How to Easily Make and Integrate Quality Videos for Medical Education

Christof Daetwyler MD Christof.J.Daetwyler@Drexel.edu

Drexel University College of Medicine, 2900 Queen Lane
Philadelphia, PA 19129-1096
http://webcampus.med.drexel.edu/interactive/cda/

When I wrote in 1998 an article about videography for medical education, I emphasized on how to anticipate the disadvantages of the then small and studdering computer-videos. Since then five years have gone – and the capability of computers playing seamless high quality video has grown to near perfection. In this article, I’d like to share with you some thoughts and practical know-how about how to make – and make use of – (interactive) video for medical education.

**Why to use video for medical education?**

Individuals who are affected by a certain disease often show similar symptoms and signs. These are sometimes obvious - but more often they are hidden. To unsheathe them, the physician takes first the patients history - a process wherein the relation between patient and physician becomes established – and then performs a physical examination. While this, the physician makes up some diagnostic assumptions which are then to be proven with the use of further technical examinations.

Video is a very good medium when it is about showing processes. History taking and the physical examination are very dynamic processes – and more and more is this true also for the results of the technical examinations like sonography and functional MRI, to name a few.

**What’s so special about video when it comes to medical information?**

There is some „other“ information in movies than text

Video transfers beside explicit information - which could be transferred as written text as well – lots of implicit informations as well. Examples for implicit informations are the sound of a voice, the way somebody takes your had and the expression of a look when somebody tells you about the death of a close friend, just to name a few. These implicit informations are the ingredients that build up the „athmosphere“ of what’s going on. Here is joy, love, hate, hope and desperation – feelings that are especially important when it’s about patients who are facing one of the hardest crisis of their lives.

It needs the talent of real artist to write a text where feelings come to live – with a videocamera you won’t have to bring them to live yourself, instead you just record what is going on – and your camera will capture as well a good part of the implicit informations.

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1 http://iml.dartmouth.edu/cda/papers/video_1998/Anleitung.htm
Video for documentary use

Video is especially suited for medical documentations because when we show patients telling their story, we can also listen to the sound of their voice and see the way they move. I learned that a.e. in Neurology up to 70% of the diagnosis is made at the moment when a patient enters the doctors office..

Another point is, that video depicts an „objective“ reality – and has not necessarily to undergo a subjective interpretation. This allows an un-biased re-interpretation of a scene at any time.

Also very important is the fact that the patients view of what is going on and what he/her is suffering from can be captured – and so become part of a comprehensive understanding of a medical condition. I’m talking here about how strange it is when young doctors know all about the microscopic aspects of a condition – but won’t recognize it when it’s present in the patient right in front of them.

Film is made at the base of a timeline. This makes it the ideal media to document the course of a condition... and because we can do this in fast-motion, we can make slow changes even more noticeable as if we were witnessing it in the slow-motion of our normal perception. So, even the course of condition in chronic and slowly progressive diseases becomes visible – and teachable.

The use of movies to explain a story or a process

A movies time-based nature makes it a good choice to explain (chrono)logical sequences. Medical procedures a.e. lumbar puncture (Identifying the right spot, sterilisation of the surface, inserting the needle, etc..) are following a certain „logic“ sequence. A sequence which should be understood and trained well in order to be applied successfully. Movies can also be used to tell stories. In this case, the sequence is made up by the dramaturgy – and not by logic. When it comes to learning, „storytelling“ has been proven to be a very valuable method to give knowledge from one to the other. And because it’s not only text, also the attitude - „how“ medicine is practiced – is being taught. A story enriched with visual „triggers“ has been showed to be far more memorable than a text-only story.

How to make best use of movies in CAT (Computer Aided Teaching)

There is more than one way how to make use of movies in learning media. Many aspects have to be considered to find the besto one, a.e. the learning style of the student: explorative learners benefit more from interactive video while more passive learners prefer to learn with linear video. Some investigations were done about the optimal length of scenes in interactive video – but no clear conclusion could be made. It seems that the length of a sequence does not matter as much as the quality of the story telling: well told stories are remembered the best. In the case of instructional movies it’s not so much about telling a story but about clearly demonstrating the structure of a process. Making sure that the student builds up an expectation before information is provided eases the translation of information into memory. A good way to do this is to ask the student every time before a chunk of information is provided to write down...
his expectation about what the information will be like („what will we do next?“ – „clean the surface!“). Then the student will be provided with the correct procedure („find the anatomic structure .... first, then clean the surface“). Out of this agreement or disagreement with his own outline the student becomes engaged – and learning happens.

**Technical aspects**

A very expensive equipment (ca 150'000.- $) was needed to produce video only 10 years ago – now we can do the same with a MiniDV Camcorder, a MultiMedia Computer and an external Harddrive for about 7'000.- $. The production and postproduction of video became affordable for small institutions and even individuals. But the equipment is only one of the ingredients that must be present in the making of movies – it won’t serve much if there is not someone who is skilled and has the know-how – and this is what I’ll try to cover in the next short section.

**The picture is a product of light and shadow**

Who considers making movies should know about photography. A photo depicts the visual part of reality as a composition of light and shadow. It is obvious that a good light is key for a good picture/movie. So we have to record either on a location with good light – or we have to bring some lighting with us. In closed rooms it is often suitable to use a bright spot (ca 1000 W) and direct it to the sealing from where it is then reflected to the scenery. If there is a window we can position „the talent“ right beside it and pose a reflector (a.e. a polystyrene-plate) on the room-side. This creates a good light with not too deep shadows. If you can allow some yards between the background and „the talent“, you will benefit of a more open setting with less disturbing shadows as if you place „the talent“ directly in front of a wall.

**Don’t forget the sound**

Sound is very important. In movie making we can say that a good picture with a bad sound results in a bad picture while a bad picture becomes a good picture when the accompanying sound is of good quality. The distance between the camera with mounted microphones and the talent is often not close enough to record sound in good quality. It is an easy task to connect the camera with a cable to an external microphone that is much closer to the talent. While recording, the sound should be monitored with an earphone to make sure that all the cables make good contact – and that there is no noise electromagnetically induced via the long cable. This happens quite often when recording happens in rooms with fluorescent bulbs – in these cases we won’t be able to make use of an external microphone.

**There is more than one soundtrack**

Another interesting point is that you can record as many soundtracks to a movie as you wish. This is how I prepared the movies about the neurologic examination: They all have the original sound and a commentary track. When a video is played by a computer, the user can choose what
soundtrack should be active. This adds in a simple way quite a bit of valuable meta-information to a movie.

**Don’t move or zoom when it’s not necessary**

A zoom in a movie equals an exclamation mark in a text – both shouldn’t be overused. The camera movements should be sparely and smooth. A tripod is of essential help to achieve this goal – but today’s camcorders are often equipped with a “steady shot” function that allows a smooth filming even when hand-held.

BTW moving a camera horizontally is called “pan” - and “tilt” when the movement is vertically.

**Hint: record twice, once an overview and once a close-up**

If we plan to record an event that is not unique but offers the opportunity to be re-captured, we should consider to tape it twice: once in an overview and once as close up. This offers the opportunity to cut between these two versions back and forth and so allows a very easy but nice cutting in the post-production. This allows also a seamless integration of other materials like movies, graphics, power-point presentations, texts and so on.

**Hint: what to do if there are reflexions in the eyeglasses**

Illustration by William Scavone (bscavone@kestrelstudio.com)

When filming a person we give some light to the face – especially the eyes - to make it more lifely. Eyeglasses can become a real problem when they reflect light. An easy work-around most
often help us to get rid of it by tilting the eyeglasses a little bit (just put the frame ca. 1-3 inches over the ears).

How to do Blue/Green Screen (insert backgrounds in post-production)
It’s becoming more and more common to shoot in front of green- or blue- screens. This can be done in very small studios and at the same time offers the ability to copy in a background image at a later stage. The requested equipment is by no means complicated or expensive: a wall (or curtain or large poster) in the background has to be painted with a special color, either Key Color Green or Key Color Blue. This wall has to be lit separate from the foreground – so no shadows can appear. If the foreground is lit with three spots – one from the front and one from each side – the later keying of the colors can be done very smooth and without ugly spikes on the edges. At http://www.theforce.net/theater/postproduction/bluescreen/key.html you’ll find a description how to do it.

What’s special about computer-videos
The picture on a television screen (NTSC) is refreshed about 30 times per second. If we look closer, we learn that the picture is build up in two parts: in the first 1/60 second all the odd lines are written and in the next 1/60 of a second the even ones, already slightly displaced by what has happened within a 1/60 of a second. The displacement between the odd and the even lines is therefore the worse if a fast movement occurs. Because a computer video does not show half-frames, we have to indicate how the computer should handle this so called de-interlacing. The options are to calculate an interpolated picture that blends the info of both half-frames or just to double either the odd or the even frames.
Another speciality of computer video is that all of the picture is shown whereas a tv-monitor won’t show the outmost parts of the picture. Here are the settings that I use when creating computer videos:
PICTURE: crop left and right by 20 pixel, up and down by 8. Resize the picture to 340 x 280 pixel, de-interlace: odd
Encode: Sorensen® or MPEG4 video compressor. Frame rate 15 pictures (each second full frame), keyframe every 50 frame, limit video data rate to 280 kilobites per second.
AUDIO: Normalize volume to 75%, use MPG3 codec for compression.

Examples
Here is a list provided with computer based/assisted medical learning programs that make use of video to transport relevant information:
- Henderson J., IML Dartmouth “Primary Care of the HIV/AIDS Patient”
  http://iml.dartmouth.edu/education/index.html
- Henderson J., IML Dartmouth “Genetics in Clinical Practice”
  http://iml.dartmouth.edu/education/index.html
- Mumenthaler M., Daetwyler C., “Kopfschmerz interaktiv”
  http://www.aum.iawf.unibe.ch/vlz/bwl/kopfschmerz/
- Mumenthaler M., Daetwyler C. “Neurologie interaktiv”, Georg-Thieme Verlag
  ISBN 3-13-115691-0
- Becker, Markus, Wilhelm, Haennecke, Daetwyler “Chirurgie interaktiv”, can be ordered at “Lehmanns Fachbuchhandlung” http://www.lob.de/.

i Cox K. “Stories as Case Knowledge: Case Knowledge as Stories” in Med Educ 2001 Sep;35(9):862-6
iv Yoder Marianne E “Preferred Learning Style and Educational Technology: Linear vs. Interactive Video” in Nursing and Health Care; v15 n3 p128-32 Mar 1994
v Verhagen P. W. “Preferred Length of Video Segments in Interactive Video Programs” see ERIC ED348036