottom ends and needed a richer sound. Thus your need for low notes will depend somewhat on the instrument with which you are working, the key you have selected, and the sound to which you are acclimated.
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> As on Carey Dubbert's harps, there may be some special chord bars with no felt across the bass end, because he has no intent to play them down there. He also designs a three key harp to fully support the central key at the expense of the two outer keys, which add versatility, played primarily on the higher strings. He places no priority on getting balance among the keys, which can't be done well on a three key anyway. Thus his GDA is a specialist in D by deliberate design. The keys of G and A are still at least as good as a chromatic, plus there are fewer damped strings in each chord.

Important to consider in a change to the note array on an instrument is a method to relabel the notes, typically marked at the tuning pins and possibly also marked at the anchor. In my own conversions I use special, hand printed labels for the tuning pins and, if fine tuners are installed, I create a note strip to place in front of the tuners underneath the strings. Fine tuners that are not marked are a nuisance and just slow down the tuning process.

String array

The standard chromatic string set is pretty ideal for an F or FC project. Calculations show that on an Oscar Schmidt model B the average string tension is about 50 pounds. Since instruments are known to self destruct at standard tension, one cannot assume that it would be okay to crank up the tension significantly in order to achieve a higher tuning such as G or GD.

Generally the whole gauging of the string set must be revisited. That is a technical issue that is far from trivial, but research, calculations, and observation of experimentation has yielded some very useful rules of thumb for changing string sizes.

If a string position is being tuned down more than a half step, the string size should be increased by one size. If tuning up by more than a half step, the string size should be reduced by one size. The string position should not be tuned up or down by more than a full step. It is physically possible to do that, given the right wire size, but you may not like the result of the note being too far from a more suitable length, habitually expected location, or familiar sound.

The standard strings have a range of notes that they can cover nicely to give a satisfactory sound. The problem is tension and how the strings will feel. The nicest playing harp will have moderate tension and a smooth progression of give to the strings (feel), so that the player can use a consistent force in plucking or strumming the strings in a given area.

The strings are naturally harder to the touch as they get shorter. The feel of the higher strings has been adjusted by reducing the wire size. The wire sizes on the remainder of the instrument are selected to regulate tension and to get a size that has a good sound. Strings that are too fine may sound thin or tinny. Note that the sizing of the largest strings in the bass is influenced by the chord bars ability to push it out of the way for string bed alignment and a properly damped chord. The bottom 3-4 strings need to be a couple sizes smaller than what might be expected to produce the best chord. One way around this limitation is to compensate the string bed height to make the big strings sit a little lower when at rest. On some luthier harps you may note that under the biggest strings the bridge rods are sunk deeper into the bridge bead or the bridge rod is actually filed down.

The string lengths in the high notes are about as long as physically possible, but the lower notes of the plain strings are dramatically shorter than their ideal lengths at exponentially higher tension. The string scale has been reduced and the wire sizes have been increased in order to make the instrument into the manageable size with which we are familiar.

The wound strings are used in order to achieve low notes at practical string lengths. Within a small range, any note can be optimized or moved by changing the size of the string. There is a limit to how small a wound string can be and still sound better than a plain string. Thus the wound strings end at around #12-14.

Plain strings, especially the largest ones, sound poorly when tuned down without an increase in wire size. Thus the lowest plain strings should not be tuned down more than a half step and preferably not at all, unless you can convert the note to have a wound string size. Where the strings start to get shorter around 12-14 is a critical area. Tuning the standard strings higher could break the harp and tuning them down could sound unsatisfactory,

Another benefit of a smooth progression in the way the strings feel is increased felt wear. One reason why felts tend to groove in the middle of the bar is because that is where the strings are a notch oversized and tight and most resistant to being plucked or pushed into string bed alignment by the chord bar. These larger plain strings are also

less flexible and tend to arch across the bridges, leaving them higher than the other strings. This can be mitigated somewhat by slightly bending the strings at the bridges.

It is very useful to consider the standard string set as a baseline. In my opinion the bass end is a little soft and weak and the middle is a little heavy and hard. Most of the strings sound pretty good, given a full set of wound strings up to around position 12-14. The majority of the strings calculate out well and no significant improvement is particularly compelling. However, improvements are possible and have been done, yielding noticeable differences. Within the scope of this discussion though and for at least the plain strings, let's just say that, at a given position, the standard string should be used, if the note is also standard. Try to preserve as many standard notes and positions as you can.

Unless you have a continuous source for custom strings, you must design the note array within the limitations of the string set. Thus some keys work out far better than others. For example, F or FC is a natural, but G and GD can be problematic and require compromises.

Note that on the Oscar Schmidt model B, changes in the bass end are limited by the winding lengths and the alternating vibrating lengths of the strings, which vary in odd and even numbered positions by 1/2". It is useful to have some tools and skill for stripping windings to fit. However, please note that an attempt to strip one of the larger sizes that is double wound will loosen the winding and ruin the string. Stripping should be limited to strings 4-12.

Chord voicing

The notes in the bass and sometimes at the very top notes (CD) do not include a complete scale. Some chord bars omit low notes that normally belong to a chord. Both conditions are due to the fact that the chords would not sound good otherwise or at least they sound best without them. Intervals that are too close low in the bass will rumble.

When you consider what chords will be needed by the key(s) you have selected for the harp, you must analyze the role the necessary notes will play in the bass. Each chord has a root or starting note for which the chord is named. Each major and minor chord also has a fifth interval note.

If you put too many notes in the bass then you will need to play across a noticeable number of dead strings to sound a chord. Enough to say that the number of dead strings played on the bass end must be minimized. The standard design works great for 3-4 keys and is well thought out. All I am doing here is justifying it, explaining why it works, and how not to break it.

The emphasis in the bass, assuming the harp will play major keys as a priority, should be on the roots and fifths of the major chords, keeping in mind that about the lowest practical note on an autoharp, all things considered, is D2 using a custom string. It will not be possible for all major chords to start on the root but, within 3 keys, it will be possible to start them on at least the fifth tone. To start a major chord on a third interval, the first inversion, is too ambiguous and unsatisfying a sound and should be avoided. While the third interval of the major chord could serve as the root of the relative minor chord, populating that area with too many notes and strings makes quite a scratch on dead wire when you try to strum a chord. The standard autoharp does not have enough string positions to make a full bass scale a priority, and you would find that some notes are not useful when that low in pitch.

If you determine which notes are the roots and fifths of the major chords and provide for all of those in the first 6-7 bass string positions, you are on your way to a good schedule. You next have to look at the minors and consider how many string positions you have with which to work. Unless the harp is going to be a single or maybe a double key, there isn't room to do much with minors beyond pretty conventional voicing.

Avoid including both a root and a major third interval in a chord, if it occurs below A2. An A major chord could be AC#E, although marginally rumbly, but a G chord should be just GD, omitting any B note, which might still be there, if you worked out a way to support B minor with a root note or provided a fifth of B for starting an E chord.

Avoid including a minor third interval in a chord if it occurs below B2. Thus a B minor chord could be BDF#, although marginally rumbly, but A minor should be just AE, omitting any C note, which might still be there, if you worked out a way to support C major with a root note or provided a fifth of C for starting an F chord. An exception I find to this rule is C minor. I strongly dislike the sound of CEbG but prefer BDF# over just BF#. You would be working in a marginal area there, so you may want to eliminate questionable notes when cutting felt and test the sound later, having the option to open up a felt position. The result (harmonics) in this marginal area seems to vary from one harp to another.

Omit any notes that are not a root of a chord, if they occur within the first five strings and the chord root is also within that range. Thus the standard C chord starts on C and does not include the lower G. The idea here is that the root note is the preferred starting note, and that the root's position within 5 strings of the bottom is close enough. A personal preference, which I am hesitant to recommend or try to justify, is to make my D chord ADF#A instead of skipping any low A that is present and starting the chord on D. Other than low E on an E or AE harp, I do not prefer big boomer strings on the bottom end, so an ultra low D note is not an option. I am not willing to give up another note to make room for it. Perhaps the point is that there is room for personal preference and that there is more than one good design for a given key. Another example of preference is with Em. This chord typically omits low G and starts on the E root. I agree with that, having tried it both ways.

Avoid starting a principal major chord on a third interval. A chromatic harp is forced to break this rule but a diatonic design should not. Since I am used to the standard voicing of minor chords, I have no problem with the sound of a minor started on a third note and do not hesitate to include almost every note I can find. Note that the minors will be secondary and do not have the support for idealized voicing. Happily, they sound fine without roots in the bass, perhaps because I am used to that sound from the standard chromatic configuration.

Eliminate any low seventh tone from a 7^{th} chord until you get up to G3 (A7) at about string position 8. Injecting that 7^{th} tone in the presence of roots, thirds, or fifths usually creates a third interval which will rumble when too low in the array. Including it when the chord does not start on the root makes the sound of the chord ambiguous. I break this rule sometimes when dealing with minor 7ths. With partial sevenths that need all the help they can get and don't sound very good anyway, I often throw in everything that will not form a third interval low enough to rumble.

If a scale is complete in the bass, there will be notes that cannot be used in chords because of voicing rules. Thus they don't need to be there. You cannot play melody clearly on those low notes in any case. Thus you should see that if you can't use a note or if it is a low priority, it doesn't need to be in the bass.

Shifting to the high end, we see the example of the old 37 string model A harps which included CD on the top, skipping C#. That is an example of priorities for notes. C# is nice but when there isn't room for everything, C and D are more important as finish notes and chord roots or fifths.

Chords

I guess we could say that an autoharp has to have at least 7 chords on it to satisfy most people. The Wildwood Flower has only 6 with no V7, and virtually nobody likes it or they would be tempted to change the V chord to a V7, sacrificing any opportunity to play Mixolydian mode tunes.

The problem is that most people come to the diatonic autoharp wearing a chromatic hat. Relatively few people are true diatonic players but rather simply enjoy the full sound of all the double strings and the reduction in the sound of dead strings. The technique that they use is often identical to the way they might play or formerly played a chromatic, i.e. chords are used at all times, no open noting is done at all, and lockbars on a multikey serve no purpose. Even worse, they bring a taste for chromatic music with them, neither accepting the diatonic's limitations nor realizing its true potential. In any case, no one chord layout is right for everyone, but one thing is certain. There is a limit to how many chords one can make on a diatonic scale, and only a handful are essential for ordinary diatonic tunes. A very common compromise is to provide an incomplete II7 chord (V7 of V), usually referred to as a partial 7^{th}.

A diatonic scale can support a chord or triad which is rooted on each of the seven tones in the scale. The chords would be I, ii, iii, IV, V, vi, VIIdim (typically covered by a V7). There are a number of 4 note chords which can be supported as well. Those that I feel are most important would include ii7, iii7, vi7, IM7, IVM7, and V7. Two suspensions, very useful and appealing for me, are also possible as Isus4 and Vsus4.

Chord set

A complete suite of chords for a single key harp can be covered by a 15 bar set. However, the placement of those bars on the strings in a way that avoids severe harmonics requires that those bars be 1/4" wide or less. I feel that 1/4" is ideal for the application. A narrower bar pinpoints lesser harmonics more precisely and just doesn't do as good a job of damping in general. A wider bar takes up more room and requires that fewer chords be included within the boundary of where the harmonics are very strong in the bass.

A 15 bar set of 1/4" bars will fit within the 1/3 node harmonic boundary. A 10 bar set of 1/4" bars will fit within the 1/4 node harmonic boundary, with the boundary defined as the relatively straight line that the harmonics form in the wound strings.

The sophistication of chord bar set design depends somewhat on the need for lockbars, some designs for which are quite elegant, while others are very straightforward, if not crude.

One consideration that is important is size of the button top. If one is really into open noting and fast tunes, the button tops have to have enough real estate to prevent missing a button too easily. Thus the narrow bars with no button top enhancement are not very popular for good reason.

"Room to play" seems to be a big deal with some folks, but I think it is only meaningful with more than 15 narrow bars. Rather than squander space in a precious area needed for useful chord bars, I would simply counsel to learn to play more precisely. Do what pleases you, but I am skeptical of placing too much priority upon the size of the picking area unless one has huge hands.

The availability of hand made chord sets is crucial to a nice diatonic conversion project. There is no factory set that is well suited to conventional diatonic configurations and goals for the design. As one who is in the process of gearing up to produce and sell special chord sets, I have made the decision not to do custom sets, i.e. every conceivable variation on demand. I could see having a 10, 12, and 15 bar set plus an 18 for a chromatic harp, but providing for a 7, 8, 9, 11, and 13 is just a nuisance which I couldn't stock and which is probably too quirky in any case. All the world really needs, in my opinion, is a nice set of 15 narrow bars with 3 rows of buttons and good lockbars. If that was the only thing available, period, everyone would use them and swear by them because it is the essential next step away from what Oscar Schmidt provides. There are enough luthiers around to serve the people who insist upon absolute customizing. I just think the instrument has more long term value, if it has enough chord bars to be freely reconfigured, even to chromatic.

I also highly recommend provision of special, additional chords, for which there is no room on a chromatic set. Those chords should really be a part of the diatonic difference, but a new diatonic player must learn how and when to use them.

Fine tuners

A diatonic autoharp with doubled strings is dramatically easier to live with if it includes fine tuners. The problem is that the doubled strings do not sound good if they are not precisely tuned. The issue of tuning is out of scope here, but I will say that it is a fact that a diatonic is louder and has more character if the doubles are not tuned exactly the same. The trick is getting them to be almost the same but in a very precise way. Tuning them roughly is just too crude and makes the single strung harp actually the better sound.

One can tune with great precision using only a tuning wrench. I think most would have to concede though that it takes longer and cannot be as deadly accurate as good fine tuners. I won't go as far to say that fine tuners are absolutely required, because my favorite harps don't include them. However, I do wish I could have them without losing tone quality. The vintage Centurion, unfortunately, is light enough that the addition of the weight of the fine tuners has a noticeable effect on the quality of the tone. Heavier instruments, for which the weight of the tuners would be a smaller percentage, would suffer less of a loss in sound.

The original fine tuners were aluminum and weighed far less by comparison. Unfortunately, since the strings came right off the crown of the cams and did not cross a bridge, the strings would buzz after wearing a groove in the aluminum cam. In about 1985 the fine tuners were changed to brass.

More recently George Orthey developed his own design for aluminum tuners and Tom Fladmark followed suit with a similar design. Cam wear is not an issue with the design of either of their harps, both of which include bridges in front of the cams. Those assemblies are for 37 strings but could be cut down. They are relatively expensive and not adaptable to the OS model B.

The OS model B could benefit from having an aluminum base and brass cams, resulting in a significant reduction in the total weight of the tuner assembly. The 20mm steel screws could also be shortened to have less of an insertion in the threaded base.

While the ChromAharp, Samick, and OS model A Reissue are not available from the factory with fine tuners, the OS model B assembly could be adapted to them using the same screw mounting technique originated by George Orthey for his Mary Lou model in the early 90s. There would be some question about the integrity of the frame member on the anchor end, since it would have 36 pin holes (that had been filled hopefully). The plastic bridge at the anchor end on these models would need to be replaced to make room for incursion of the tuner assembly.

Lockbars

Again, lockbars are only useful on a multikey instrument. If one does not know how to play with open notes, lockbars may not need to be provided in any case. However, a player new to diatonics would be wise to get them in anticipation of learning how to take full advantage of a multikey diatonic and all its possibilities.

The main element of a lockbar is the detent mechanism and whether it is quick and easy to use and is reliable. The two main variations of design are those that hold from the button area and those that hold from either end of the bar. Worth mentioning is the lockout mechanism used by Mark Fackeldey, which is not a bar at all but rather engages from beneath the strings, not requiring the space of a chord bar.

An issue that has not received enough attention is lockbar placement, which is actually quite critical. First priority is that a lockbar cannot occupy a position within the normal, basic chord pattern. Secondly, it cannot be placed directly over a harmonic, which would defeat the bar's purpose and sound even worse than a routine chord bar harmonic, since the string is very firmly damped.

So where do we want lockbars, aside from being out of the way? Actually we don't want them out of the way, or one should at least consider making them an active part of his or her playing. An approach which I attribute to Steve Young places the lockbars where they can be played dynamically, without engaging the lock mechanism (detent) in all cases. Open noting can be used completely on a tune that requires a II7 chord, if the lockbar is held with the thumb throughout the tune, releasing it only when the II7 chord is needed. Obviously, that would require a two key harp and could only be done from the chord set nearest the center of the harp. For example, an FC harp could use this approach when playing out of F but needing a G7 as an essential part of the tune. That is to say that the tune is not diatonic and has an accidental of B natural. I use this technique to play Carolan's Draught out of G on a GD harp and for Ashgrove, very nice in a number of keys. I also use a variation of the technique to play Ragtime Annie on a GD harp, starting in D and then playing the C part in G, all with extensive open noting. I shift back and forth between the two lockbars, following the modulation of this tune, when playing the three part version.

Both my chord layouts and Steve's place the majors in the middle row, the minors in the bass row and the 7^{ths} and lockbars in the treble row. The two lockbars of a two key harp occupy the positions in the treble row that are not needed for 7^{ths}, allowing the lockbar buttons to fall directly under the thumb.

Note that some lockbar designs do not include a button and are thus not "playable", so consider that when choosing chord bar sets or providing specifications for a custom set.

Conclusion

I did not include the minutiae of individual actual string schedules or chord layouts for a couple of reasons. First I didn't want to get lost in the trees during the presentation. Secondly, useful basic charts are already available, specifically in either George Foss' GOING DIATONIC or in Mary Lou Orthey's THE AUTOHARP OWNER'S MANUAL, compiled from early issues of Autoharp Quarterly magazine. Thirdly, the permutations and our individual quirks are almost endless. Lastly, my own string schedule refinements and extensive documentation are available for sale separately and can be done readily for a custom design, when not already in the library.

Please note that, aside from string size calculations, I have given you every guideline needed to fabricate useful schedules on your own. If you were to deviate from the guidelines or want to optimize the string selection, doing or obtaining some calculations to control string tension and feel would be wise.

I believe this material could be expanded to include a set of schedules, alternate 36 and 37 string schedules, and every conceivable variation of chord layout for different keys, number of button rows, and number of chords. That would be exhaustive on its own, and I will leave that to another time and perhaps ultimately to the individual collector.

I have included a copy of my music reference chart as a guide to diatonic scales/modes, keys, chord choices, etc. regardless of key requirements.

Suggestions for enhancing this material and the workshop presentation are welcome.

This material is available on my website and may be used freely, if printed in its entirety or quoted with acknowledgement of the source. The link is http://www.autoharpworks.com/htdocs/pages/posts/diatonic/conversions.htm.