# Digital Images and Photography

Eugenio Falcioni, Photographer

# A brief historical introduction to cultural heritage photography

# William Henry Fox Talbot first photograph of a manuscript in 1840

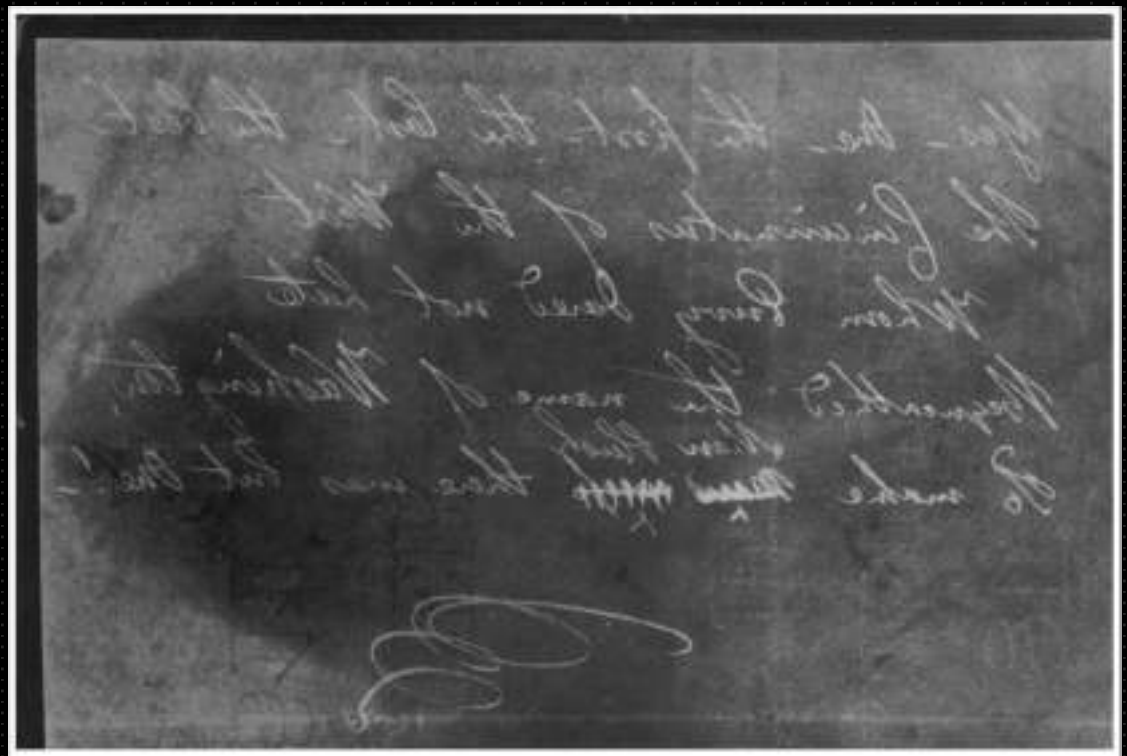
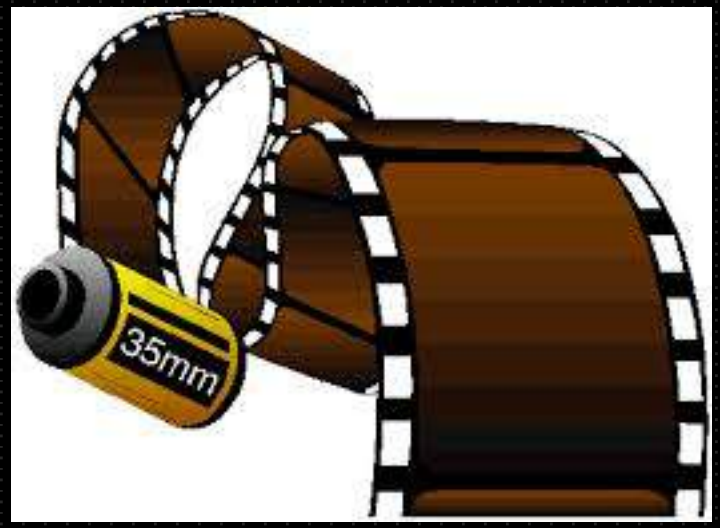


FIGURE 1.1. William Henry Fox Talbot (British, 1800–77), *Copy of a stanza from the "Ode to Napoleon" in Lord Byron's hand*, prior to 4 April 1840. Photogenic drawing negative; 12.3 x 18.3 cm on 13.2 x 19.0 cm paper. Partial watermark "J Whatman Turkey." Credit: The Collection of Dr. Walter Knysz, Jr. Courtesy of Hans P. Kraus, Jr., New York.

# How does a camera work?

A camera is a box with a circular opening, through which a lens system projects the images on a surface sensitive to light.

This surface is the biggest difference between analog and digital photography.




- In analog cameras it is a film
- In digital cameras it is a sensor

# Introduction to cameras and digital images

- Digital images are made by pixels. A 'pixel' (short for 'picture element') is a tiny square of colour and it is the minimum controllable element of an image
- The quality of an image depends on the quantity and density of the pixels that compose it
- A Camera with many megapixels does not always mean higher quality
- The size of the sensor is the most important parameter to look at when choosing a camera
- A large sensor corresponds to larger pixels. The bigger the pixel, the more light it captures, with a more accurate rendering and less noise
- There are sensors of all sizes (in mobile phones they are very small) but the first sensor that can be defined as professional is called Full Frame measuring 36 x 24 mm and also known as the (35 mm)

# Types of Professional digital cameras

- DSLR (Digital Single Lens Reflex)
- Medium format
- Large format

# DSLR (digital single-lens reflex) camera

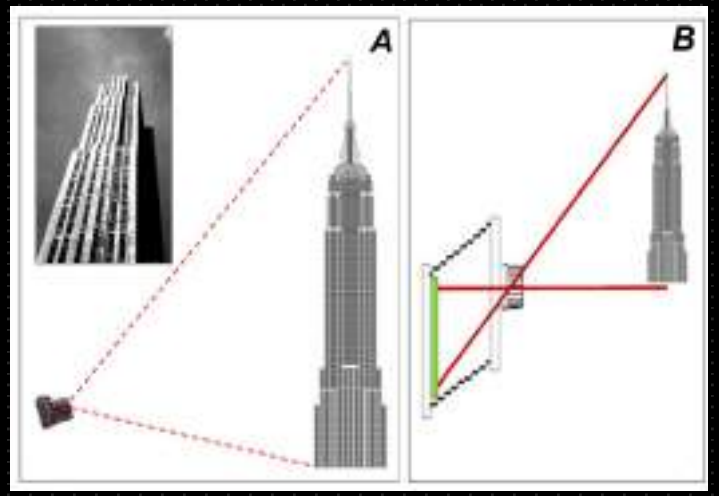
- The easiest and cheapest camera between the professional ones
- Full Frame Sensor 24x36 mm (35mm)
- Interchangeable lenses
- Direct optical display
- Very Flexible
- More expensive and complex to use than a compact, mirrorless and Bridge (non professional)

# Medium format Camera

- It consists of: Digital back, Camera body, Lens
- Larger Sensor than a Full Frame (eg. Phase One IQ4 100MP Trichromatic, 53.7 × 40.4 mm sensor)
- The individual pixels are larger than a Full Frame
- A larger sensor produce larger lenses, with superior optical quality
- Low light performance is much better (High Iso are fine)

# Large Format Camera

- The term **comes from the big** film size from 4x5 to 8x10' (20,3x25,4cm) attached to a View Camera
- There are not such big digital backs but Medium-format digital backs can be adapted to fit large format cameras or scanning backs (which scan the image like a flat-bed scanner)
- View camera displacements can be utilised to adjust and correct the perspective and allows to control the convergence of lines.
- The movements of a view camera include: Rise and Fall Shift, Tilt, Swing
- Useful for architecture photography and oversize items
- Exclusive lenses
- Very complex to use high professional
- Expensive



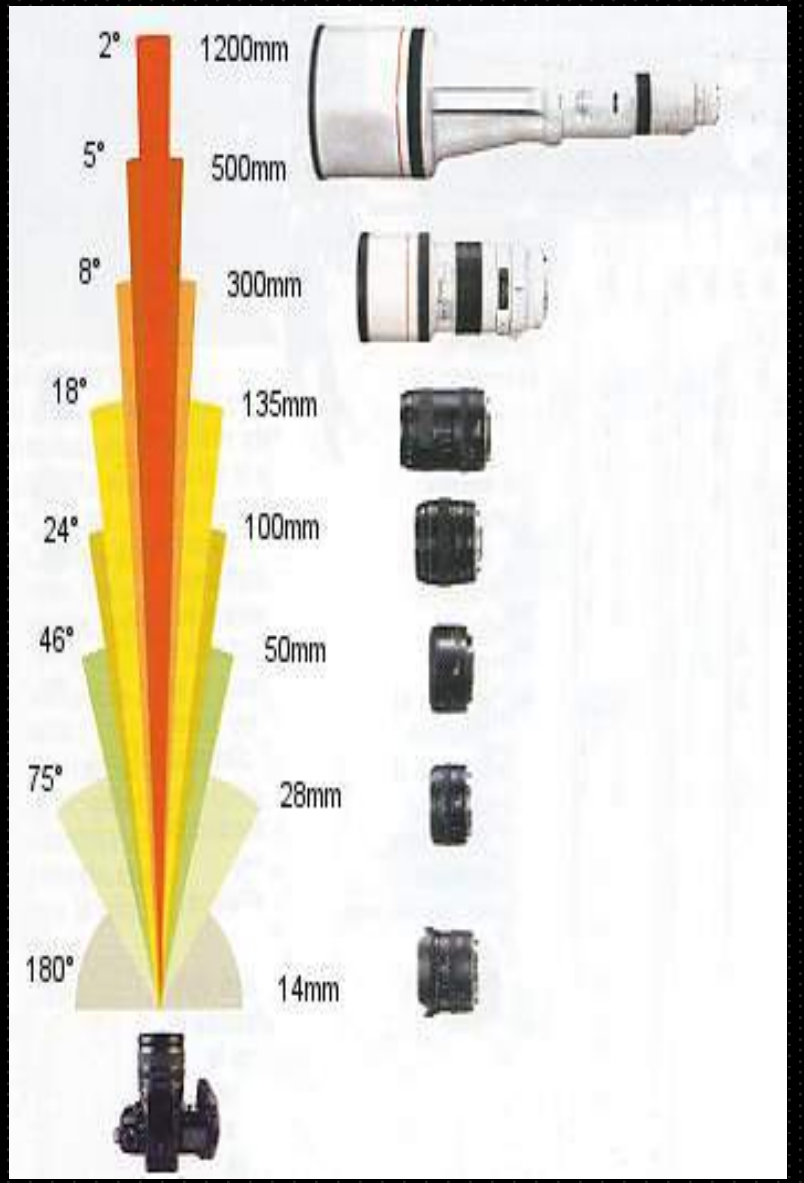

# Lenses

The lenses are named according to their focal length (the distance between the centre of thr lens and the sensor).
There are three macro categories of lenses:

- **Wide-angle** lenses: allow shots with a wide angle of view. The focal length is less than 50mm

- **Standard** lenses: they are those lenses that capture with a visual angle similar to what a human eye can observe. The images are reproduced practically without deformation and their proportions are not distorted. The focal length is usually between 50mm and 80mm (it depends on the size of the sensor). Thanks to their reliability, **these are the lenses most used in cultural heritage photography**. Especially in their "macro" version that allows to be able to focus on a much shorter distance from the subject than a normal lens

- **Telephoto** lenses: those lenses resume within a very narrow angle of view, but they allow to frame subjects that are at a great distance, magnifying the dimensions on the frame. They have a focal length ranging from about 80 mm upwards



# Lighting

- Day Light
- Tungsten
- Flash
- Florescent
- Led

# Tungsten light

- Cheap
- Controllable
- Heat
- Power consumption
- IR/UV

# Flash

- The most widely used
- Controllable
- Works with short exposure times
- Can be hot
- Power consumption

# Fluorescent

- Low power consumption
- Long exposure time
- Spectral anomalies

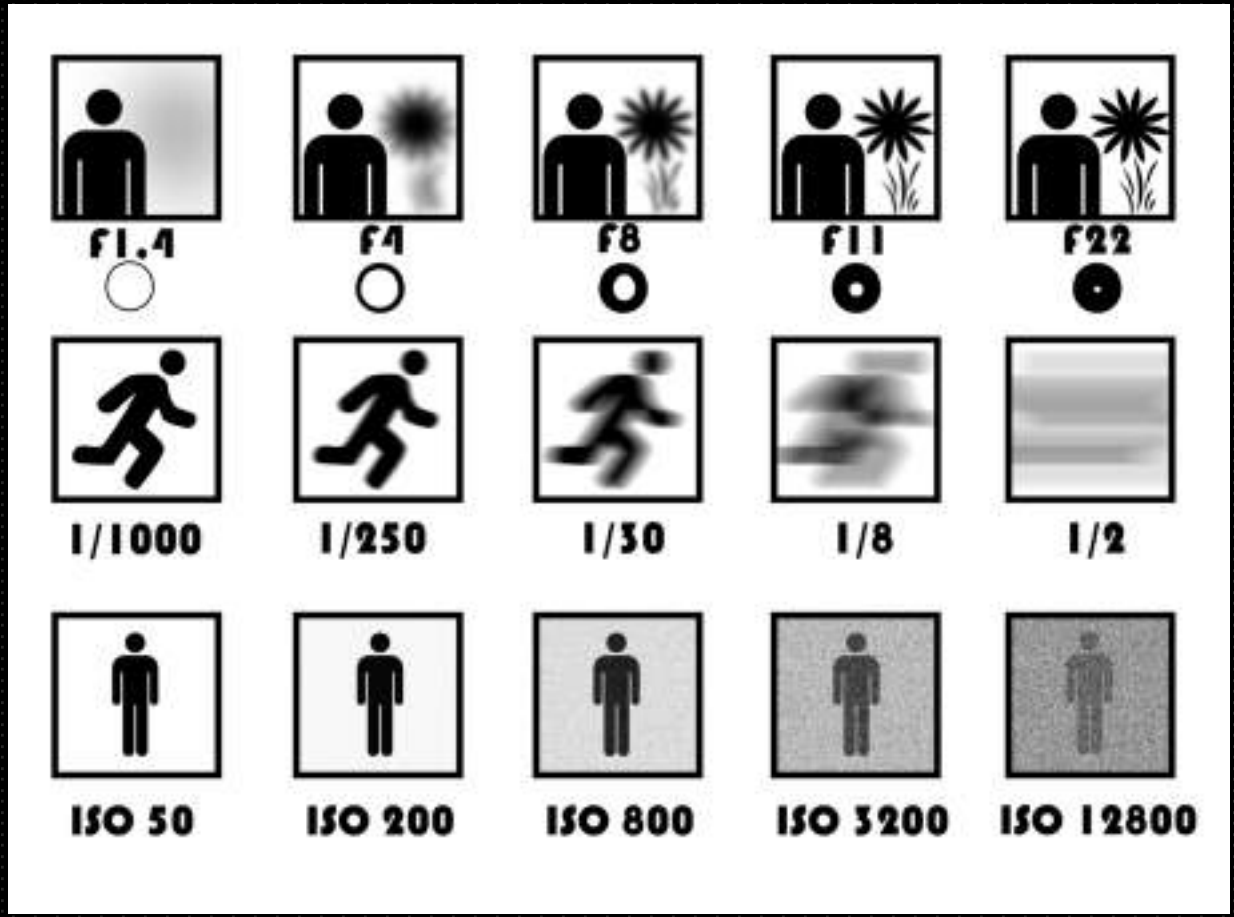
# Led

- Cold
- Low energy consumption
- No UV/IR
- Long exposure time

# Exposure control

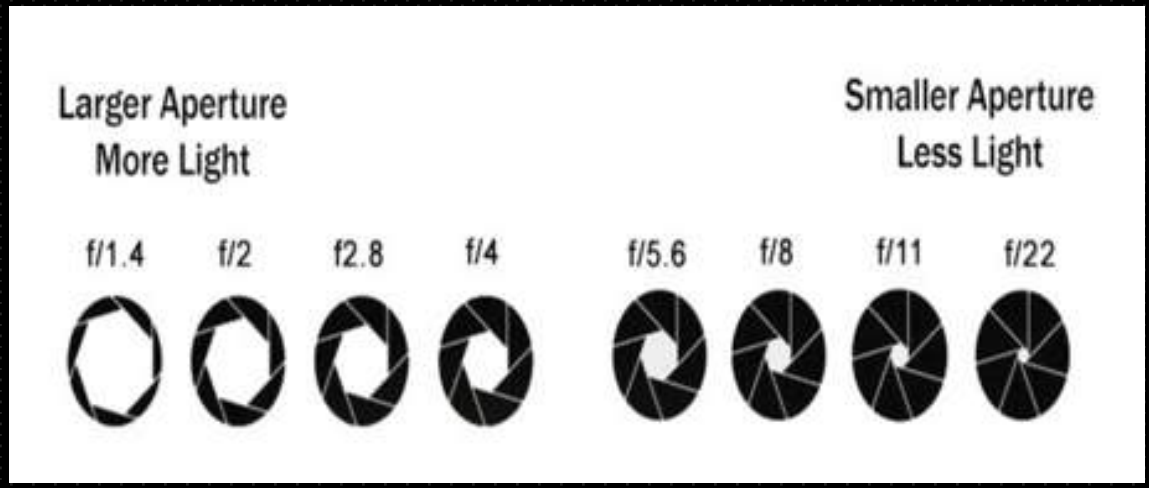
- There are three parameters that determine the exposure of an image in a camera:

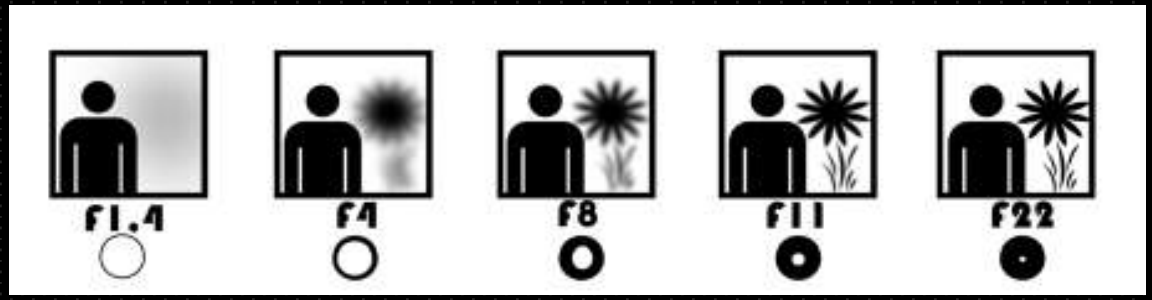
- Aperture
- Shutter speed
- ISO sensitivity



# Aperture - Depth of field

- Aperture is the opening in a lens that allows light to pass to expose the digital sensor. The aperture is measured in f-stops; a small f-stop like f/1.4 is a wide opening, a large f-stop like f/22 is a very small one
- The depth of field is the distance between the nearest and the furthest objects giving a focused image
- In general, a large depth of field is achieved by small apertures. Using a large aperture, the camera draws the central figure sharply, while everything in front of and behind appears out of focus



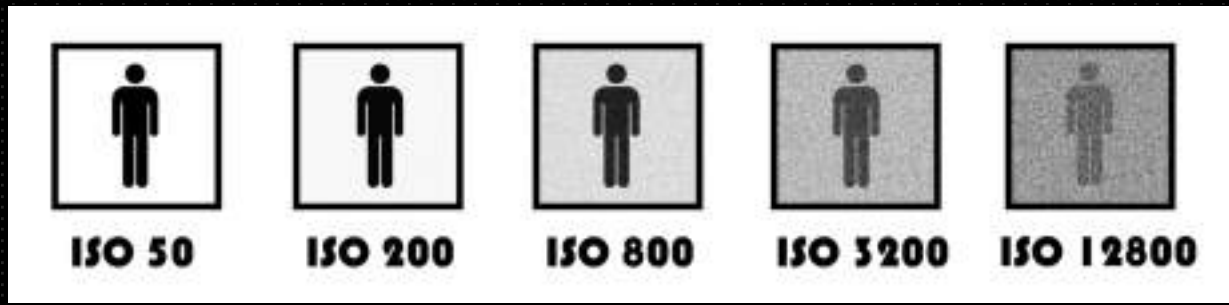



# Shutter Speed – Motion Blur

- Is the time during which the shutter remains open to allow light to reach the sensor. The longer it is, the more light comes
- In a long photographic exposure, the subject's movements (or camera shake) can be captured. To avoid "motion blur" it is better to use a shorter exposure
- However, Using a very short exposure with flash light could not sync with the flash and could capture in the image the shutter closing

# Iso Sensitivity - Noise

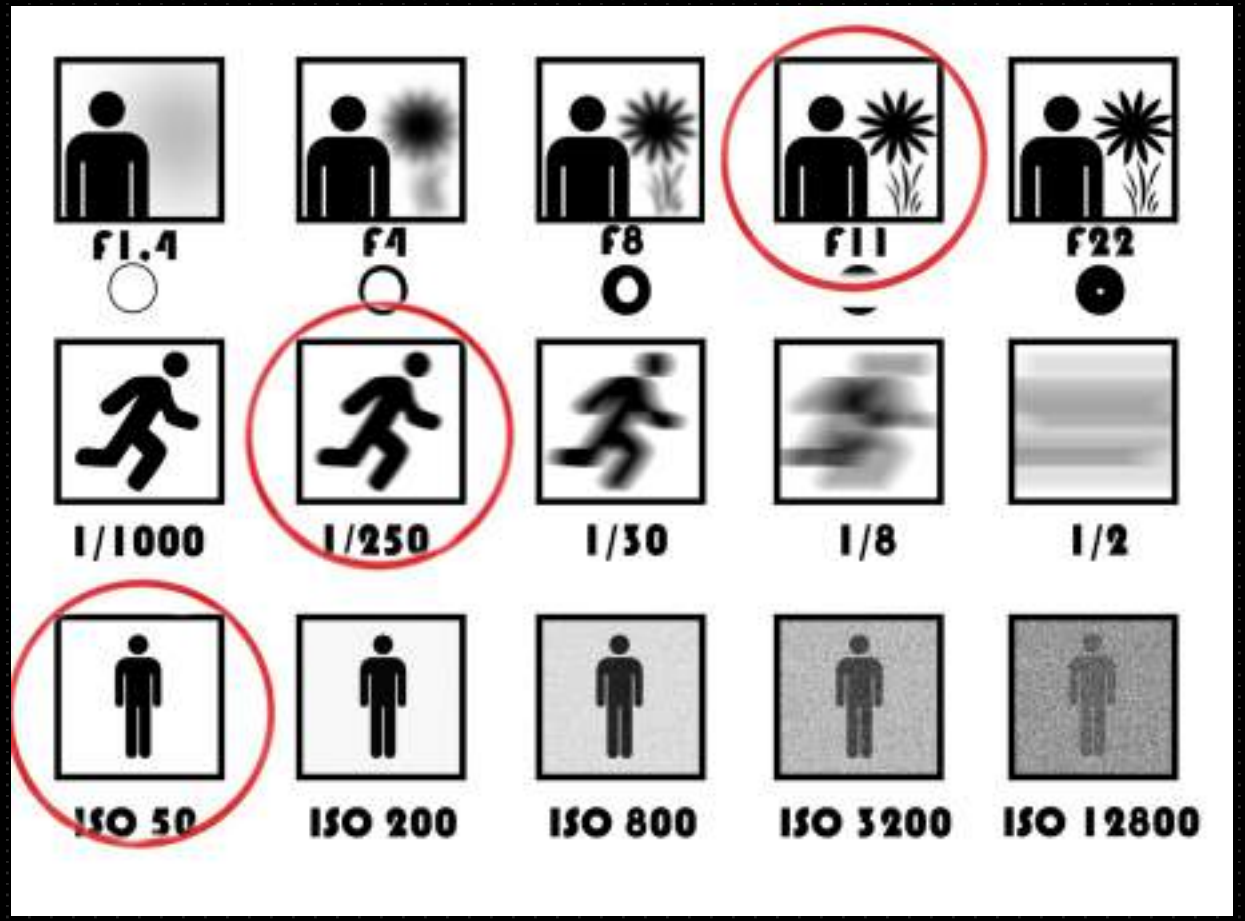
- It is the sensitivity of the sensor to light. The higher it is, the more light is impressed
- using high ISO could create a noise in the image, that becomes very visible in the lowest quality cameras
- If possible, it is always good to keep ISO at minimum



# Best exposure

There is no better exposure, it depends on many factors from the light to the lenses we have mounted on the camera.
In general in cultural heritage photography in a photographic studio with a controlled lighting system, these are the best settings:

- A smaller opening to have a good depth of field, but not too small in order to avoid diffraction
- An exposure time between 1/80 and 1/250 (depending on the lighting system)
- ISO sensitivity at a minimum



# Scanners

- A scanner can handle only  2 dimensional items
- Fast and cost effective
- the reproductions can be made per opening (2 pages per scan)
- Best scanners produce high quality images
- Easy to use and less chance of errors than a camera
- Ideal for mass digitisation
- limit the size of the items to be digitised
- it is generally not possible to change the capture parameters
- There could be problems of conservation linked to the presence of glass and when books do not have to lie open at 180°

# Digitisation

Different types of items to be imaged

# Printed Books

# Manuscripts

# Manuscripts

# Manuscript Digitsation Tools

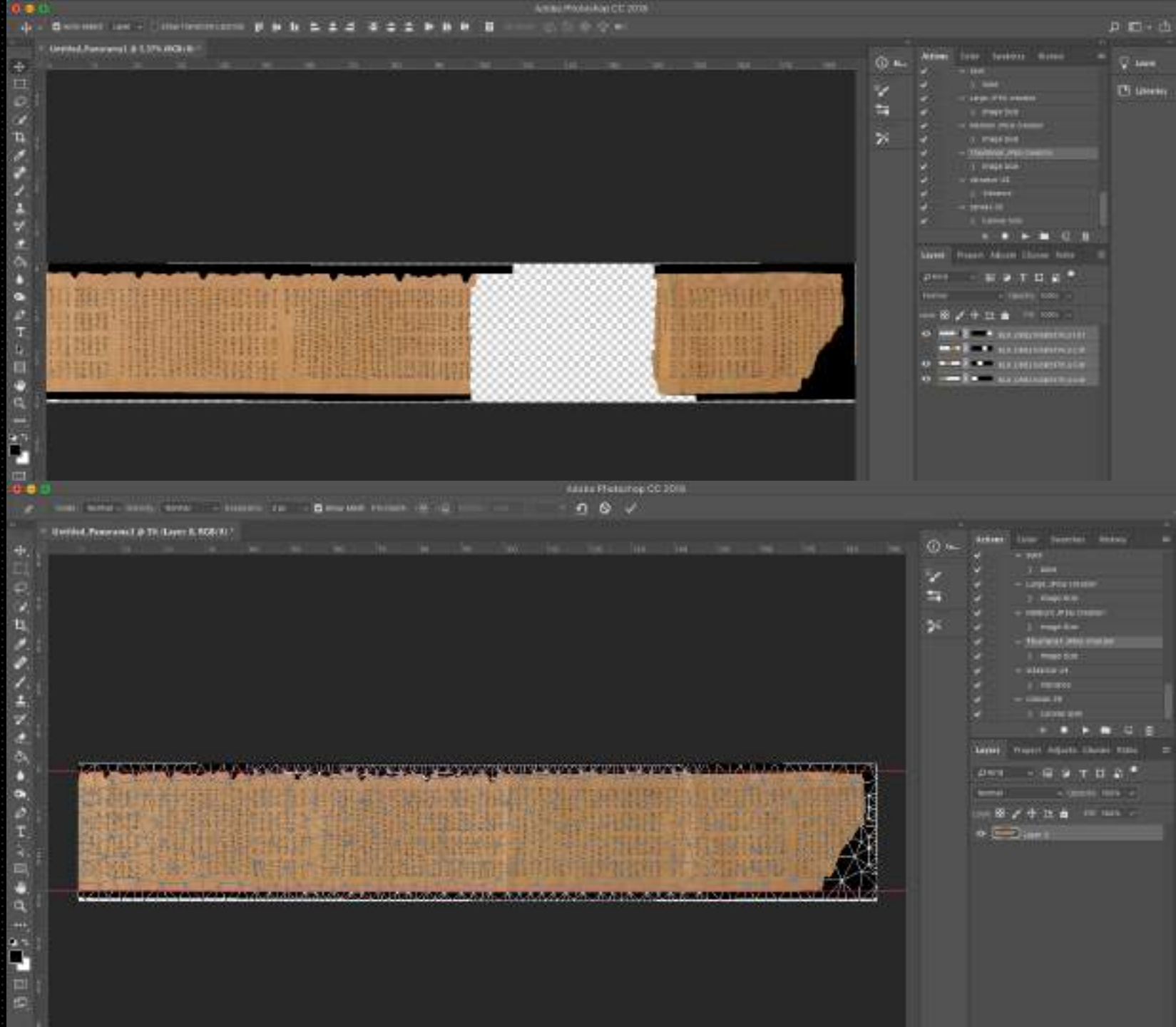
# Copystand

- Free standing
- Desktop
- Wall mounted
- With or without attached lighting

# Scrolls

# Stitching

- Photomerge (Photoshop)
- Hugin (Open source)
- AutoPano (Open source)



# Small 3d objects

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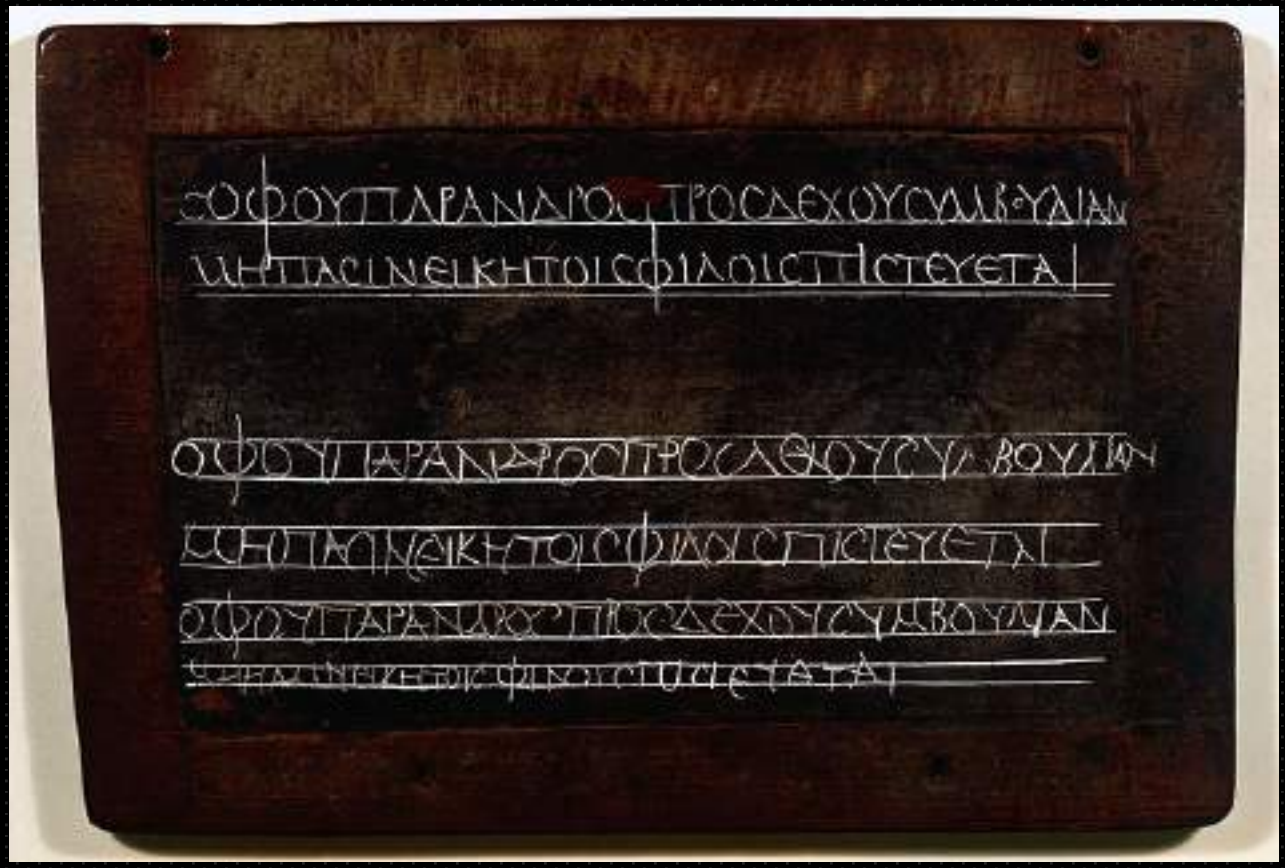

# Pints and drawings

# Maps and Oversized items

# Preparing and Handling originals for imaging

- The digitisation process increases the amount of handling of an item, which can increase the risk of damage
- Each item prior to imaging must pass the assessment of conservatives who may consider the item to be in a green / amber / red state of preservation
- In the event of a amber state of preservation, the conservator will provide the photographer with all the information relating to the issues of the item and if necessary assist the photographer during imaging
- In case of red state of conservation the item cannot be digitised unless a restoration is done first. This is a decision involving conservators and curators

# Basic conservation rules during the imaging

- Wash hands frequently with soap and dry them before touching any item. Gloves are not required: they cause the fingers to lose sensitivity and, in case of cotton gloves, they can leave the fibres on the item
- Turning the folios of a manuscript must be done slowly and trying to flex the leaves as little as possible. Pigments and inks could be no longer firmly attached to the parchment/paper
- Avoid sudden movements that could tear the pages.
- If the binding is tight, use the cradle and do not force the opening to capture writing into the gutter
- Food and drinks are not allowed in the studio

# Image Quality control

- It can be done by the photographers (in the case of a few images) or by the Digitization officers (when working in mass digitisation projects)

  The most typical issue during QC are:

- File name
- Order of the files
- Orientation of the image
- Completeness of image / cropping
- Pages missing
- Readability/Resolution
- Sharpness
- Image corruption
- Sensor spots
- Lighting

# Museum and Monuments Photography

# Pietà (Michelangelo)

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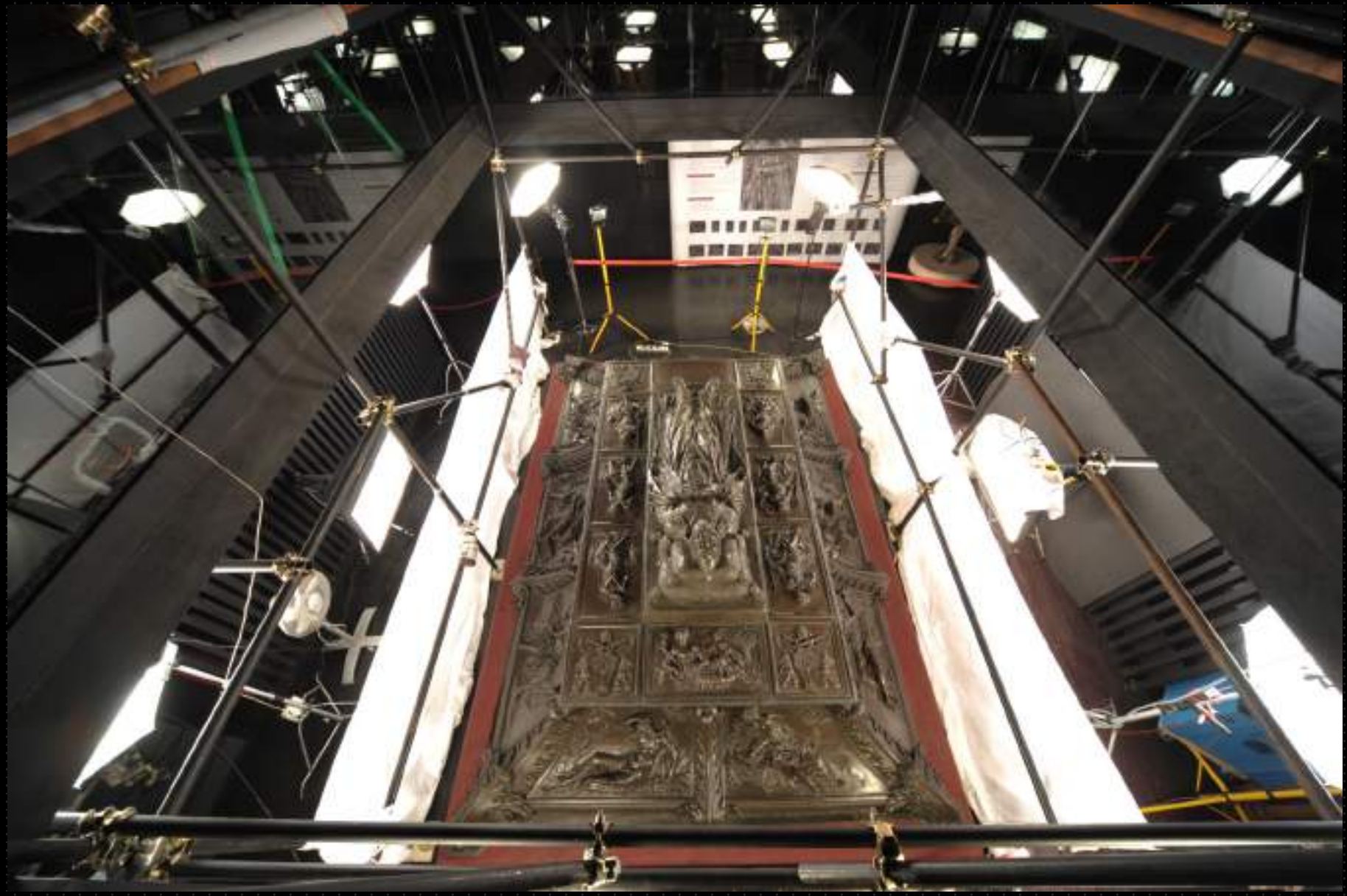
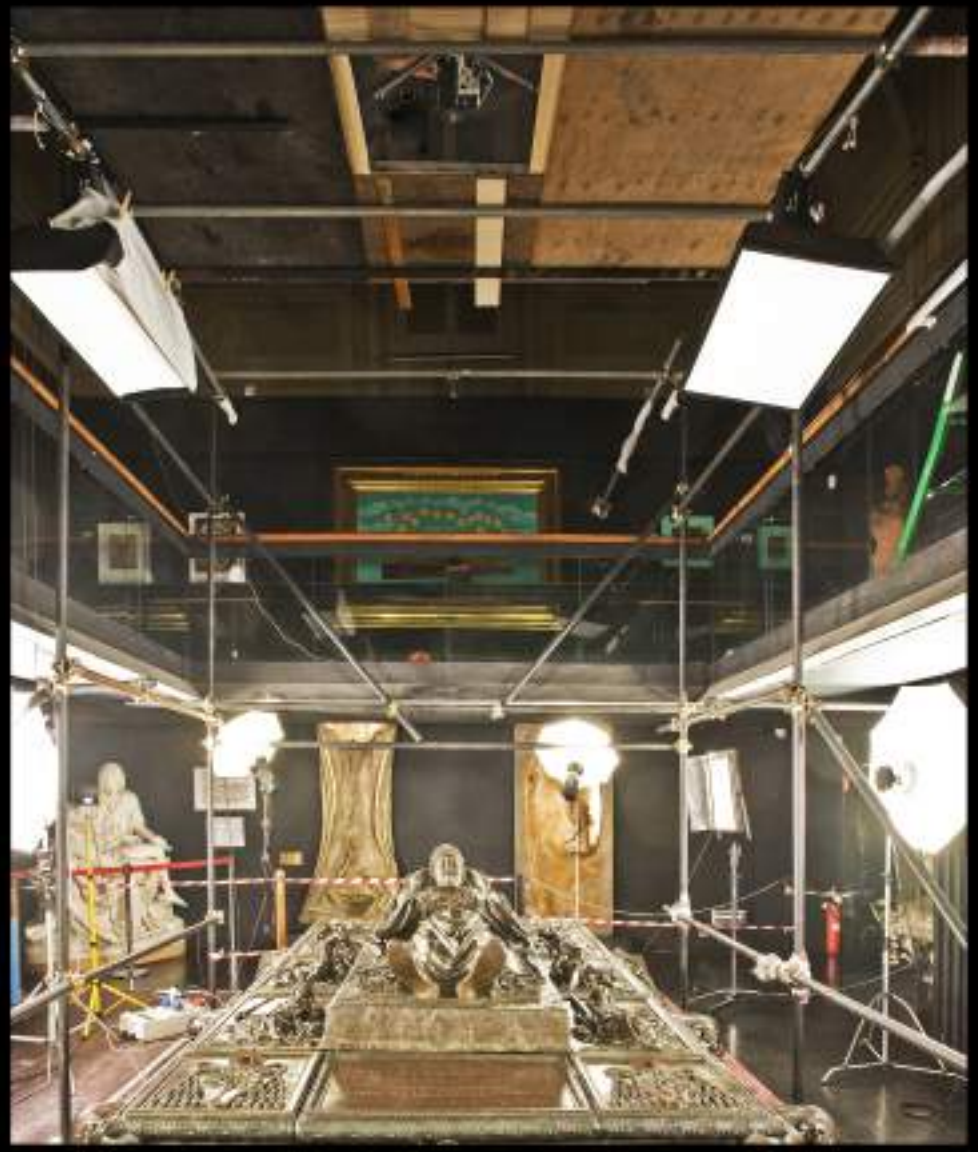
# Moses (Michelangelo)

# Tomb of Pope Sixtus IV (Antonio del Pollaiolo)



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# Some tips to do photography by your own

- If you shoot indoors and you can't use the flash, bring a tripod with you
- Use long exposure times rather than high ISO
- If your camera is not professional but you need to photograph a large item, do not try to capture the whole item in a single shot, get closer and take more shots, then stitch them together
- If the ink has faded, try raking light
- If you are outdoor, not all hours of the day are the same morning and evening have the best light