Track and Stabilize

A key to visual effects work is removing or re-creating camera movement.

▽ Getting Started

Make sure you have downloaded the file archive for **Lesson 9** and decompressed it. It contains the project file and sources you need to execute this lesson.

Life is easy when you can capture everything exactly the way you want it. But reality often intervenes: Maybe the camera shook too much. Or maybe it wasn't possible to shoot an actor or object in the desired environment. And you might not get permission to shoot arcs of electricity across a canyon, or hang a huge banner from a skyscraper.

Therefore, if you are interested in a career creating visual effects, you need to learn how to *stabilize* footage plus *motion track* objects already in footage.

Overview

The basic concept behind Motion Tracking and Stabilization ("tracking" for short) is to follow specific features in a shot as they move around from frame to frame. Once that is done, you can perform some tricks:

• Stabilize the footage: If you know a feature was supposed to be in the same place from frame to frame, but it actually moves, After Effects can track that movement, then warp or animate the layer in the opposite direction so the shot appears to be steady.

• Make one object follow another: If you know how a feature is moving through a scene, you can make another layer follow the exact same path. For example, you can replace one computer screen, license plate, or poster with another, or have words follow a person around. Effect control points may also be animated to follow a feature throughout a shot.

• Reconstruct where the camera was: After Effects features a 3D Camera Tracker that automatically identifies hundreds
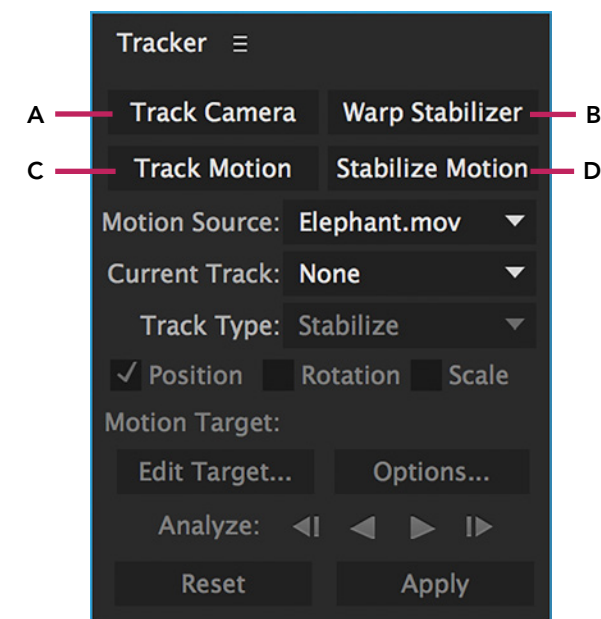

of features and analyzes their movements. It uses their relative movement to reverse-engineer where the camera originally was and how it moved through a scene, and how far away various surfaces such as walls were from the camera.

After Effects offers a variety of tracking tools with their own strengths, weaknesses, and methods of working. Two of the newer tools – Warp Stabilizer VFX and the 3D Camera Tracker – are highly automated, choosing the features to track for you. By contrast, the legacy "point" tracker in After Effects requires you to identify one or more features in the footage for it to then track. Similar but different, the third-party "planar" tracker mocha AE CC (from Imagineer Systems) requires you to identify a flat surface for it to follow throughout a shot.

In all cases, the best features to track have clearly defined shapes with distinct edges that don't change their underlying shape over time. These features should also have contrasting color or brightness compared with the pixels around them. Once After Effects (or mocha AE) has this initial idea of what to look for, it searches for the same feature in the next frame of footage. Once it finds the same feature, it updates its understanding of where the feature is and what it looks like now, and looks for it in the next frame.

Tracking one feature is often enough. However, sometimes it is useful to track multiple features. If you track two points, After Effects can calculate the angle and distance between them, allowing you to rotate and scale the layer being attached or stabilized. And if you track four points (such as the four corners of a poster) or an entire plane, then After Effects or mocha AE can take perspective distortion into account and "corner pin" a new object over the object you are tracking. And, as alluded to above, the Warp Stabilizer VFX and 3D Camera Tracker track hundreds of points. This is so Warp Stabilizer VFX can construct a mesh to warp the moving image into the desired shape, or the 3D Camera Tracker can reconstruct the original 3D world these features occupied.

In this lesson, we will explore each of these tracking and stabilization tools, suggesting which ones to use for specific tasks.

Caption: Tracker panel with labels A, B, C, D pointing to Track Camera (A), Warp Stabilizer (B), Track Motion (C), Stabilize Motion (D).

After Effects CC features multiple trackers and stabilizers. If you do not have a mask selected (Lesson 4), the choices in the Tracker panel are the 3D Camera Tracker (A), the Warp Stabilizer VFX (B), plus the legacy point-based motion tracker (C) and stabilizer (D). The first two are used in the Composition panel; the second two must be used in the Layer panel. The remaining options in the Tracker panel apply to the legacy tracker and stabilizer.

In addition to the options shown here, mocha AE CC from Imagineer Systems is also bundled with After Effects, and is accessed from the Animation menu.
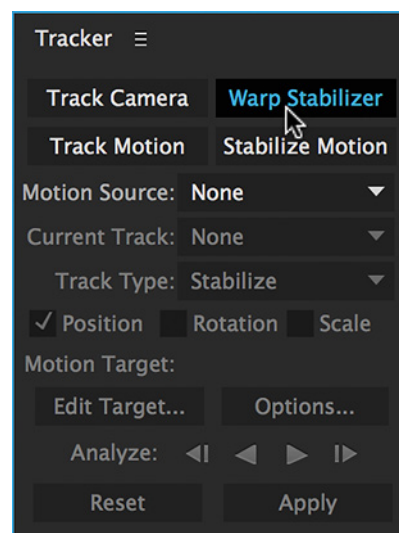
Warp Stabilizer VFX

As cameras keep getting smaller, more of them are being carried by hand or attached to unusual places such as the side of a car or handlebars of a bike. Although many cameras have some form of image stabilization built in, the often-shaky result may still be distracting. Warp Stabilizer VFX can smooth out the camera shake in many (but not all!) shots.

1 Open this lesson's project file: **Lesson_09.aep**. In the Project panel, the **Comps** folder should be twirled open (if not, do so now). In this folder, locate and double-click **WS-Warp Stabilizer*starter** to open it.

2 This comp contains one layer: **Elephant.mov**. Preview the clip and watch it closely: Despite the camera operator's best efforts to create a smooth pan, there are wobbles in the motion – particularly near the end of the clip when the camera stops panning.

3 Open the Tracker panel and apply the Warp Stabilizer (top). After Effects will analyze (A) then stabilize (B) the clip automatically. Clip ASC113 courtesy Artbeats.com.

3 Select **Elephant.mov** and press (Home) to return to its start at 00:00. Open Window > Tracker, and click Warp Stabilizer.

When you do so, the Effect Controls panel will open, showing the Warp Stabilizer VFX effect applied to your clip. Initially, a blue banner will be displayed over the Composition panel – this indicates Warp Stabilizer VFX is analyzing the clip frame by frame; progress will be updated in the Effect Controls. Next, an orange banner will appear as After Effects stabilizes the clip.

4 When the analysis and stabilization are complete, the clip will appear to be scaled up slightly. Preview again: The panning movement will be smoother, especially at the end of the clip.

Underneath the hood, After Effects has tracked multiple features of the shot, determined what areas contained the dominant movement (usually the background) and what areas had opposing movement (usually the foreground, such as the elephant), figured out the motion path for the background, and then

smoothed that movement. It then panned and scaled up the clip to make sure it always covered the entire viewing frame; the amount of scaling is displayed in Warp Stabilizer > Borders > Auto-scale.

After viewing the resulting dreamlike motion, you may be tempted to say "That's great; I'm done!" – but you can tweak the shot further if you desire.

5 In the Effect Controls panel, increase Warp Stabilizer VFX > Stabilization > Smoothness from its default of 50% to 200%. After Effects will restabilize the clip (requiring it to be scaled up slightly more). Preview again; the panning movement will be even more constant and sedate. Tweak this parameter to taste.

6 Stabilization > Method controls how After Effects rearranges the pixels to create smooth motion. The default of Subspace Warp has the ability to warp the background differently than the foreground to correct parallax errors between the two. If the result has a noticeably rubbery look, try less-sophisticated methods: Perspective warps the entire frame as a unit; the other two choices perform no warping and merely offset transform properties (scale, rotation, and position) for the layer. Choose the option that is least distracting to watch.

7 Borders > Framing determines how After Effects will then treat the stabilized image to make it more presentable:

• *Stabilize, Crop, Auto-scale* (the default) performs the minimum amount of scaling required to make sure the entire frame is covered by a portion of the original image.

• *Stabilize, Crop* keeps scale at 100% (maximizing image quality) at the expense of not covering the entire frame. Instead, it performs the minimum amount of cropping required to keep the edges stable.

• *Stabilize Only* leaves it to you to deal with the edges that are exposed by the stabilization process (note the pink background color in the figures below).
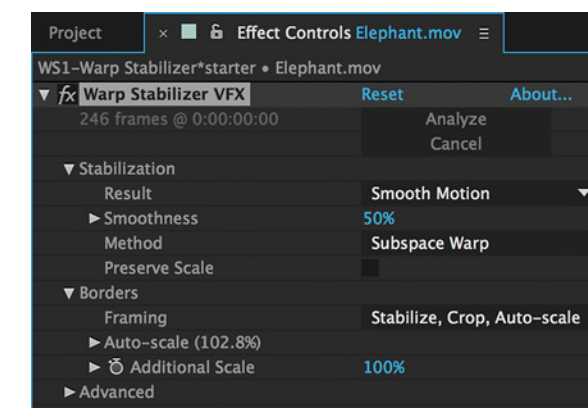
4 The Warp Stabilizer effect contains a number of parameters you can tweak to improve the stabilized shot.
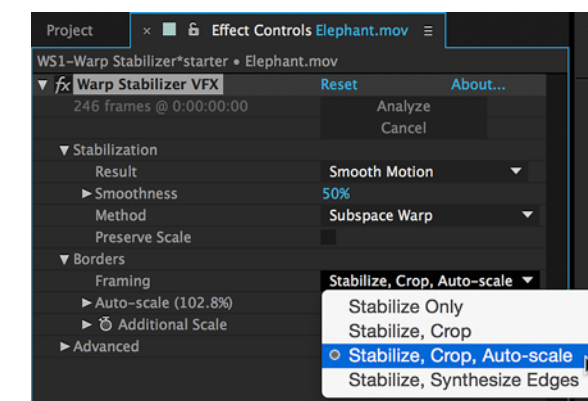
7 The default framing method of Stabilize, Crop, Auto-scale (above) fills the frame by balancing off smoothed movement with automatic scaling (A). Stabilize, Crop doesn't scale the result, but crops the edges so they remain consistent for the duration of the shot (B). Stabilize Only leaves any scaling, cropping, or reframing up to you (C).
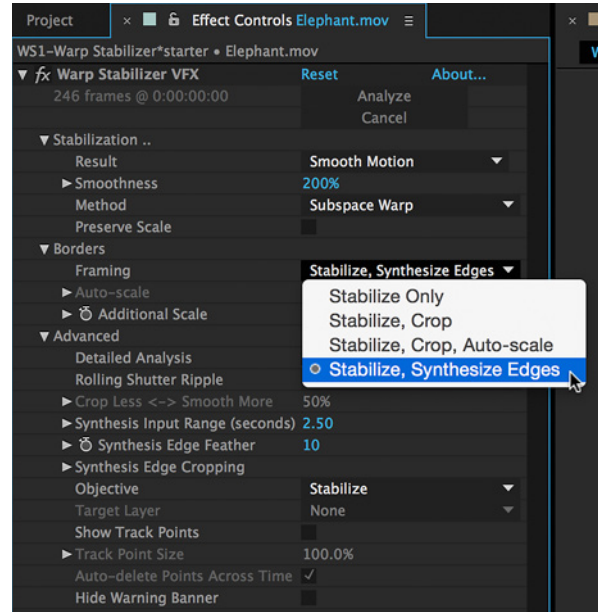
8 Set Borders > Framing to *Stabilize, Synthesize Edges*. This mode turns off Auto-scale and deals with edge issues by looking for visual information in adjacent frames that it can copy and paste to the current frame to cover the missing areas. At the start of this clip, there is no additional information for the left edge of the frame – but by the time you get to 00:22, it has found enough pixels elsewhere in time to cover the gap. To see how much area Synthesize Edges is synthesizing, toggle Framing between Stabilize Only and Stabilize, Synthesize Edges.

When Synthesize Edges cannot find enough material to cover the entire frame, there are three parameters you can balance off each other to help make up the difference:

• Decrease Smoothness: Decreases how much After Effects has to offset the original image to compensate for undesired movements.

• Borders > Additional Scale: Increase until the edges are covered.

    • Synthesis Input Range: Twirl down the Advanced section and increase this parameter. This allows Warp Stabilizer to search earlier and later in time to find replacement pixels. For this clip, set both Smoothness and Additional Scale to 100% and locate to 04:00 in time: There is a small gap along the top of the frame. Increase Advanced > Synthesis Input Range, and more of the gap will be filled in.

Sometimes your original clip will have artifacts around the edges that you don't want used to fill in missing pixels. You can crop out these undesired pixels using the Advanced > Synthesis Edge Cropping section. Advanced > Synthesis Edge Feather determines how softly the new edges are blending into the existing frame.

8 The Framing option of Stabilize, Synthesize Edges (top) copies pixels from adjacent frames in time to fill in the edges as well as possible without scaling (above).

There are two more Advanced parameters that are not required by this example, but are still good to be aware of:

• Detailed Analysis tracks even more elements in the original clip, at the expense of calculation time and larger file size (all of Warp Stabilizer VFX's internal data are stored with the effect in the project file).

• Rolling Shutter Ripple attempts to remove the "jello-cam" artifacts caused by the type of image sensor used in cell phones, DSLRs, and some other cameras. If some of this wobble is still visible after stabilization, try setting it to Enhanced Reduction.

▼ Locked Down Camera

Most traditional motion stabilizers remove all camera motion in a shot, compared with Warp Stabilizer's attempts to merely smooth out this motion. However, Warp Stabilizer can also remove all motion. To do this:

• Set Stabilization > Result to No Motion.

• Ignoring the edges for now, choose the Stabilization > Method that produces the fewest visual artifacts.

• Set Borders > Framing to the desired method for dealing with missing edge information. Because Warp Stabilizer is no longer allowed to pan the image to help recenter it, more severe cropping or scaling will be required.

For example, with **WS-Warp Stabilizer*starter**, a Framing method of Stabilize, Crop, Auto-scale requires us to twirl open the Borders > Auto-scale section and increase Maximum Scale to 239%. This is a case where Synthesize Edges can really help – as long as you have lots of additional source material earlier and later in time (often called "handle") for After Effects to use.

Reversible Stabilization

One of the main uses of stabilization is to temporarily remove the camera movement from footage, insert a new object into the scene, and then reintroduce the original movement. That's the goal of our next exercise. But first, we're going to deal with a common problem that arises when using Warp Stabilizer VFX – and its solution.

1 Return to the Project panel (if necessary, click the Overflow menu to the right of the Effect Controls tab and select Project) and double-click **WS2-Reversible Stabilization*starter** to open it. Preview; it's a hand-held shot of a person typing on a computer, and the audio of a speech he's supposedly transcribing.

2 Select **Laptop.mov** and apply Animation > Warp Stabilizer VFX. When it is done, set its Stabilization > Result menu to remove all camera movement, and preview. The video warps and wobbles unacceptably.

If Warp Stabilizer produces results like these, the usual culprit is that After Effects is also trying to stabilize a part of the image that is moving contrary to the rest of the scene. In this case, the walls and laptop are stationary parts of the room, but the person is moving. We need to get Warp Stabilizer VFX to ignore the person and just track those stable areas.
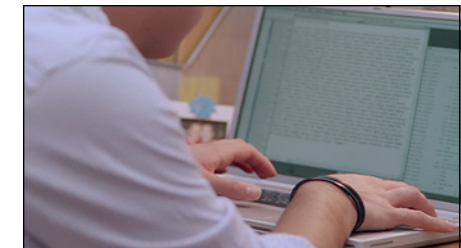
▽ **tip**

Docked Layer Panel

In some of the earlier lessons, we had you dock the Layer panel alongside the Comp panel, so you could see both at the same time. In this lesson, it is fine to have the Layer panel docked into the same frame as the Comp panel; you can simply switch between the two as needed.

▽ **tip**

Panning and Zooming

To zoom into and out of a display such as the Layer panel, you can use the ⌘ on Mac (**Ctrl** on Windows) and the ➕ and ➖ keys above the normal keyboard, or the scroll wheel on a mouse. Press and hold **Z** to temporarily switch to the Zoom tool, then click to zoom in. To pan around the display, hold either **Spacebar** or **H**, then click and drag inside the display.

2 At its default, Warp Stabilizer VFX introduces warping into the footage, rather than stabilizing it. The effect needs your help to work better. Clip F129-02 courtesy Artbeats.com.