

Hand animation, and specifically finger animation, is becoming more important for realism in animated characters. There are four ways to animate a hand. This article will give a brief description of each of them.

Key framing involves dragging each joint of the character's hand to create a pose. This can be done using inverse kinematics or forward kinematics. When using inverse kinematics the animator will drag the end of a finger, for example, to a position. The computer will calculate the joint angles necessary to get the end of the finger to that position. When using forward kinematics the animator will adjust each joint manually until the end of the finger is in the wanted position. When the whole hand is in a position, the animator will tag that pose as a key frame. The animator will then move the hand and fingers to another position and tag the new position as a key frame. The software will then fill in the necessary frames of data to transition smoothly between the first pose and the second pose. This is similar to the old claymation motion except that in claymation every frame of data has to be posed. In key framing, only the key frames have to be posed, the software fills in the rest.

The next three methods of animating hands and fingers involve motion capture. Motion capture uses sensors to digitally record the movements of objects or people. There are many motion capture systems available but only a few are able to capture hand and finger motions. Most motion capture systems are designed for capturing full-body movements. It is difficult to design a system that can record full body motion at the same time as full hand and finger motion. Some systems, like high end optical systems, can do both but not at the same time. Some systems, like most portable systems, can't capture finger motion at all.

Capturing hand and finger motion while capturing full-body is the first motion capture method of animating hands and fingers. Optical systems, like the Vicon, can capture hand motion, but with optical markers if the camera can't see the marker the camera can't measure the marker. This is called occlusion. It is easy for the tiny markers on the fingers to get occluded during the capture session. Each hand will have a large number of markers on it to capture each joint of each finger. Three cameras have to see each of these markers to measure their positions. The high resolution cameras can accurately measure the position of these tiny markers, but only if they can see them. Occlusion is such a problem for hand capture that most people do not attempt this method of hand and finger capture.

There is a second system that can do both full-body and finger motion capture at the same time. Measurand's ShapeWrap III system can include one or two ShapeHands. This is a portable system that is not as accurate as the high end optical systems like Vicon but there are no occlusion problems. The ShapeHand uses an array of 40 fibre optic bend and twist sensors to measure the movement of the hand and fingers. There is no external reference point to make the measurement. The sensors are inserted into a tight-fitting glove and the data is transmitted, wirelessly, to the computer for recording. The trade-off with any portable system is accuracy. Portable systems are very good but will never be as good as a Vicon.

You may be asking yourself - Is there any way to get the benefit of both – accurate full-body with occlusion free hand? The answer is yes. A hand motion capture device, like the ShapeHand, can be used with a full-body system like the Vicon. The trick is to time the capture of the hand data so it matches the full-body data. By using a longitudinal time code generator to send a timing code to both the optical system and the hand motion capture system the data can automatically be synchronized when both files are brought into MotionBuilder.

So what if you already have full-body data with no hand and finger data? Can you add hand and finger motion capture after capturing the full-body? The answer is again, yes. MotionBuilder allows you to play back motion capture data while simultaneously recording new motion capture data. An optical system can be set up to capture just hand motion capture. This reduces the chance of occlusion because it puts the cameras closer to the hands. However, optical data cannot be brought into MotionBuilder in real-time. The motion capture artist would have to watch the full-body data while performing and recording the hand motion. This is similar to doing a voice over for animated characters. Voice actors perform the character's dialogue while watching the animated characters on a screen. The voice is then manually synchronized with character. In this case the hand data would have to be manually synchronized with the full-body data. The other method is to use a device like the ShapeHand that can record directly into MotionBuilder so the recording is done at the same time, in the same program, as the full body data is played back. This is called a hand-over. Similar to a voice over except the data is automatically synchronized with the full-body data through MotionBuilder.

As budgets get tight and realism requirements increase there are a few options available to animators to animate hands and fingers. The motion capture techniques in this article can improve the feel of a hand while decreasing the time it takes to animate fingers. Stop animating fingers by hand, go motion capture.

If you need a hand call Scott Thomson, Vice-President of a company where full-body capture goes hand in hand with fingers.