Television and Video Standards

There are three main TV standards that exist worldwide: PAL (Phase Alternation Line-rate), NTSC (National Television Systems Committee) and SECAM (Systeme Electronique Couleur avec Memoire). PAL is extensively used in Western Europe, parts of South America, Australia, India and China. NTSC is used in North America and SECAM is the system prevalent in Russia, Eastern Europe, some parts of Africa and France:

This map of worldwide television and video standards is not to be confused with the following map of region codes, often used in DVD production:
The image on a TV screen is produced by an electron beam that hits the face of a TV's tube. This beam scans the screen from the top right to the bottom left. In this process it skips every other line: it starts with the odd lines (1, 3, 5, ...) and then continues with the even lines (2, 4, 6,...). Scanning one set of lines (one field) takes 1/60th of a second (on NTSC system). If the first field starts with an odd line it is called "upper field first", if it starts with an even line, it is called "lower field first".
Television history: the following pictures show the technological development of television’s resolution in an early experiment of German television between 1929 and 1934 (picture source: Technikmuseum Berlin, Wolfgang Maria Weber). The pictures quite nicely show the relationship between scanlines and resolution.

Actresses Schura von Finkelstein (right) and Imogen Orkutt (left) in an early television experiment conducted by the German Reichspost between 1929 and 1934.
Image Resolution and Aspect Ratio – SD video
The aspect ratio of standard video is 4:3 (in contrast to widescreen which is 16:9 or film which is 2.35:1). There are different ways of representing the video image. This representation is based on the aspect ratio of the pixels that constitute an image. Digitized NTSC video has a resolution of 720x480 pixels, the resolution of digitized PAL video is slightly higher: 720x576.

The picture above shows the difference between square pixels (on the computer screen) and non-square pixels (on the video screen). If you prepare still images for Final Cut Pro, After Effects or any other video software, make sure to work at a resolution of 720x540 pixels (4:3) first and then in the last step scale them to 720x480 (turn off proportional scaling!). Likewise, if you digitize video and export frames as still images, make sure to stretch the stills in Photoshop from the original resolution (720x480) to 720x540.

Frame Rate
NTSC video has a frame rate of 29.97fps (frames per second). This odd number was a result of changing black and white video to color video. We do not need to worry about this uneven number too much and usually consider NTSC video to be 30fps. PAL video has a frame rate of true 25fps. This is one of the reasons why there is no easy way of exchanging PAL and NTSC footage.

HD video
The footage from the HD cameras can be stored in their source format on your hard drives (they are often in the AVCHD (Advanced Video Coding High Definition) format, individual video files have the ending .mts and encoded in an mp4 format). You can simply copy the content of the whole solid state recording medium onto your external hard drive. See the next page for an overview of the file organization on the HD cameras using AVCHD. You don’t need to worry about pixel aspect ratios (the footage is square pixels) and you can prepare still images at the same resolution of 1920x1080 in Photoshop. However, you have to scale down your final movie for distribution on DVD, to 16:9 SD video format (720x480 pixels), since we cannot burn BluRay DVDs.
File Organization on many AVCHD camcorders:

Root directory of recording medium

- [PRIVATE]
  - [AVCHD]
    - [AVCHDTN]
      - THUMB.TDT .......... Thumbnail image
      - THUMB.TID
    - [BDMV]
      - [STREAM]
        - XXXXX.MTS ........ Video clips
      - [CLIPINF]
        - XXXXX.CPI .......... Clip information
      - [PLAYLIST]
        - XXXXX.MPL .......... Play lists
      - [BACKUP] ................. Optional backup data
        - INDEX.BDM .......... Clip index file
        - MOVIEOBJ.BDM .......... Clip description file
    - [DCIM] ........................................ Still images
    - [MISC] ........................................ Optional vendor data