

A CAMERA HANDBOOK

Filippo Fanciotti



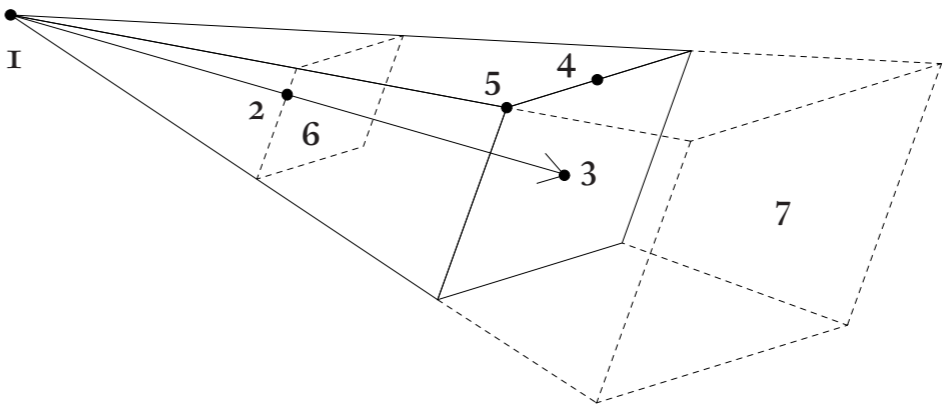
The Music Lesson
Johannes Vermeer
1662-1665
oil on canvas
74.6 cm × 64.1 cm
Royal Collection, St. James's
Palace, London

The Vermeer's Music Lesson,
camera variation: reverse shot
Filippo Fanciotti
november 2017
Rhino, V-ray, Photoshop
1465 x 1465 pixels
EPFL, ENAC, LAPIS

How to frame a scene is as much relevant as the scene itself, including all the choices concerning a certain point of view, a particular focal length, the shape of the layout and so on. This apparatus involves decisions supporting the story told by a painting, enhancing effects linked to a particular artistic genre or movement, a pictorial technique or an expressive intent.

Since these settings are real choices in the real world, it becomes extremely important to be conscious of the available options provided by rendering softwares when shifting to the virtual dimension - from how to chose a layout to how to set up a camera - since not taking any choice is a choice itself, simply taken by the programmers of that engine when called to define the default settings.





- 1. Camera viewpoint.
- 2. Camera location (can be used to move the whole camera widget).
- 3. Target point
- 4. Roll control (to tilt the camera).
- 5. The field of view/lens angle
- 6. Near clipping plane (nothing visible "before")
- 7. Far clipping plane (nothing visible "after")

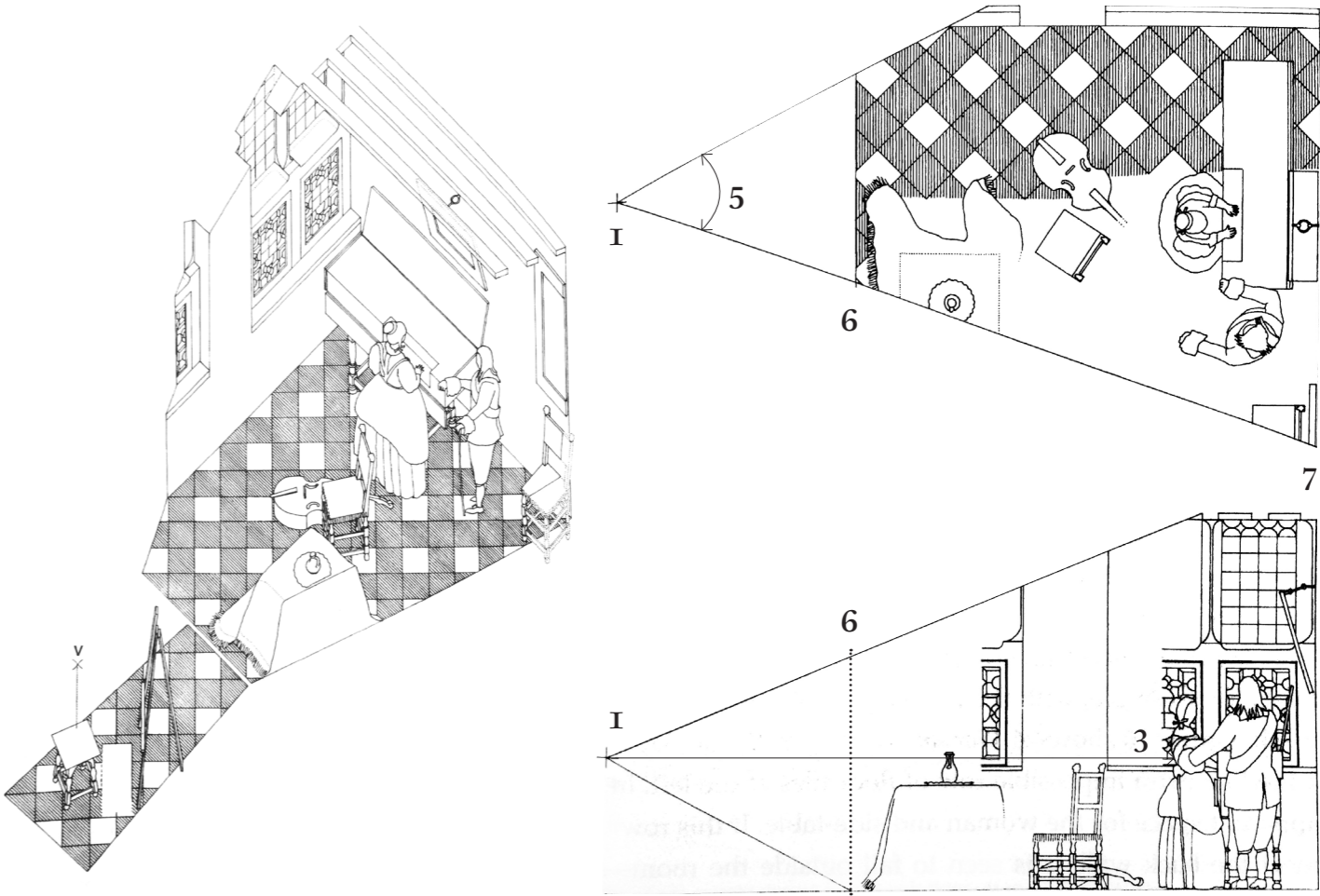
Any numerical camera is composed by a series of elements recreated in order to provide a realistic control of it.

Besides the viewpoint (1. the place where you are looking from) and the target (3. the point you are staring at) there is a widget to control the rotation of the camera -so how to tilt it (4.), another one to

open up or decrease the field of view, so manually changing the lens length, as well as a pair of ideal surfaces delimiting the beginning (6.) and the ending (7.) of the visible portion of space captured by the camera.

Mind that the Physical camera - e.g. so named in Vray - is also the tool to control the light

exposure of a scene, being the rendering a simulation of the photography act happening in real life [We'll face this topic in the lighting handbook].

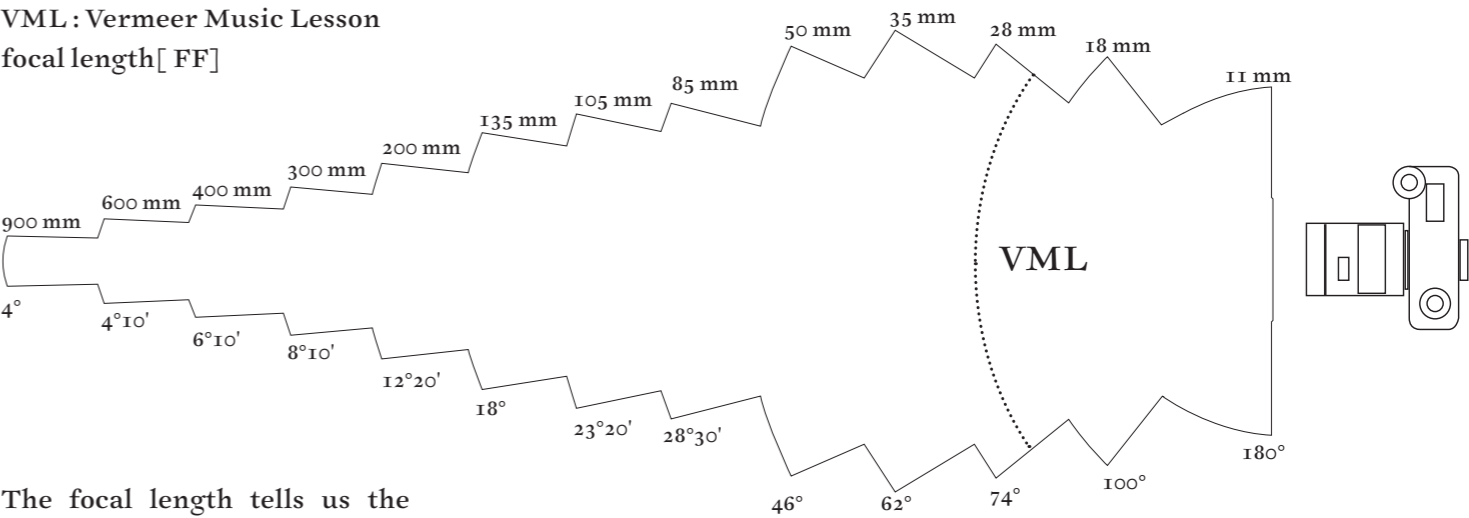


drawings from "Vermeer's camera, uncovering the Truth Behind the Materpiece", Philip Steadman

lens length



VML : Vermeer Music Lesson
focal length[FF]



The focal length tells us the angle of view - how much of the scene will be captured - and the magnification - how large individual elements will be -.

A proper management of the lens length is necessary not only

to include portions of space otherwise not visible with, for example, a lower angle, but also to emphasize a personal expressive intent (i.e. if used in an interior, by radically

enhancing depth and distorting nearby objects, a very short focal normally gives a sense of anxiety, almost of vertigo, to the viewer).



22.5 mm (original)



30 mm



40 mm



18 mm



10 mm



5 mm (previous page)

camera rotation



A camera rotation can add a lot of dynamism to your scene, specially if combined with a proper lens length (see previous chapter).

Although this kind of shot has been long more used in the cinematography environment - i.e. the *Dutch Angle*, a shot in which the camera angle is deliberately slanted to one

side, used for dramatic effect to portray unease, disorientation, madness, etc. - it is not unusual in the history of art as well, in fact you may notice that the Vermeer Music Lesson is already a camera rotation case, which we straightened only for educational purposes.



Inception, Christopher Nolan, 2010, Warner Bros (US, UK)



0° | lens legth 22.5 [mm]



25° | lens legth 22.5 [mm]



341° | lens legth 10 [mm]



Basically, in a rendering engine the type of camera determines how the scene (what you see, the model) is projected onto the screen (once you render it to get a bidimensional projection). The behavior of the rays cast into the scene can change according to the type of camera used.

Besides the standard camera (usually a [pinhole](#)), there are other types of camera, each one working with different lenses and, therefore, rendering a different projection of the scene. The most common are:

- Spherical camera (1): the lenses has spherical form.



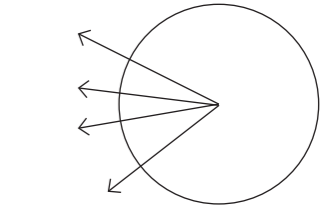
spherical camera ov. FOV 45°



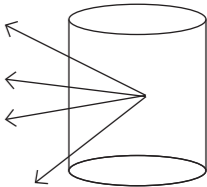
cylindrical camera ov. FOV 20°

As shown in the following examples, with override FOV setting the renderer overrides the Field of View angle. (because some camera types can take FOV ranges from 0° to 360°.) This kind of camera can be useful to make [HDRI](#) like images.

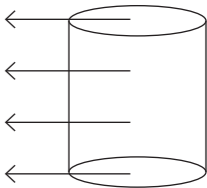
- Cylindrical(point)(2) all rays cast from the center of a cylinder; - z axis (vertical direction): the camera acts as a pinhole camera - x,y axis (horizontal direction): spherical camera.
- Cylindrical (ortho) (3) - Like the previous one, but with the camera acting as an ortho view in the vertical direction.



1



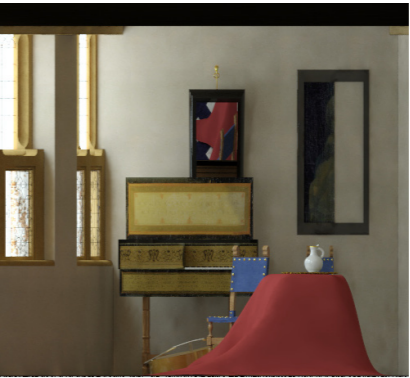
2



3



spherical camera ov. FOV 90°



cylindrical camera ov. FOV 60°

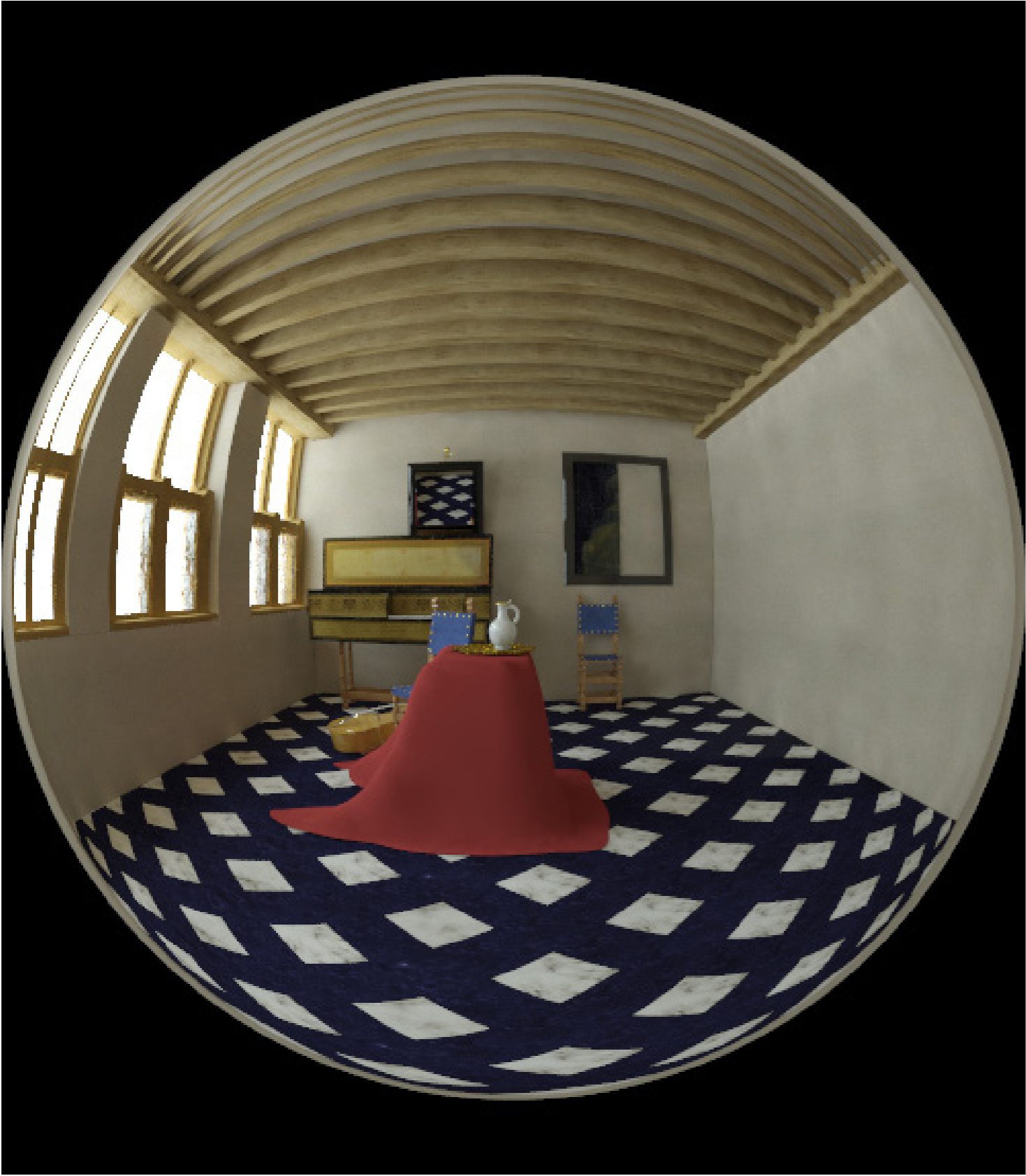


spherical camera ov. FOV 180°



cylindrical camera ov. FOV 100°

Fisheye lens



Fisheye lenses are exasperated wide-angle lenses able to produce strong visual distortion to create wide panoramics or hemispherical images. "Instead of producing images with straight lines of perspective (rectilinear images), fisheye lenses use a special mapping (for example: equisolid angle), which gives images a characteristic convex non-rectilinear appearance."

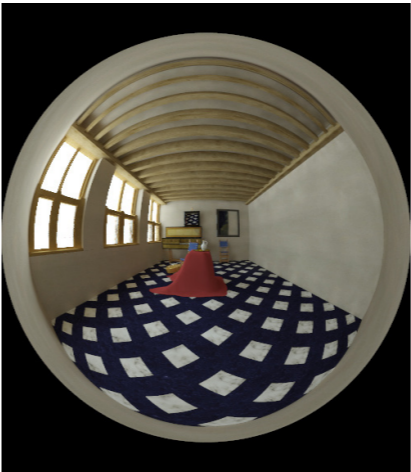
[source](#)

Fisheye captures the scene as if it is normal pinhole camera pointed at an absolutely reflective sphere which reflects the scene into the camera's shutter.

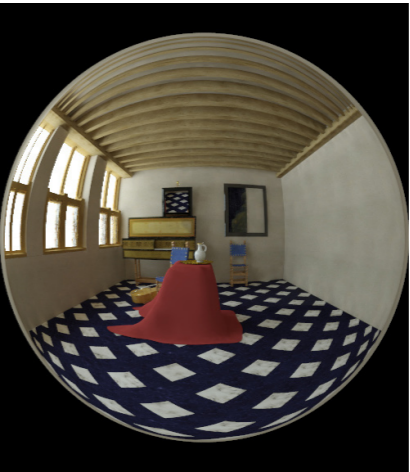
curve - fisheye main parameter - contorts the way the rendered image is warped. A value of 1.0 corresponds to a real world Fish-eye camera.



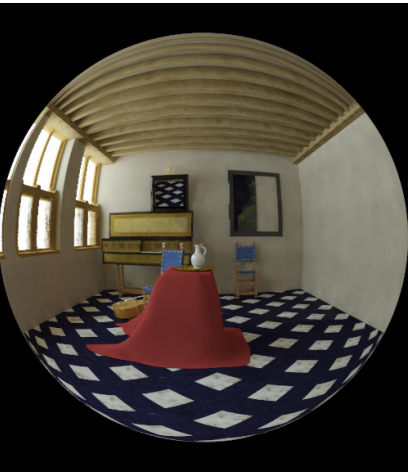
2001 A Space Odyssey, Stanley Kubrick, 1968, MGM (US, UK)



fisheye ov.FOV 20,dis.t 2.0, crv 1.0



fisheye ov.FOV 20,dist. 2.0, crv 0.5



fisheye ov FOV 20, dist 2.0, crv 0.1

Box camera



"Box – Six standard cameras placed on the sides of a box, generating a vertical cross format image.

This type of camera is excellent for generation of environment maps for cube mapping. The Box camera can also be used for generating irradiance maps for GI: First you would calculate the irradiance map with a Box camera, then save it to a file and

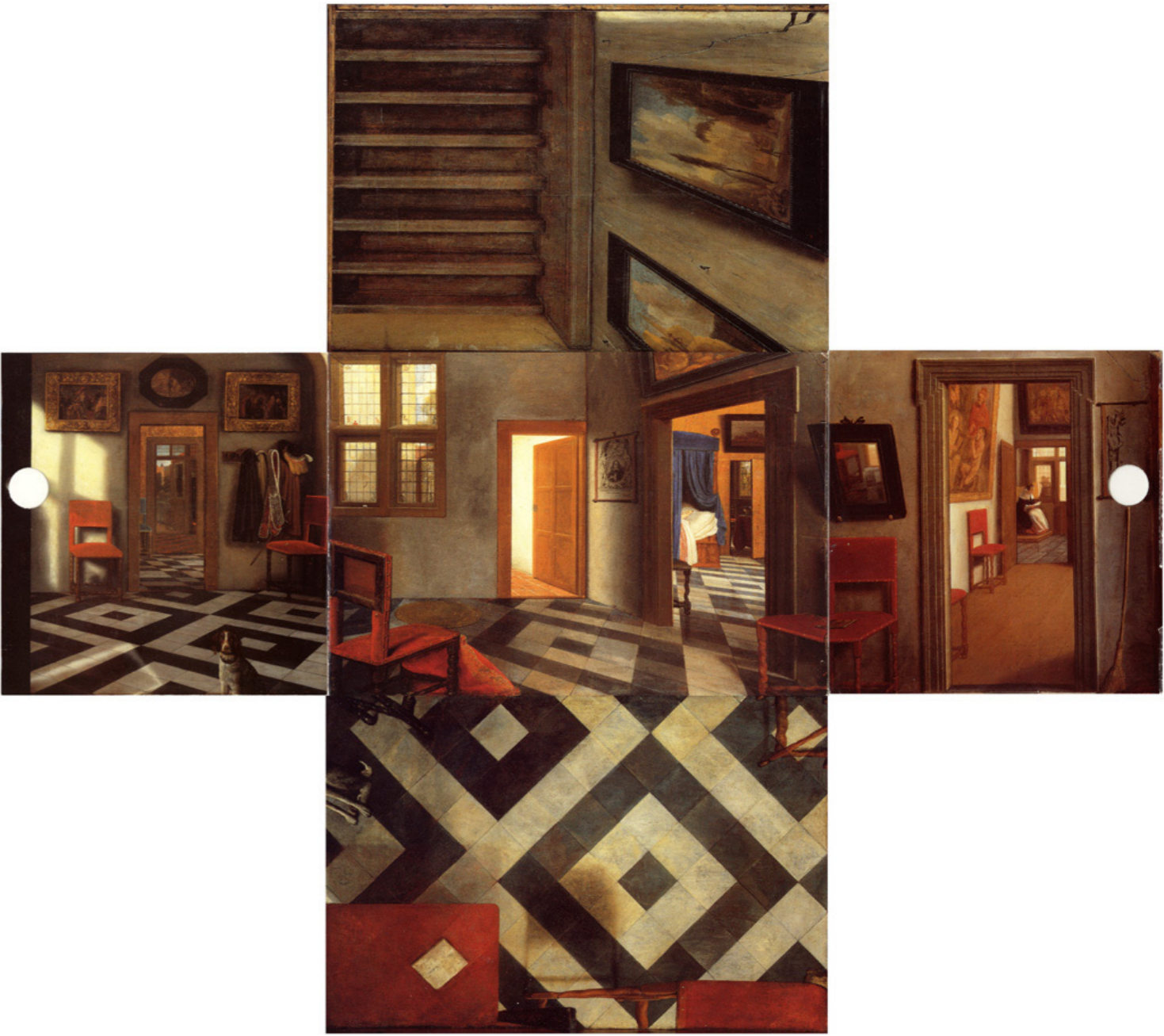
finally reuse it with a Default camera that can be pointed in any direction."

[source \(chaosgroup.com\)](http://chaosgroup.com)

Although it is a very specific feature of software like Vray, the Box camera turns into something extremely interesting looking at the notorious Peepshow by Samuel Van Hoogstraten and imagine

than that complex process can be obtained just turning on this option...

Peepshow faces with Views of the interior of a Dutch house Samuel Van Hoogstraten 1655-60 National Gallery, London



camera location and target



In the representation of architecture it is customary that the position of the eyes and the gaze coincide, so that the vertical lines do not go toward a vanishing point and, consequently, are straight as in an orthogonal projection.

Although this is really a good norm, it should not be taken as an incontestable principle, since moving around the scene and changing the target can lead to other narrative lines, otherwise excluded in a more classical representation.

We can find an exceptional example of combined management of point of view,



Vertigo, Alfred Hitchcock ,1958, Paramount (US)

zoom (thus focal length change) and camera position in the dolly zoom (or vertigo effect), invented by Alfred Hitchcock in

his notorious Vertigo.



z loc. 5 | z target 5 | lens 22.5



z loc. 5 | z target 250 | lens 22.5



z loc. 5 | z target 25 | lens 10



z loc. 270 | lens 10



z loc. 270 | lens 22.5



reverse shot



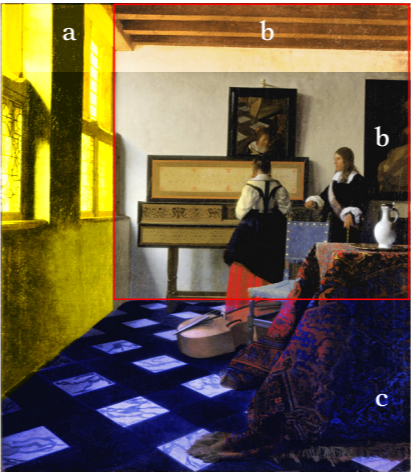
The center of the canvas is neither coinciding with the vanishing point neither with any relevant geometrical element -....



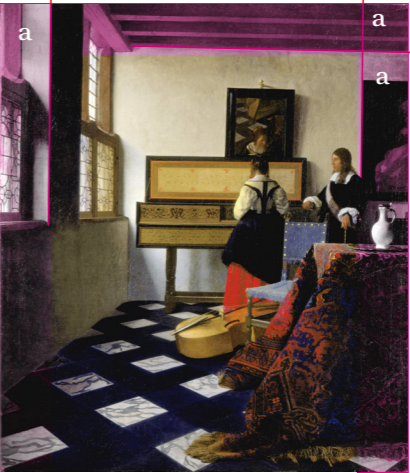
The vanishing point is displaced from the center of the canvas, focusing the apix of the drama on the arm of the lady, intended to play at the virginals.



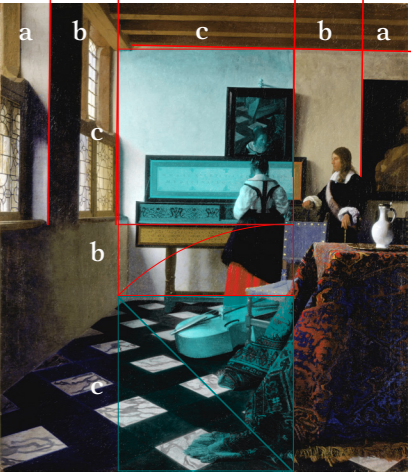
The vanishing point is displaced from the center of the canvas, I decided to let it coincide with the edge between the wall and the window on the right, therefore enpoewing that line.



the front wall occupies the space between the pavement and the left wall, inscribing the core of the scene in a perfect sqaure.

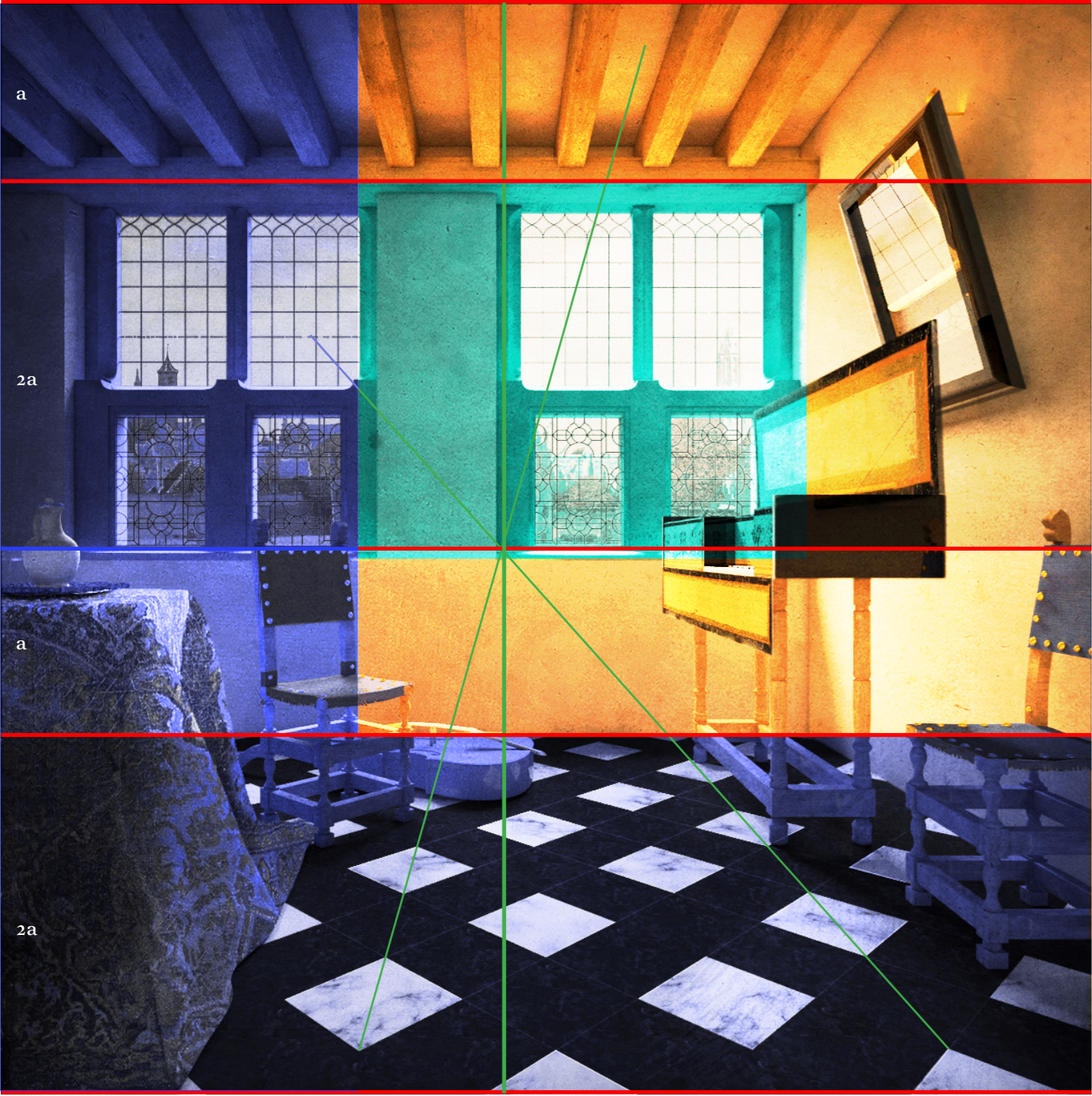


as in a scenic stage, three lines have the function of framing the scene, so letting the observer gradually approach the representation: on the left the edge of the window, on the right the border of the Caritas Romana painting, the last wooden beam of the ceiling above.

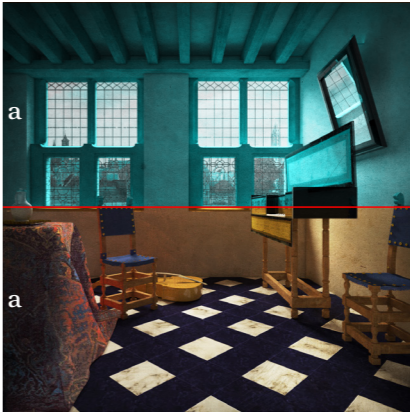


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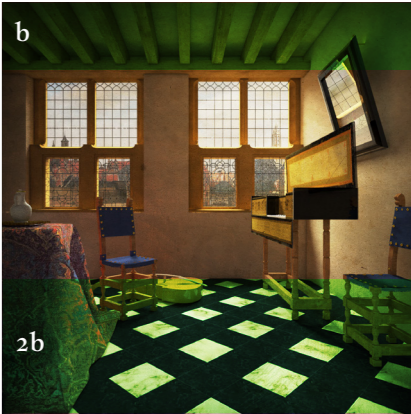
Gestaltic proportions



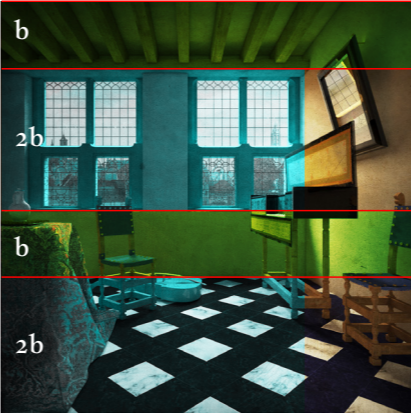
The vanishing point is - like in Vermeer's Music lesson - not at the centre of the scene, but a bit shifted. I decided to let it coincide with the edge between the wall and the window on the right, therefore enpowering that line.



The other edge of the window divides the image in two equal parts, so ...



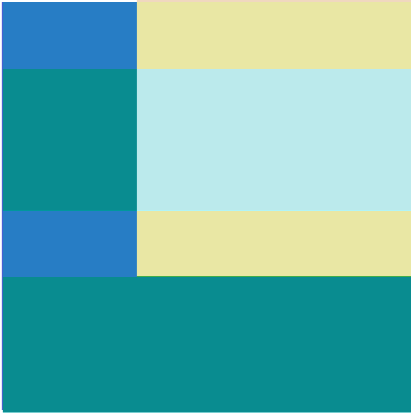
The proportion between the visible parts of ceiling and pavement is central in the composition : here the floor is twice the ceiling.



the "b+2b" proportion is repeated twice, theredore generating a rhythm between ceiling, windows, wall and pavement.



lthe limit of the pavement and the beginning of the other window are equally distant from the border of the drwing, thus generating a square including the core of the scene.



main areas/lines of the composition

