

UGED 1533

Linear Perspective

Deviations



[The Interior of the Grote Kerk at Haarlem \(1636-7\).](#)

[Pieter Saenredam](#)

The Column Problem

So far, in our discussion of linear perspective, the basic setup was that the perspectival image is the intersection of the picture plane and the cone of light rays reflecting off the physical scene.

As such, the perspectival image is an absolutely faithful imitation of the physical scene. Namely, an appropriately situated viewer of the picture sees an image that is optically *identical* with what they would see had they been physically in front of the actual scene at a correspondingly prescribed distance.

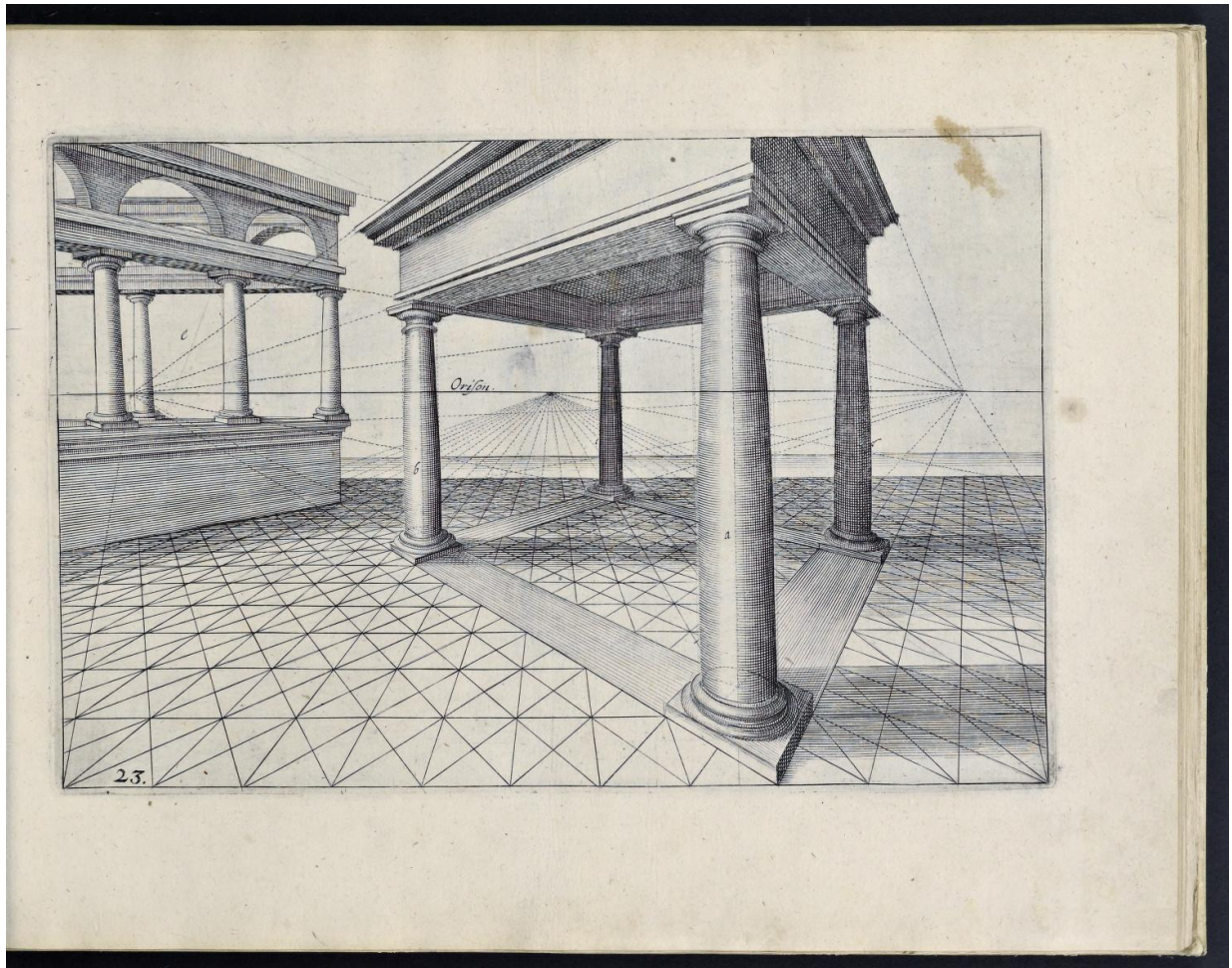
We now examine what might happen when the viewer's eye is not fixed in space, in the context of what's commonly known as "The Column Problem."

Suppose we wish to depict a row of evenly spaced Greek columns parallel to the picture plane (i.e. front facing). Two rules of linear perspective relevant to this construction are as follows:

1. Physical ellipses project to pictorial ellipses.

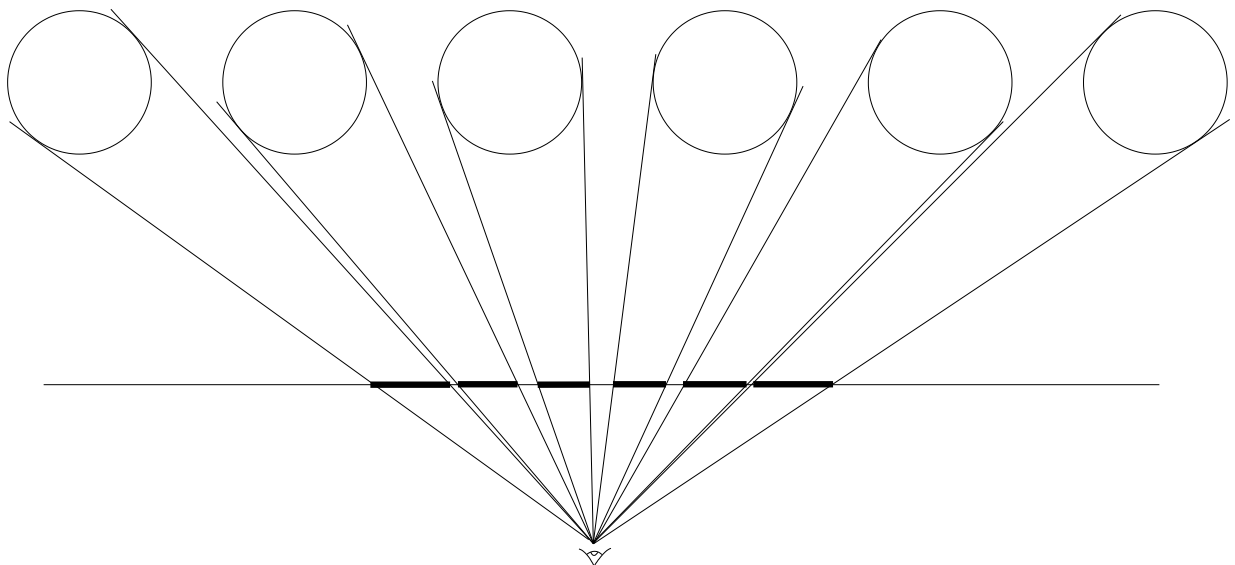
2. Linear perspectival projection preserves tangency. In other words, if a physical line is tangent to a physical object, then their pictorial projections are also tangent.

From these two rules, it may be deduced that the bases of the columns project to ellipses which becomes more and more elongated and slanted towards the left and right ends of the picture.



Perspective Hans Vredeman de Vries

Moreover, the projected images of the columns would appear wider and wider, and spaced closer and closer, towards either end of the picture plane.



All of that is perfectly fine with regard to the rules of linear perspective, and would in fact create the correct optical illusion, provided that the spectator views the painting ***from a uniquely prescribed height and distance with one immobile eye.***

In reality, that is almost never the case, and to a casual viewer strolling by, the columns would just appear distorted.

This phenomenon has been a subject of serious consideration since the Renaissance, by such eminent figures as Piero della Francesca and Leonardo da Vinci.

Leonardo studied this problem of distortion to the roving viewer and concluded that it cannot be avoided, unless the picture plane is situated:

...at least 20 times as far off as the greatest width or height of the objects represented.

In otherwords, if you want to incorporate into your painting a row of columns, and you have not either the means or intention of fixing your viewer's eye at one point in space, *and* you want to achieve a convincing visual illusion, then you should consider placing any front-facing row of columns far into the background.

In practice, painters who utilize linear perspective sometimes "break the rules" when it comes to circles and columns. Dora Norton opined in *Freehand Perspective and Sketching* that:

... cylindrical objects, however placed, should be drawn as if for those objects alone... But this does not apply to the straight-line portions of the picture..., nor to the placing of the cylindrical parts, nor to their height. These must be determined in the ordinary way [(i.e. using standard rules of linear perspective)].

Hence, in a painting which otherwise adheres to the rule of linear perspective with absolute precision, the base of a cylindrical column off to the side may be depicted as a level ellipse, instead of a slanted one.



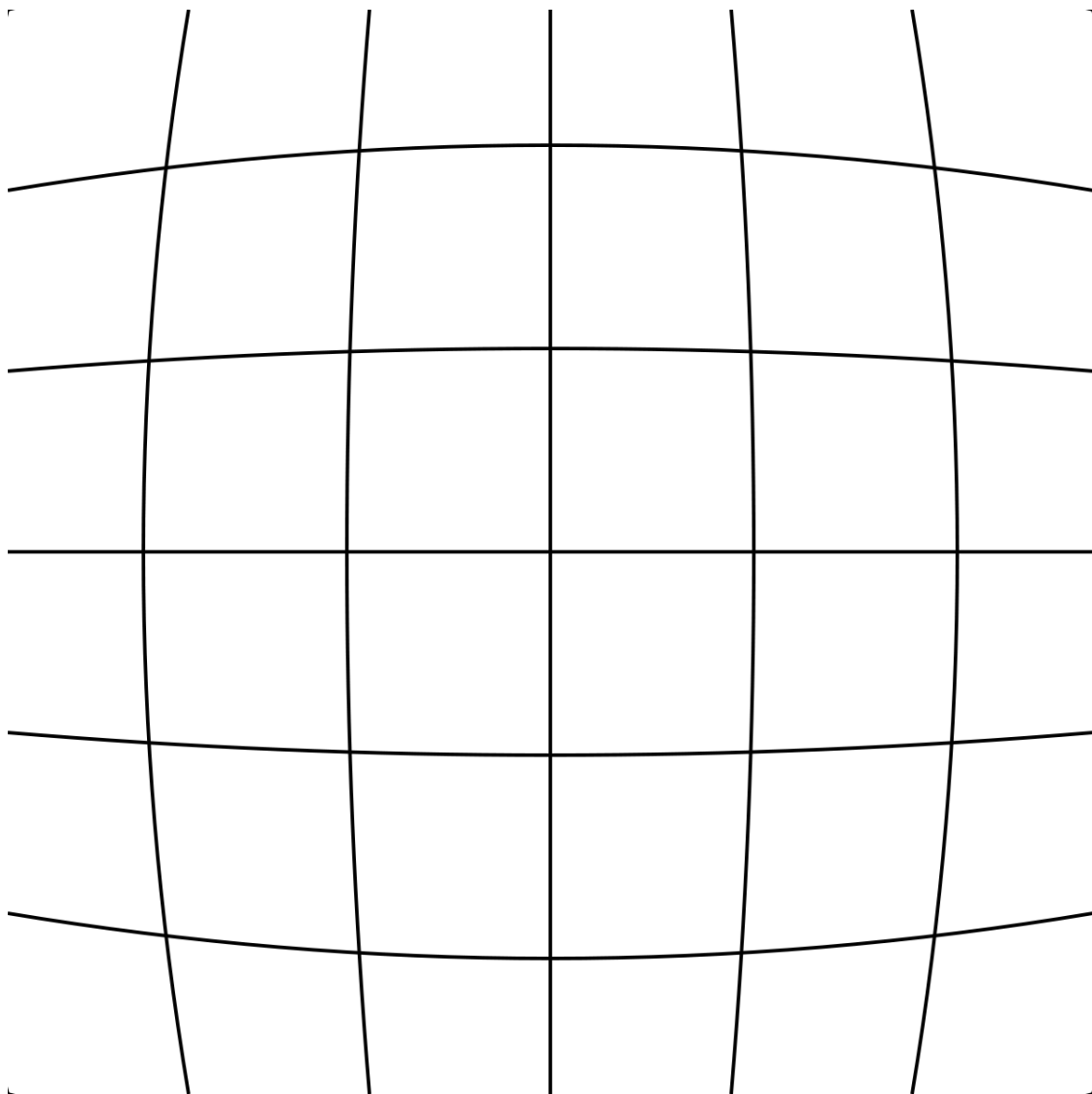
[The Chess Game](#) (1883)

Charles Bargue

Curvilinear Perspective

The basic optical mechanism of the human eye is not unlike that of a camera. The chief difference is that an inverted image of the physical scene is now projected onto the *spherical* (or more accurately quasi-spherical) surface of the retina.

This projection is a type of **curvilinear perspective**. In the eyeball situation, the projected retinal image is subject to **barrel distortion**, where every physical line projects to a line which terminates at a vanishing point (whereas in the case of linear perspective, a transversal line has no vanishing point.)



By [WolfWings](#) - Own work, Public Domain, [Link](#)

In more concrete terms, barrel distortion is demonstrated in Leonardo da Vinci's observation that a long rectangular shape facing the viewer appears to diminish in height towards either end of the field of vision. Likewise, it is barrel distortion at work when a tall building appears narrower and narrower (however slightly) towards the top of our field of vision.

Hence, our visual experience of the world really obeys the laws of curvilinear perspective, even though we may not think that is the case, since the deviation from linear perspective is often slight, and only clearly noticeable in our peripheral vision.

Links

- Antonio Lopez Garcia
 - <https://linusfontrodona.files.wordpress.com/2017/06/antonio-lc3b3pez-lavabo-y-espejo-1967.jpg?w=775>
 - <https://linusfontrodona.files.wordpress.com/2017/07/el-cuarto-de-bac3b1o-the-bathroom-1966-oil-on-panel.jpg>
 - <http://www.timlowly.com/a/lopezgarcia.html>

