



Everything you wanted to know about swing analysis systems but were afraid to ask:

The golf instruction industry uses more advanced technology than any other sport. If you find all this technology confusing, you are not alone.

Video taping a golf swing and analyzing its motion is not as simple as pulling out the family Camcorder and shooting. The golf swing is a combination of objects moving at high and low speeds.

In this article, I will attempt to shed some light into the different components needed for a swing analysis system and the key points to consider when choosing the appropriate one for you.

Lets start with video cameras. The truth about them is: you can take bad video with expensive cameras and good video with inexpensive ones. All video cameras use a device called a CCD (Charged Coupled Device). This silicon chip has thousands of “buckets” that collect light. To take a picture the camera opens and closes the shutter, and the light collected in each bucket is then read. Frame Rate is the number of pictures the camera takes per second (FPS). Exposure is the amount of time the camera shutter is open.

A regular TV works at 29.97FPS. To analyze a golf swing you need between 25 to 30FPS. 60 FPS is teased out of normal DV and TV cards by cutting the video resolution in half to get 2 frames from one.

Higher frame rates are possible but with industrial video systems but these are expensive (\$15,000).

Blurring is the biggest issue with video and golf swing. Blur is caused by the club head moving while the camera shutter is open. Limiting the exposure time reduces blur.

A camera capturing frames at 30 FPS may only open the shutter for 1/1000th of a second per frame. If a club is moving at 100mph with a 1/1000th of a second exposure, that club can only move 0.18 inches (4.5 mm). Exposure around 1/500th results in good video.

What camera should you use? Manual exposure control is the key. With manual exposure, you can force the camera to use short exposure.

Many consumer cameras only have “Sports Mode” for high-speed action shots. In this mode, the computer inside the camera looks at the background movement and uses it to adjust the exposure. In a golf swing, the background never moves, therefore Sports Mode is no good.

You are now ready to capture a video of a student golfer. Now how do you get this video into the computer? Below there is a table that describes the different options available.

	USB 1.0 or Universal Serial Bus	USB 2.0 or High Speed Universal Serial Bus	Firewire, IEEE1394 or iLink	TV Card
Picture Quality: @ 30FPS	320x240 pixels	640x480 pixels	720x480 pixels	320x240 pixels to 720x480
Cost: *Not including camera	\$30.00 to \$200.00	\$90.00 to \$300.00	\$500.00 to \$2,800.00	*\$65.00 to \$200.00
Advantages:	Inexpensive and widely available, don't require many cables, and batteries. Simple one cable connection to the computer.	Excellent picture quality and excellent value, with all the benefits of the USB1.0 webcam.	Excellent picture quality and cameras offer all the features of old Camcorder and much more.	Capture the video straight out of the VCR or analog Camcorders. Re-use your existing Camcorders.
Disadvantage	Picture quality is not great.	Your computer may not have USB2.0 port	Cost for features you may not use, and more batteries to worry about	Require desktop computer, and tend to be a little more difficult to work with.



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We now turn our attention to computers. With computers more is better, but more of what? Memory, Hard-drive, CPU, Screen?

Unless you are always working in a fixed office, get a notebook computer. Desktops are cheaper and better valued but at some point, you will want to take the system to the customer. With the notebook, just put it in a bag and go. Generally computers today are all the same under the keyboard, Intel makes most of the important parts. Look for good support and warrantee plans.

CPU: Any new computer with over 1Ghz speed is enough for swing analysis. More power is better, the Intel P4 is faster then Celerons at the same GHz speed. Intel Centrino is a new technology giving you longer battery life, it is faster then Celerons at the same speed.

RAM: Surprisingly lots of RAM is not important. You are better off with a faster CPU. Video does not use much memory, only a couple of frames are in memory. Minimum of 128MB of memory; most computers come with 256MB.

The Screen: "Day light" screens are better in outdoor conditions but the screen size is only 10" and low 800x600 resolution, also they are very expensive.

TFT/LCD screens use reflected light so are good enough for outdoor conditions. These screens are also larger 15" and better resolution 1024x768. If working in sunny conditions, place the screen so the sun is directly on it, this maximizes the light going into the screen.

Hard-drive: Video is a big data consumer. At least 20 Gig hard-drive, 30 Gig is better. You will see hard-drives of different speeds: 7200RPM and 5400RPM are the current common speeds. The faster hard-drive is better because the computer can easily save the video data. This allows for more cameras or higher quality pictures.

CDWR drives: These allow you to give recorded lessons to students. Most CD writing drives are now combo DVD and CDWR. This does not mean they write DVD but they can read them. A new generation of DVD writers is coming, but these devices are expensive, the disks are expensive, and DVDs are not as universal as CDs.

Printers: Today's ink jet printers (\$100.00) can produce amazing results on normal paper at very low cost. Look for a printer that has separate color ink cartridges. Golf pictures use lots of green, which will empty two of the color cartridges but leave the other full.

Remember, computers are like everything else in this world. Simple to operate once you know it. The easiest golf swing analysis system in the world has only one button but once you know that button, you will want another button. Look carefully at the growth path of the system; simple to start but expandable. Starting small reduces the total cost of system ownership because you are not paying for features you will not use for years.

If you have any questions about the hardware I have spoken about here, contact me by either phone or e-mail.

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