MUSIC FROM PHOTOSHOP

by Richard Canedo

Perhaps you've seen them on eBay or at swap meets, offered for a few dollars each. Or maybe you found a box of them in Grandma's attic—piano rolls, an all-but-forgotten digital storage medium, preserving the keystrokes of decades-old solo performances as 88 channels of binary data. Ever wished you could hear those performances? Surprisingly, the same program that can restore old photographs can help to restore old piano performances as well.

As the punched paper deteriorated over the years, many fine performances were in real danger of being lost forever; but recently, the dedicated efforts of roll preservationists, who developed hand-built roll scanners and custom software, have reopened a unique window into our musical heritage. The data on the rolls can now be converted into midi files (the standard musical note file format of the computer age) that can be played on most any computer with QuickTime or Windows Media Player, or even on a new generation of midi-capable player pianos. The midi files may also be used to create an audio CD.

Best of all, anyone with a flatbed scanner (no transparency adapter needed), Photoshop CS or CS2, access to a Windows machine (or a Mac running Virtual PC, BootCamp, or Parallels Desktop with Windows 98 or later) and a bit of patience can revive a roll performance and let the whole world hear it for the first time in decades.

Piano roll facts

With a few rare exceptions, piano roll paper is 11¼ inches (28.55 cm) wide. Most flatbed scanners are built to accommodate US and ISO page sizes, giving the wider dimension of both height and width — an A4/letter size scanner typically has a live area of about 8½ x 11¾ inches (21.6 x 29.8 cm). Piano rolls are therefore just narrow enough to be scanned eight inches at a time (allowing for necessary image overlap) on an A4/letter scanner. Figure 1 shows part of an assembled roll image made from 8-inch scan segments.

Piano rolls are fragile! Remember that you will be handling nearly century-old paper that has been punched full of holes, weakened by time, and damaged simply by being played back in its day. Player pianos were vacuum-operated; the roll paper was dragged across a metal bar with precisely spaced holes exerting constant suction. Often, the more popular the performance, the more damage the roll has suffered.

Piano rolls are long. 20 to 30 ft (6 to 9 m) is typical, corresponding roughly to a two to three minute song (30 to 45 scans on an A4/letter size scanner); but much longer performances exist. One roll in my possession, "Hungarian Rhapsodie No. 12," clocks in at 8 minutes 20 seconds when played at the recommended tempo (an adjustable speed setting on player pianos) — over sixty feet long! Such rolls are best sent to the growing community of roll preservationists who have built motorized continuous-scanning devices (see resource list at end of this article).

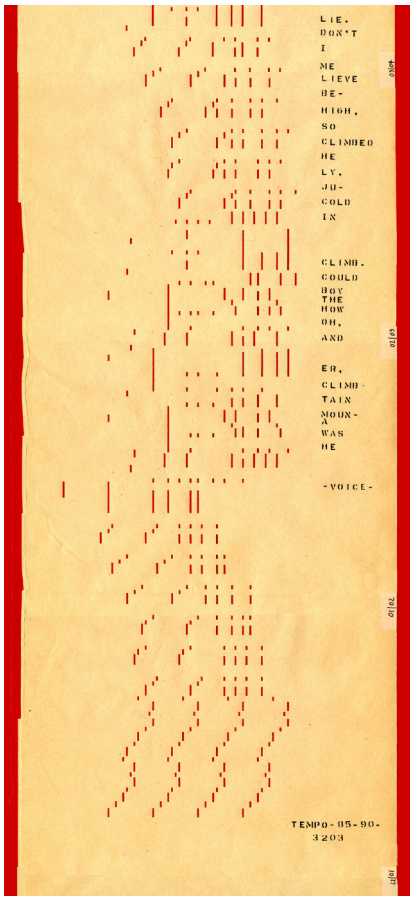

Figure 1. Part of a piano roll image assembled in Photoshop CS from several scans. Note the tempo indication and roll number at lower right, scan section marks placed on adhesive tape along the right edge. Damage to left edge did not affect the midi result.

A scanner bed-size piece of Gator board or foam board with red paper affixed to one side was used in place of the scanner lid, hence the red color of the perforations and margins; this allows for accurate magic wand selection of the perfs at a later step.

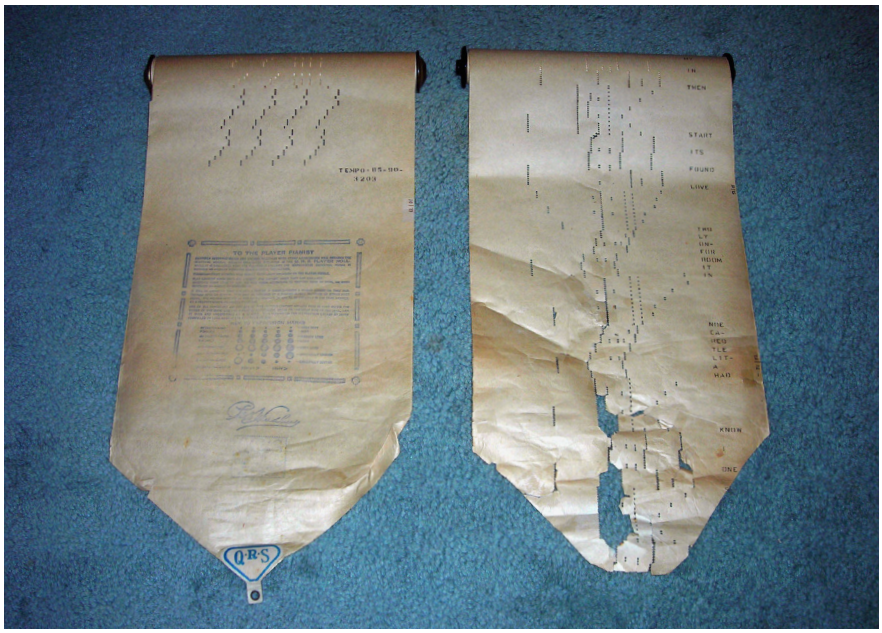

Figure 2. The piano roll on the left is a good candidate for scanning: it has only minor damage and a nearly intact leader containing useful information about the roll. The roll on the right has lost the first several inches of paper, including the opening notes of the song. Long ago someone "helped" by cutting a new taper, sacrificing even more notes. Subsequent playing did more damage. With no leader or box, only the printed lyrics identified the song as "Beautiful Ohio." See box at end of article, "An Example of Roll Repair," for a method of restoring opening notes.

Several piano roll formats exist. Refer to the "Supported Piano Roll Formats" box at right to make sure the RollScan midi converter has a template that corresponds to your roll type.

Look for the leader. This refers to the first several inches of the roll, cut to a tapering point where the reinforced "leader tab" usually identifies the manufacturer (see figure 2). Information about the song is usually printed on the leader and typically includes manufacturer's roll number, song title, composer/lyricist, performer, song copyright year, roll type, and recommended playing tempo, commonly a number from 60 to 100. With luck, you may also have the original box the roll came in — look for a label on one box end, which will have at least some of the same information.

If the roll is damaged with a missing or illegible leader, all is not lost. Many rolls have printed lyrics from which a tune title can be deduced. An internet search of the title may reveal additional information such as composer and copyright date.

Even the absence of some perforations at the front end is not necessarily fatal, as some rolls often have repeated passages, from which the missing perforations may be deduced and copy-pasted into place in Photoshop (see box at end of article, "An Example of Roll Repair").

Don't be concerned about missing or damaged roll ends (flanges) or ragged edges, as long as the damage doesn't extend into the perforations.

Supported Piano Roll Formats

There are dozens of formats of piano rolls; the more common varieties are supported by Warren Trachtman's RollScan Converter, but you should check this list to make sure. A piano roll's format, if other than standard 88-note, is usually clearly indicated on the leader, leader tab, or box end label.

58-note uniform
65-note uniform
Standard 88-note (most common)
Ampico
Duo-Art
Duo-Art British
Welte Licensee
Welte T-100
A-roll
G-roll

You may still succeed with a format not listed, such as the Recordo roll type, but you may have to identify and edit out the expression/accent tracks in Photoshop before attempting conversion to midi — otherwise these tracks may "play" as errant low or high notes. Keep a version of the assembled image with all tracks intact; some of the contacts listed at the end of this article have specialized midi conversion software that can handle roll types not listed above.

Has this roll performance already been scanned? Before doing lots of flatbed scans and image assembly in Photoshop, you should check the roll scanner websites listed at the end of the article to see if the work has already been done. Just finding the same song title shouldn't dissuade you; many popular songs were "covered" by several artists, just as they are today. Check for the same artist, manufacturer, and roll number.

What you'll need

- A piano roll in fair condition as discussed above, preferably not too "fat" (long).
- a ruler, black felt-tip pen and low tack transparent tape such as Scotch™ brand removable tape to mark scanning intervals
- a long table or other long, clean, flat surface
- a flatbed scanner, A4/letter size or larger
- a mailing tube about 12 inches long to serve as a "take-up" spool. For extra protection, you can attach roll-end flanges made from those clear plastic discs that protect CD 50-packs (see figure 3).
- a piece of bright red mat board; or gator board or foam board with bright red paper such as Pantone® 180C affixed to one side, slightly larger than the scanner bed area. When used red side down, in place of a scanner lid, the red color will show through the holes and be easily selectable with the Magic Wand tool.

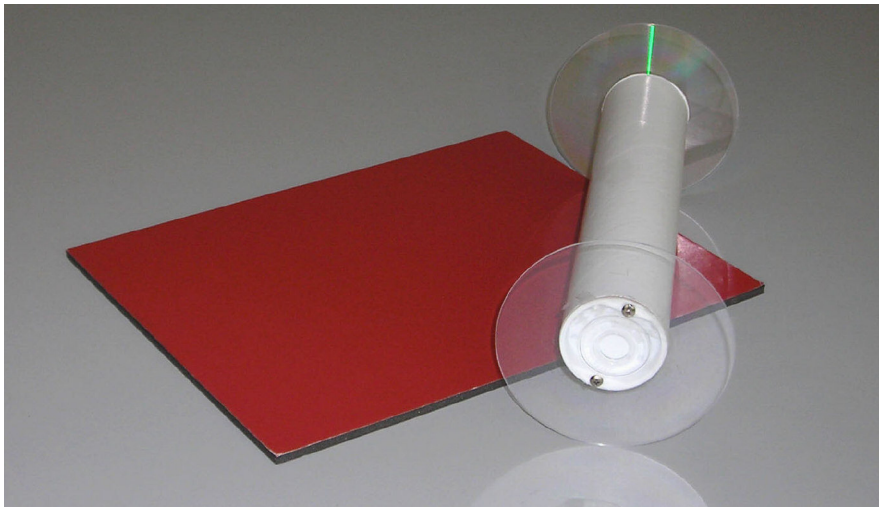

Figure 3. A piece of Gator board or Foamcore, slightly larger than your scanner's live area, will serve as the lid (held in place with one hand during scanning). Many scanner lids have heavy transparency adapters that could damage piano roll paper. Bright red paper affixed to the gator board will make the roll perforations appear red on the scans; they will then be easily selectable with the magic wand tool.

A "take-up" spool is easily made from a 12-inch length of mailing tube and two plastic protective disks that come with CD 50-packs. A take-up spool placed on the opposite side of the scanner from the roll is preferable to letting the scanned portion of the roll accumulate on the floor. See also Figure 4 at right, a roll repair rig adapted for scanning.

Figure 4. People already involved in piano roll repair will likely have a hand-cranked "rig" that can be easily adapted for scanning. A flatbed scanner can be mounted on its surface, and the roll repair rig's spool mechanism will make paper handling much easier.

(Courtesy Terry Smythe)

- Photoshop CS or CS2 (earlier versions wonÕt support files with the vertical pixel dimensions an assembled piano roll image requires)
- two free software utilities:

  Anthony RobinsonÕs BMP2CIS.exe

  and Warren TrachtmanÕs rollscan converter

  2005April27_RollScanConverter_XML.zip.
- a PC with Windows 98, 2000, or XP to run these Windows utilities; or a Mac using Virtual PC with Windows 98, 2000, or XP (the utilities should also work when running Windows on the new Intel Macs). The scanning and Photoshop work may of course all be done on either a PC or a Mac; as with all Photoshop work, the more RAM and the faster the CPU, the better.

Preparing the roll for scanning

Don't even think of cutting the roll into letter-size sheets for easy scanning! Instead, carefully unroll the first few feet of the roll onto the table surface, printed side up. Along the right edge of the paper, place a piece of transparent tape just before the start of perforations and mark on the tape (not the roll paper) as shown (see figure 5). Use the ruler to place scan tick marks at exactly every eight inches (every sixteen inches if you have an A3/Ledger scanner). The tape should extend a bit beyond the roll edge so it can be folded over (for easier positioning when the roll is face-down on the scanner). I use the marking convention |01.....01|02.....02|03.....03|04 etc., so each scan shows a mark at each end with the "inner" numbers for that scan appearing twice. Make sure the marked tape does not interfere with perforations, or printed lyrics if it's a word roll. Since you'll be making reflective scans, you'll have an image of the entire roll, which you can size down later and scroll along as the midi file plays. As you continue marking, carefully wind the marked portion onto the mailtube take-up spool. You may want to use a couple of paperback books to hold down the curl-prone paper at both ends of the table as you measure and mark.

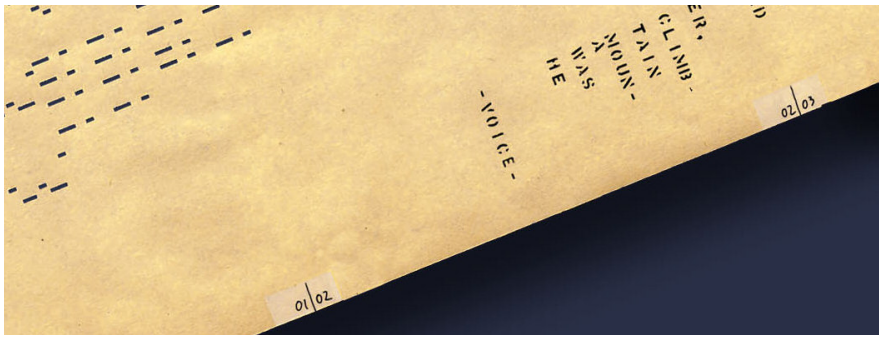

Figure 5. Marking the roll at eight-inch intervals along the right edge. Rather than writing directly on the roll, use pieces of removable tape with scan tick marks the full width of the tape. Fold the tape over the roll edge; the tick mark on the back will assist in positioning the roll face-down on the scanner.

When you reach the end of the roll, you will likely find an odd pattern of closely-spaced rows of perforations (figure 6) — a "signal" to the player piano to stop and rewind the roll. There is no need to scan this portion unless you want a complete visual record of the roll. These roll-end perfs should not appear on the final 1-bit image for midi conversion, as they may "play" as errant low and high notes.

If the roll is in poor condition, you may want to start scanning backward from the end of the roll after placing tick marks to avoid subjecting it to an extra hand-rewinding; but this can get a bit confusing, especially if you're sharing the scanning chore with others. If you're not going to scan immediately after markup, it's best to rewind the roll onto its own spool for storage.

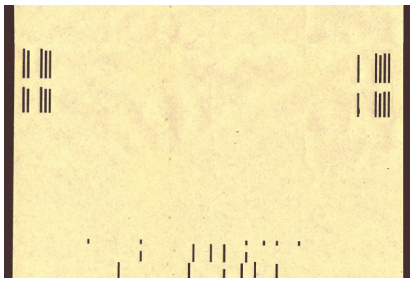

Figure 6. Typical perforations at the end of a roll. Their original purpose was to signal a player piano to rewind the roll. They should not be included in the assembled scan, as they will likely play as errant notes when converted to a midi file.

Scan...take-up...scan...take-up...

Let the tedium begin! With the roll paper face-down and the roll edge aligned to the scanner edge as straight as possible, make a series of reflective RGB scans of at least 150 pixels per inch. Roll scanners' standard is 300 ppi for the final 1-bit image, but an RGB piano roll file at 150 ppi will "upsample" cleanly enough when converted to grayscale, then to bitmap at 300 ppi; and while working in RGB the file size will be relatively manageable. If your computer has trouble with very large image files, see box at right for an alternative approach.

Advanced Photoshop users may want to create "actions" to automate some repetitive scanning and image assembly tasks. See "Automating tasks" under Photoshop's Help menu for more information.

Be certain that BOTH marks for a given segment (e.g., 1|2 and 2|3 when scanning segment #2) are showing fully on each scan. Use the red backboard as a scanner lid for each scan, applying pressure gently, but firmly, and as evenly as possible (to avoid shadows in the holes). NOTE: If you want a complete visual record of the roll, scan the leader, including tab, using the same settings as above. I recommend saving each scan (rather than assembling "on the fly" and losing lots of work in a crash, or enduring slow computer performance as the file grows) as a JPEG with level 8 quality for disk space conservation (you'll be making a truly huge file later). Each scan segment file will average about 300-400K in size when saved, and any JPEG artifacts will be far below the threshold of troublemaking for midi conversion purposes. Save each scan segment with the name of the song followed by the two-digit scan segment number (L1 and L2 if leader is scanned, typically two segments on an A4 scanner): for example, MandalayL1.jpg, MandalayL2.jpg, Mandalay01.jpg, Mandalay02.jpg and so on.

Use the take-up spool as before, carefully winding after each scan to advance the roll to the next marked segment. Be sure that both the original roll and take-up spool can rotate freely on the work surface on either side of the scanner, but not accidentally roll off onto the floor, get tangled in computer cables, etc.

When you've made the last scan, carefully rewind the roll onto its spindle, place the roll in its box if it still has one, and store it in a safe place.

Long on Ambition, Short on Horsepower?

If you have an old, slow computer, an old version of Photoshop, or both, you can still try your hand at roll scanning, as long as the roll is under 25 feet long. I've gotten acceptable midi results from scans of 100 ppi, keeping that resolution through the entire image assembly and conversion process. Schoolteachers considering a class project in roll scanning might try this approach if their classroom computers can't handle large image files.

A 100-ppi assembled image of a roll under 25 feet long will be less than 30,000 pixels tall, which older versions of Photoshop can handle. It also allows saving the black-and-white "perf-only" image as a single BMP file for conversion to CIS format. Scanning times will be shorter; the RGB assembled scan will be under 100 meg; and the 1-bit BMP file will be 4 meg or less. At this lower resolution, good track alignment and a clean selection of the red perfs in the assembled image is especially important. Remember to enter a resolution value of 100 in the BMP2CIS utility and the midi converter.

Assembling the image

If you have a wide-screen monitor, you may wish to assemble the scans "sideways", with perforation tracks running horizontally, and rotate 90° when the image assembly is done; but you'll probably find it easier to build a vertical image, with printed lyrics (if present) oriented normally (as shown in figure 1).

You may be tempted to use an image "stitching" utility of the type used to make panoramas from a sequence of photos; but my experience with these has shown that they have trouble distinguishing one perforation from another, and often misalign or overshoot the proper join positions. Also, the composite image size will likely exceed their capability.

It is very helpful to use Photoshop's Grid feature when aligning the roll segments. In Preferences>Guides, Grids & Slices, use the grid settings as shown in figure 7 for a typical roll with 9 tracks per inch; for older and less common 6-track-per-inch rolls, change the "Gridline every" value to 2 inches. Use the View>Show>Grid menu command to make the grid visible. Figure 8 shows a roll scan segment with gridlines. Bold vertical gridlines are an octave apart.

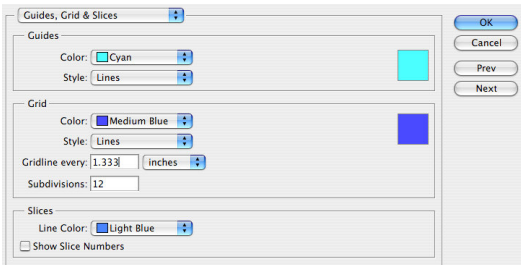

Figure 7. These grid settings will assist in aligning roll segments and keeping tracks vertical.

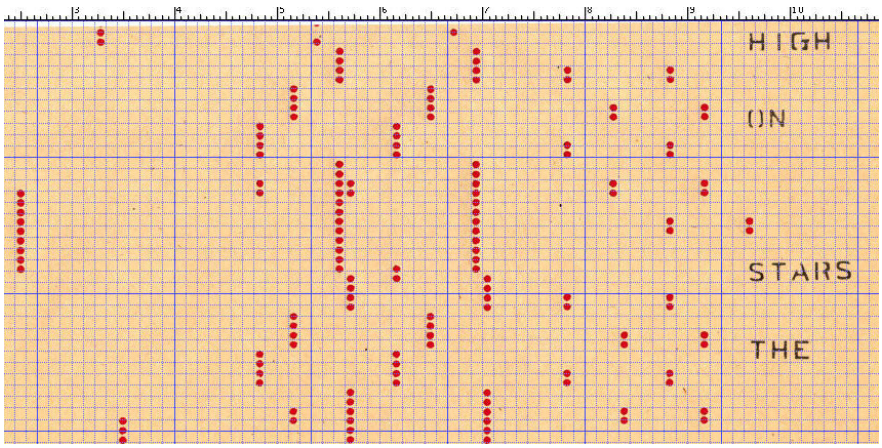

Figure 8. Each note track falls between vertical gridlines; bold vertical gridlines are an octave apart.

Open the first scan image and rotate 90° if needed. You will almost certainly need to apply a bit of numeric rotation to get the tracks vertical: Command + A, select all (Ctrl+A in Windows); Command + T, transform (Ctrl+T in Windows), enter tenths of a degree or minus tenths of a degree in Angle of Rotation field; double-click in the image area to apply.

Next, increase canvas size (Image>Canvas Size) to accommodate the rest of the scans. If you scanned 8-inch segments and 32 scans total, you will need to make the canvas height 256 inches. On the "anchor" diagram in the Canvas Size dialog box, select the bottom-center square. Note that your 11¾ x 256 inch file, at 150 ppi, will be nearly 200 megs. See box on page 5, "Long on Ambition, Short on Horsepower?" if you encounter problems with a file of this size.

Save as a Photoshop (PSD) file, or as a TIFF with LZW compression if desired to keep file size small. Other file types generally do not support images over 30,000 pixels tall.

Keeping this file open, open the next scan segment file and rotate it in the same way as the first. With the Move tool (access by hitting the V key), drag the image onto the first file, which automatically creates a new layer. Close the second segment file without saving changes (the 90° rotation). On the first file, set the new layer's opacity to about 50% and align the edge mark to the identical mark on the base layer (see figure 9). Again, some rotation of the image on the new layer will probably be necessary: Command+T (Ctrl+T in Windows), enter numeric value in angle of rotation field, double-click in transform bounding box on image to apply. Don't get discouraged if it's difficult to get a segment's tracks absolutely vertical; the midi converter software you'll be using has some tracking correction capability. After aligning, reset the new layer's opacity to 100%, then flatten layers.

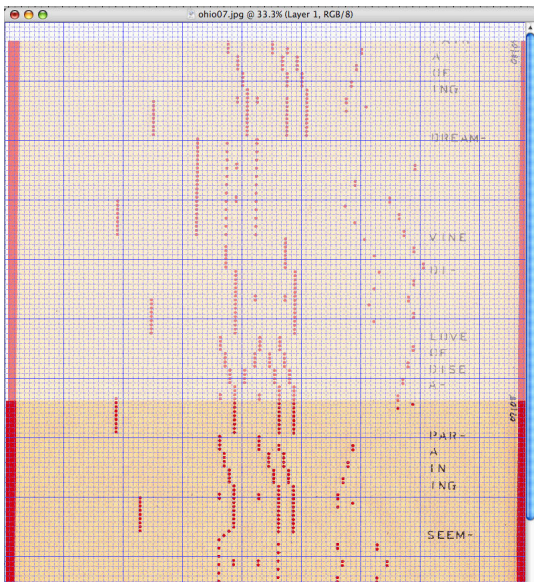

Figure 9. Assembling the roll segments into a continuous image.

Continue adding segments one at a time, aligning then flattening each segment. Save often! As note tracks start and stop throughout the song, you may need to add vertical guides to assist in aligning. One of the most useful tracks is usually the sustain pedal track near the left edge of the roll; but not all rolls have them, and the expression rolls mentioned earlier have additional tracks near both edges. Avoid the temptation to use the image of the paper edge for aligning, as it may be unevenly worn, and the perforation tracks may have been a bit out of alignment to the edge when the roll was manufactured.

After all segments have been added to this file, scroll through to check alignment, make sure all layers are flattened, and save. You may want to save a second smaller version of this color image to scroll along with the music file you'll be listening to. I've found that resizing to 5.625 inches wide (half the actual roll width) and 72 ppi, then saving as an RGB JPG, quality level 7 or 8, produces a relatively compact file that is detailed enough to read if it's a word roll.

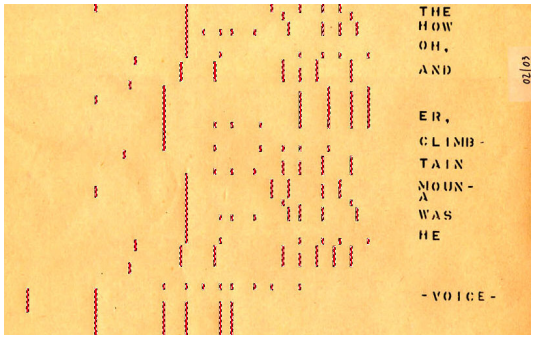

Figure 10. The red perforations selected with the magic wand tool.

Preparing the image file for midi conversion

In the large assembled file, zoom in on one of the red perforations. Using the magic wand with tolerance of 45 to 50, anti-alias option checked, and contiguous option UNchecked, select the center of the perf. The selecting operation may take a while due to the large image size. All the perfs should be selected, but none of the blemishes, specks, or printing, as shown in figure 10. (This is why I recommend bright red as the show-through color—it's different enough from the paper color as well as from the often bluish-green printed lyrics, black and brown specks, etc.) It may be necessary to adjust the tolerance number lower or higher and retrying the magic wand, but I've gotten consistently good results with a value of 48 when using the Pantone® 180C colored backboard.

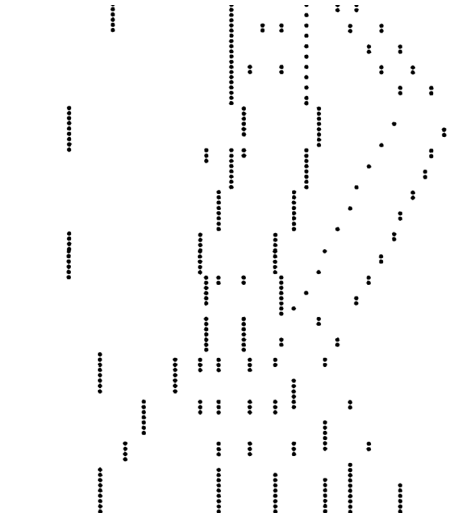

Figure 11. After selecting the red perforations with the magic wand, fill the perfs with 100% black; then invert the selection and clear the background to white.

Set foreground color to pure black and background color to pure white (the default foreground and background colors — click on the small black/white double square to the lower left of the large double square icon near the bottom of the Photoshop toolbar). Fill the selected perfs with 100% black (Edit>Fill, foreground color, normal blending mode, 100%). Now choose Select>Inverse to select everything BUT the perfs. Hit Delete. Your image should now look like figure 11 — solid black perfs on a solid white background.

Select Image>Mode>Grayscale. If you get the "Discard color information?" dialog box, click OK. Then select Image>Mode>Bitmap and set output ppi to 300. For Method, choose 50% threshold. Next, select Image>Rotate Canvas>Flip Canvas Vertical. This last step is required by the midi converter, which "reads" the image from top to bottom, rather than a physical roll in a player piano which travels in the other direction across the stationary reader bar. Figure 12 shows an RGB assembled scan alongside the flipped 1-bit version.

Save the image as a new TIF file. This will be the only file option available, as only TIF supports 1-bit files greater than 30,000 pixels tall within Photoshop. If your RGB scan included the tapered leader, crop it off — it will only confuse the midi converter. Also delete any roll-end signal perforations discussed earlier, either by cropping off that section or erasing to white. Next, crop the image's overall width to the visible roll edge, as closely as possible; your image should now be nearly 11¼ inches wide.

If you anticipate sharing your work with other rollscanners, do this additional step: With background set to black, increase canvas size width (Image>Canvas Size) to 3648 pixels; leave canvas height as is. Select the center square for anchoring and click OK. This creates a roll image centered between black margins, and an overall width of 12.16 inches @300ppi, which is what some midi converter programs require.

For the next step, you'll have to break the image up into at least two and probably four parts (Yes, I know you just finished putting them together!). The midi converter software evolved on the PC side of things, using a proprietary file format called CIS (after Contact Image Sensor, the heart of most home-built motorized roll scanners). Photoshop cannot save directly to CIS format, one of the few that supports dimensions exceeding 30,000 pixels; fortunately, a free utility exists that can convert sequential images saved in the venerable Windows BMP image format to a single CIS file.

Like most image file formats, BMPs cannot exceed 30,000-pixel dimensions in Photoshop. Check total pixel height of the TIF image (Image>Image Size). If it's under 60,000, you'll only need to break it up into two BMP files. More likely, it will be around 100,000 pixels or more. Here's how to divide it into four equal-height files with no overlap or omitted pixels:

Use Command + 0 (Ctrl + 0) in Windows) to fit the entire image on your screen. Select View>Snap. Drag a guide down from the top ruler slowly, and it will snap to the exact midpoint of the image. Use the marquee to select the upper half of the image, snapping the bottom of the selection to the midpoint guide. Now drag another horizontal guide down slowly, and it will snap to the midpoint of the selection. Invert the selection, then do the same for the lower half. Now you have guides at ¼, ½, and ¾ of the height of the image. Select the top quarter with the marquee, making sure you've got the full width, and copy-paste into a new file, flatten layers, then save as a 1-bit Windows BMP. In Save options, choose Windows, not OS2; 1-bit depth; Flip Row Order unchecked. Save as (songname)1.bmp; do the same for the remaining quarter-images to create (songname)2, 3, and 4.bmp.

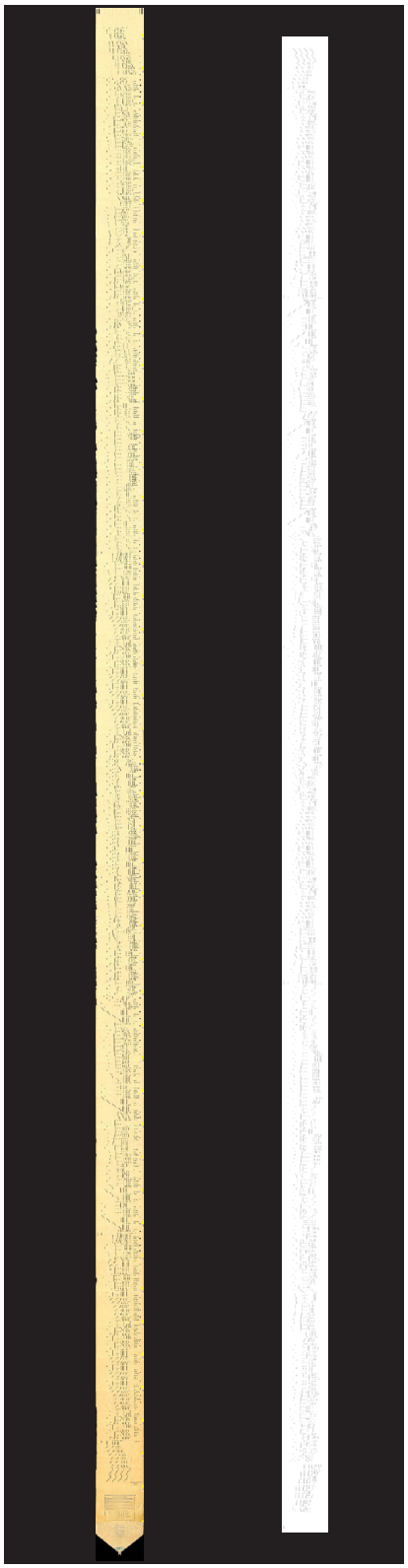

Figure 12. An RGB JPEG of the assembled roll image, with leader, lyrics, and roll-end perforations; and the vertically flipped 1-bit (black-and-white) image of the same roll with music perforations only, as the midi converter requires.

Nearly There

In Windows, double-click the BMP2CIS.EXE file to launch (see figure 13). If you're using Windows with Virtual PC on a Mac, you'll need to drag the BMP image files into a folder on the Virtual C drive; BMP2CIS will generate a CIS file in the same folder, but cannot use a folder on the Mac desktop.

Enter a name for the CIS file (no need to type the ".CIS" extension). Enter the name of the song in the Roll Title field. Enter the Tempo number, typically 60 to 100, which should be printed on the roll leader. If the leader is missing or the tempo is unreadable, enter 80; you can change it later if the resulting midi sounds unnaturally fast or slow. Enter 300 for Horiz DPI and Vert DPI. "Single Array" should be selected. Since you inverted the image in Photoshop, do not check "Vertical Invert." "Negative" should also be unchecked. Launch Windows Explorer and open the folder containing the BMPs. Drag (Songname)01.BMP into the BMP2CIS window; you'll see a CIS file created in the same folder. Next, click the "File Append" checkbox at lower left in the BMP2CIS window. Drag the remaining BMPs, one at a time, in correct order. Note the CIS file size increasing with each appended BMP. Close BMP2CIS after dragging in the last BMP.

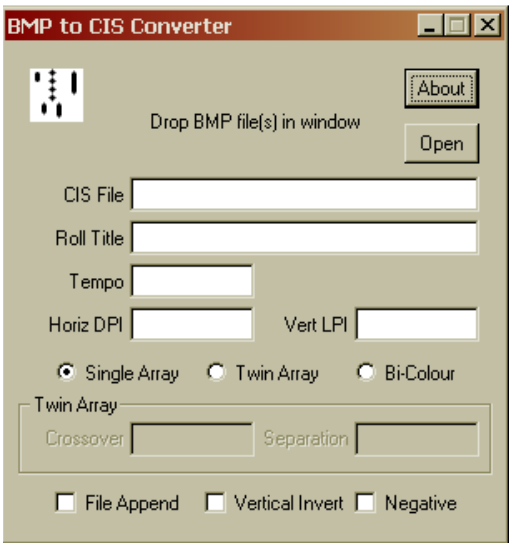

Figure 13. The BMP2CIS Converter dialog box.

Make the midi

Still in Windows, launch the rollscan converter by double-clicking the 2005April27_RollScanConverter_XML.exe file. Open the CIS file with the File>Open... menu command. A dialog box will appear (figure 14) in which you can enter known information about the roll. Click OK when done; you can access this dialog box again if needed by clicking the View/Set Embedded Text button.

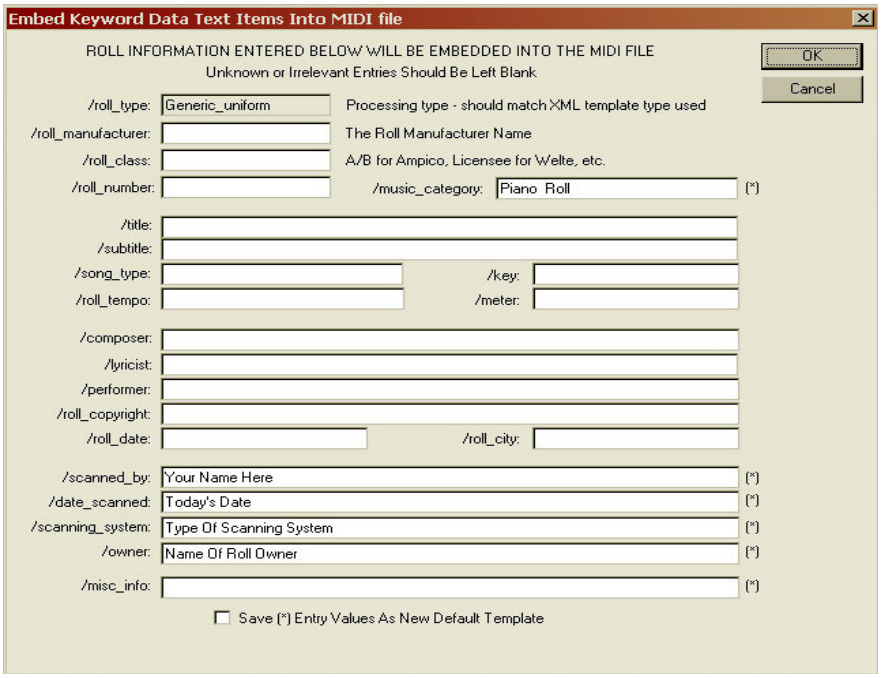

Figure 14. The RollScan Midi Converter dialog box for embedding roll info.

In the "Roll Type" drop-down menu, select the type of roll if known (figure 15). "Fail-Safe" sounds promising, but it lacks the ability to use the sustain pedal track that most rolls have; "Generic_Uniform" is usually the best choice for a standard 88-note roll. If your roll has extra "expression" tracks near both edges (figure 16), select the roll type that matches the expression or reproducing roll manufacturer, such as Ampico or Duo-Art. If the roll has expression tracks, but you can't identify the type, try to match it to one of the templates in the converter; if no match can be found, see the "Supported Piano Roll Formats" box earlier in this article for a possible solution.

The sustain pedal track just mentioned is the one closest to the left edge on a standard 88-note roll. Click on the Scanner Settings button to enter an offset number (figure 17) and adjust the value until the sustain track falls in the pink stripe on the left side of the converter. The PPI value should be 300, matching the PPI of the final 1-bit Photoshop image. Other values should be as shown. In most cases, roll "stretch" should not be a problem, so leave this setting at 1 unless tracks are not coming close to lining up in the stripes. They don't need to fall exactly in the stripes at this stage; you'll be using an Active Tracking feature a bit later. The ScanMIDI box should be checked; the eRollMIDI box should be unchecked unless you want to simultaneously create a special type of midi file used by certain electronic player pianos.

In the menu bar, select Settings>ScanImageMIDI settings — the dialog box that comes up is called General Settings (figure 18). Enter values as shown; the "merge holes" option prevents rolls with the dot-chain perforation style from playing as a bizarre torrent of 64th notes. If the midi result sounds like musical machine gun fire, try a higher value, but always under a tenth of an inch.

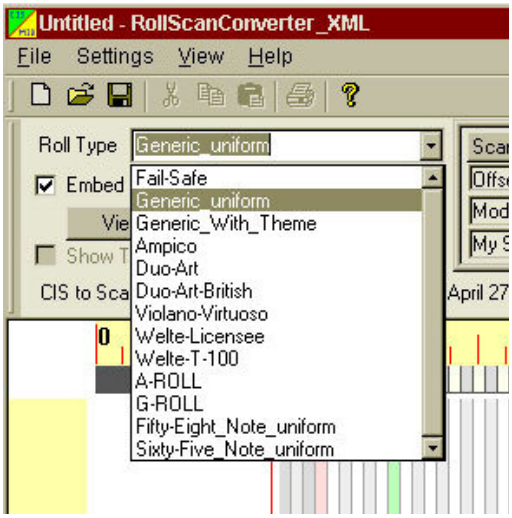

Figure 15. The RollScan Converter roll type list.

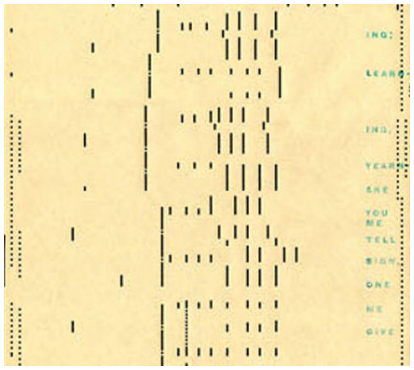

Figure 16. A piano roll with expression tracks near the edges.

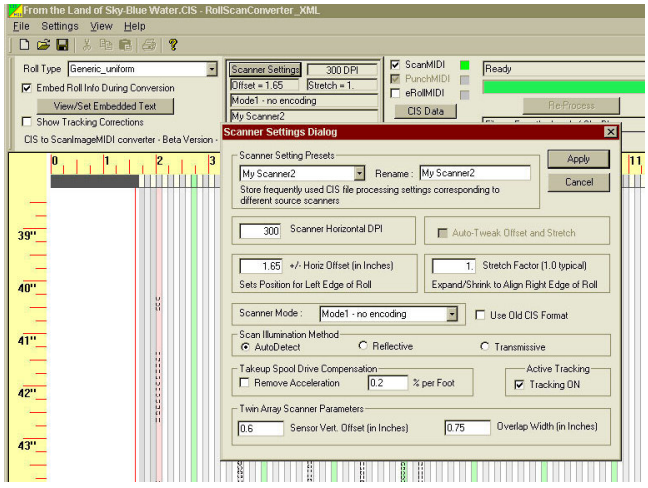

Figure 17. Using "Horiz Offset" to move the sustain pedal track into correct position (pink stripe). This usually gets other tracks close enough to their correct position for the converter program's "Active Tracking" to work properly.

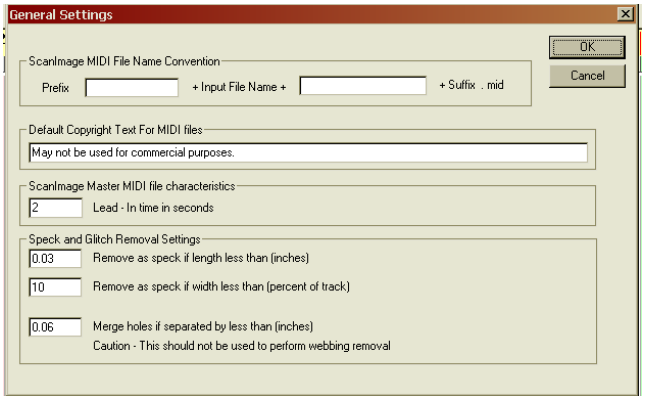

Figure 18. RollScan Converter general settings.

Clicking the CIS Data button brings up a dialog box (Figure 19) in which you can change the tempo and other attributes that were entered when the CIS file was created; useful if you need to experiment with tempo, but otherwise editing these values will probably not be necessary.

Click on Re-Process in the main window after making any changes. Checking the Show Tracking Corrections box will let you see how the converter has snapped the perforation images into the key tracks. The converter has automatically made a .mid file in the same folder as the .cis, and will overwrite it when you click Re-Process.

That's it! You can listen to the midi file with QuickTime, iTunes, or Windows Media Player. Don't be discouraged if your early results don't sound right; most common problems are easily fixed by adjusting settings in the midi converter. Problems such as abrupt changes in key or unnatural gaps or skips in the song are usually the result of inaccurate positioning of scan segments when assembling the image in Photoshop. Often these problems can be found and fixed by examining the BMP files in Photoshop, requiring only the BMP to CIS and midi converter steps to be repeated.

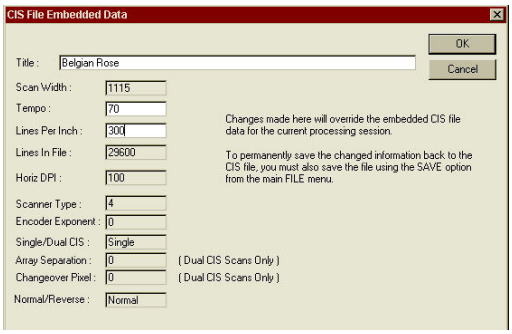

Figure 19. The RollScan Converter's CIS Data dialog box.

Sharing Your Results

If you're pleased with your piano roll midi file, I encourage you to share it with the world through any of the websites listed at the end of this article. The resource list includes some very dedicated individuals and organizations. They will likely be interested in the CIS file as well as the midi; a CIS file can be used to create special midi types for modern electronic player pianos, and even to recut new rolls for the pneumatic player pianos still out there!

An Example of Roll Repair

Many piano rolls have suffered severe damage over the years, mostly in the first few feet. When the damage extends into the start of perforations, you will of course have an incomplete performance; but if the song has a typical structure, with verses repeated, you may be able to salvage it with a simple copy-paste. The figure at right shows a section of "Beautiful Ohio" (artist and roll manufacturer unknown due to leader damage).

The black perfs are the surviving opening notes; the yellow area represents missing or severely damaged paper. The gray perfs are copied from the start of the second verse, offset in this illustration to show a nearly 100 percent correlation. It was common for piano roll makers to mechanically duplicate passages, a dubbing trick similar to recording studio techniques used today. By aligning a copy of the intact second verse section over the corresponding first verse, I was able to create a complete-sounding performance.