

Replacing Data Screens

How to use perspective corner pin motion tracking to replace data screens in your shots.

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More visual effects are creeping into filmmaking – even industrial and corporate videos! One common trick is to replace a sign, poster, television screen, or video display with a different image. Artbeats has a pair of versatile Control Panels collections that are particularly well suited for that last task. They also happen to be giving away Controls Panels clip CP121 in December to their newsletter subscribers.

Therefore, we thought we'd follow up on our previous article on motion tracking by showing you how to use After Effects Professional to track and replace a computer screen with a new display. This technique is known as “perspective” or “corner pin” motion tracking. Although we're going to be focusing on computer screen replacement, the same technique may be used for signs, posters, pictures, license plates, or virtually any other rectangular object you need to replace.

For this article, we'll be using Artbeats clip VMU134 from the Medical Surgeries collection as the footage we will track, and CP121 as the replacement screen. Of course, you can use your own footage when working through this exercise.

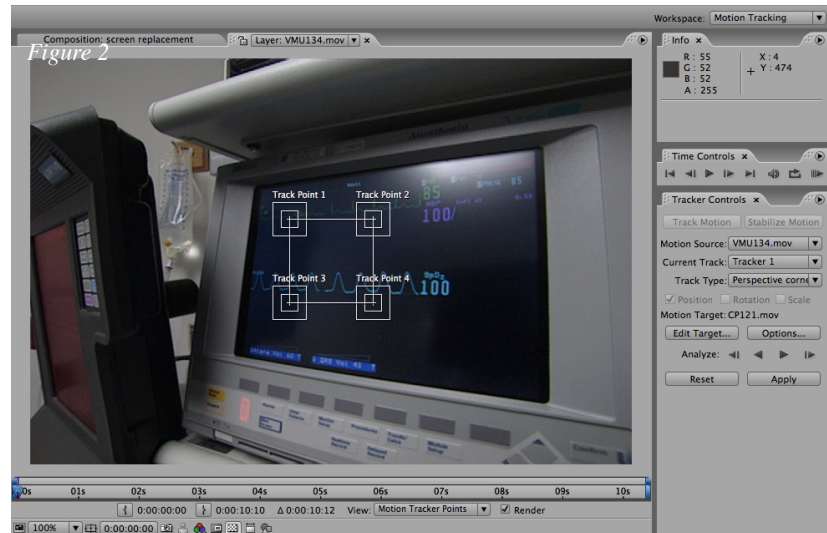
Setting up the Track

Place both your footage to be tracked and the replacement screen in the composition, with the new screen as the top layer. Make sure Window > Tracker Controls is open and visible. In After Effects 7 Professional, you can select Workspace > Motion Tracking to automatically recall a window arrangement that features it.

In the Tracker Controls, click on the popup next to Motion Source and select your footage to be tracked (VMU134, in our case). After Effects will open this clip in its Layer panel, which is where track-

ing needs to take place. Back in Tracker Controls, click on Track Motion, and a Track Point (two sets of boxes plus a crosshair) will be created for you. Then for Track Type, select Perspective Corner pin. You will now see four Track Points: one for each corner of your display.

Figure 2: In the After Effects Tracker Controls, select your clip to track as the Motion Source. Click Track Motion and select a Track Type of Perspective Corner Pin, and four Track Points will appear in the Layer panel.



Press Home to make sure you are at the beginning of the shot. Hover your cursor over Track Point 1 until it changes into a pointer with a four-headed arrow at its tail. This indicates you can drag the Track Point as a group. As you start to drag it, the center of the track point will turn into a magnifier. Center it over the upper left corner of the display bezel, capturing the contrast between the gray bezel and the dark screen. Do this for the other three corners of the display.

Figure 1a-c: We're going to take this handheld, sharply angled shot of a display screen (a), and replace it with a new, easier-to-read screen (b) while maintaining the original shot's motion and perspective (c).

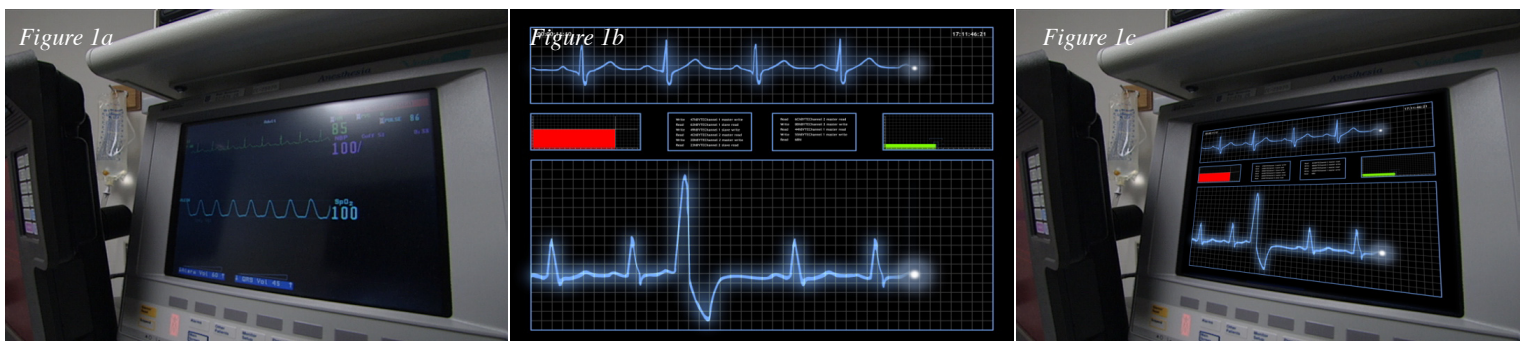


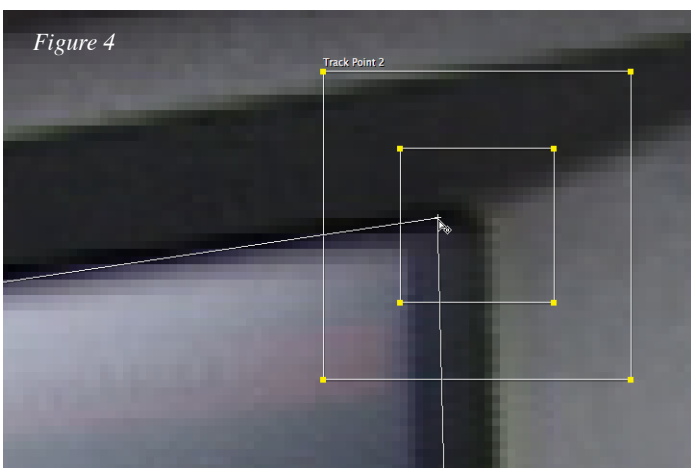
Figure 3: Place the center of each track point around a feature with clearly defined shapes, sharp edges, and good contrast, such as the corners of the computer screen's bezel.



Depending on your own shot, tug the corners of the inner rectangle – the feature region – to somewhat tightly fit the corner of your display. Tweak the size of the outer rectangle – the search region – so that the difference between it and the feature region is just greater than the maximum amount you expect the display to move in any given frame.

Now, zoom into the Layer panel to study each corner in more detail. (You can hold down the spacebar and drag the image in the Layer panel to easily pan around the zoomed-in display.) You want the lines connecting the four corners to just enclose the old display you want to replace. To accomplish this, you will need to drag the crosshair – the attach point – in each corner to be just outside the brighter area of the display, but still inside the black area of the screen's

Figure 4: Place the attach point (the crosshair) just beyond the visible portion of the old display, so that your new display will completely cover it.



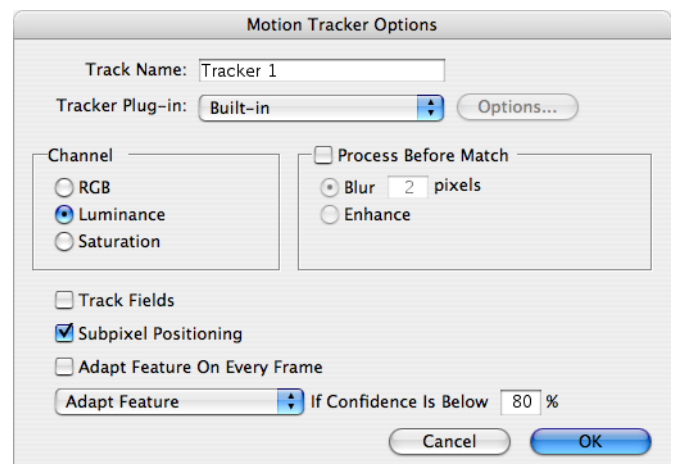
surround where there is no display. If you don't do this, portions of the old display will peek out behind your new display. When you're done, press Shift+/- to return to normal magnification.

Tracking

Once you've finished placing the Track Points, click on the Options button in Tracker Controls. This dialog gives After Effects important clues on how to perform the track.

- Since we're tracking the difference between the light bezel and dark screen, set Channel to Luminance.
- You can usually leave Process Before Match off. If the footage is blurry, enable it and choose Enhance; if it's noisy or grainy, choose Blur.
- If the shot moves slowly or in somewhat predictable fashion, leave Track Fields off. If the shot has sudden, fast changes in motion, and is also interlaced, then enable Track Fields.
- Always leave Subpixel Positioning on.
- If the features you are tracking constantly change shape during the shot – for example, if the camera is constantly pushing in, pulling back, or changing the angle at which it views the features you are tracking – then enable Adapt Feature On Every Frame. Otherwise, it is better to leave it off.
- We like to set the final popup to Adapt Feature, and leave Confidence at 80%. This tells After Effects to keep looking for the same feature that it found on the first frame. If that feature changes by more than 20%, After Effects will then assume the camera angle has changed, and instead start looking for the feature it found in the previous frame. If something temporarily obscures one of the corners of the display, then set this popup to Extrapolate Motion instead.

Figure 5: Set up the Motion Tracker Options to reflect the nature of your track and the underlying footage.



Once you've set your options and closed that dialog, click on the Analyze Forward button – it's the one that looks like a Play button near the bottom of Tracker Controls. After Effects will go about performing the track. When After Effects is finished, you will see a motion path for each Track Point in the Layer panel. If you see one of the Track Points get lost during the track, hit any key to stop, Undo, and either tweak the offending Track Point or try altering your options.

Make sure that Motion Target is set to the name of the clip you want to use as your replacement display (CP121 in our case); if it isn't, click Edit Target and set it there. Then click Apply. The Comp panel will come back forward, and a Corner Pin effect will be applied to your new screen, animated to match the paths of the Track Points. Congratulations: You have now replaced your screen.

Figure 6a-c: After applying the track. We feathered the edges of the new display to blend it in, and used Levels to better match its black point to original screen.



Zooming Out

Of course, the devil's in the details, and it's the folks who master the details who get paid the big bucks:

- To better blend your replacement display into its new home, apply a full-image mask, feather the edges to smooth the transition between the new screen and the its surroundings, and slightly reduce Mask Expansion (use about half of the Mask Feather value). You can also edit this mask as necessary to fit the bezel, or to cut out areas where someone's finger or some other object might temporarily get in the way.
- A peculiarity of replacing CRT displays is that glass picture tube may be curved, causing the edges of the display to be bowed. Effect > Distort > Bezier Warp is the tool to compensate for this. Make sure you drag it to be before (above) the Corner Pin effect in the Effect Controls panel, or your new display may fly off the screen!
- Enable motion blur for the new display layer. This helps match any blur resulting from the camera movement in the original shot.

- And finally, it's always a good idea to perform some color correction to better match the old and new footage.

Motion Tracking isn't easy – but it's a good skill to have, whether you're an editor, motion graphics designer, or visual effects artist.

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*Chris and Trish Meyer are the founders and owners of CyberMotion (www.cybmotion.com), an award-winning motion graphics studio in Los Angeles that has created a wide variety of work for film, broadcast, corporate events, and special venues. They were one of the original development sites for After Effects, wrote the highly-acclaimed books *Creating Motion Graphics* and *After Effects in Production*, and are long-time Artbeats users.*