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GOPIGO 小汽車：格點圖像算術《色彩空間》時中：立體視覺【一】

2017-07-18 | 懸鉤子 | 發表迴響

假設人類沒有『雙眼視覺』：

Binocular vision

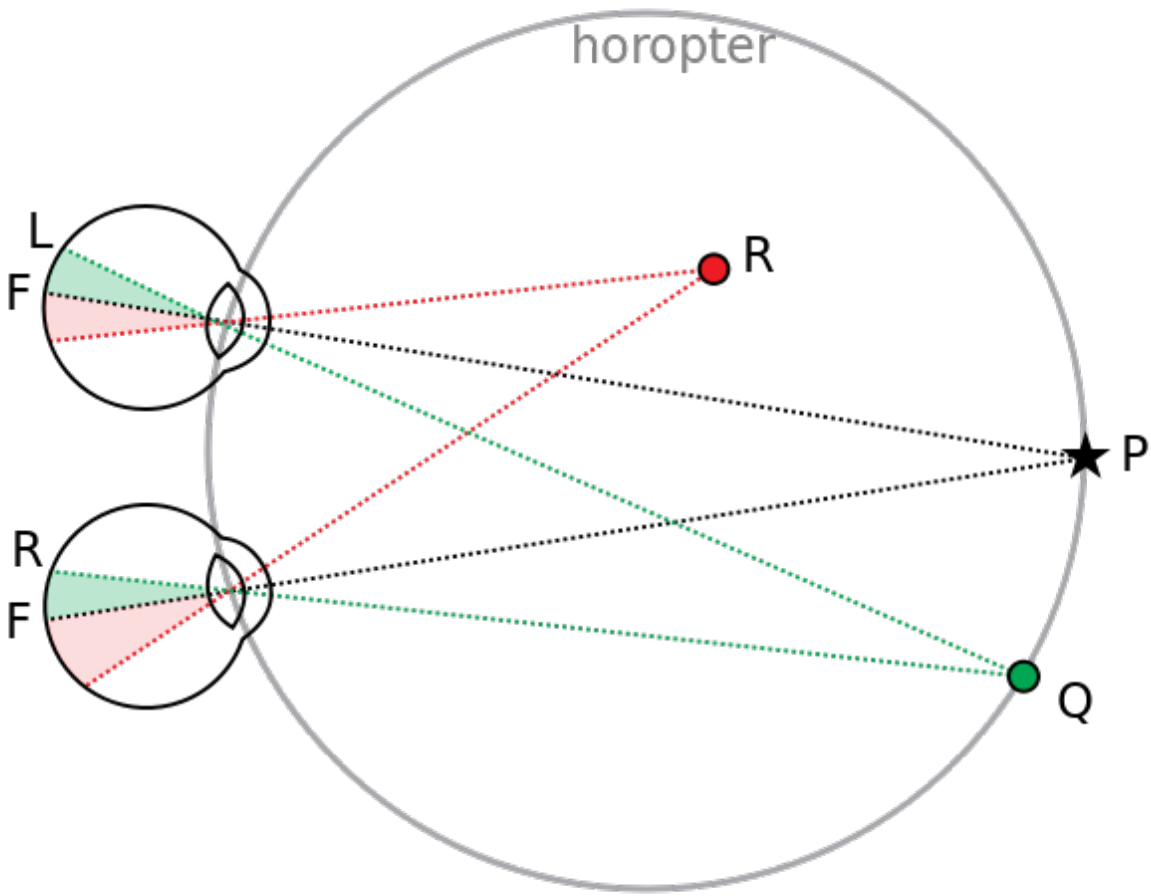
Binocular vision is vision in which creatures having two eyes use them together. The word binocular comes from two Latin roots, *bini* for double, and *oculus* for eye.[1] According to Fahle (1987),[2] having two eyes confers six advantages over having one.

1. It gives a creature a spare eye in case one is damaged.
2. It gives a wider field of view. For example, humans have a maximum horizontal field of view of approximately 190 degrees with two eyes, approximately 120 degrees of which makes up the binocular field of view (seen by both eyes) flanked by two uniocular fields (seen by only one eye) of approximately 40 degrees.[3]
3. It can give stereopsis in which binocular disparity (or parallax) provided by the two eyes' different positions on the head gives precise depth perception. This also allows a creature to break the camouflage of another creature.
4. It allows the angles of the eyes' lines of sight, relative to each other (vergence), and those lines relative to a particular object (gaze angle) to be determined from the images in the two eyes.[4] These properties are necessary for the third advantage.
5. It allows a creature to see more of, or all of, an object behind an obstacle. This advantage was pointed out by Leonardo da Vinci, who noted that a vertical column closer to the eyes than an object at which a creature is looking might block some of the object from the left eye but that part of the object might be visible to the right eye.

6. It gives binocular summation in which the ability to detect faint objects is enhanced.[5]
7. It helps see and analyze 3 dimensional objects which are the ones having depth.

Other phenomena of binocular vision include utrocular discrimination (the ability to tell which of two eyes has been stimulated by light),[6] eye dominance (the habit of using one eye when aiming something, even if both eyes are open),[7] allelotropia (the averaging of the visual direction of objects viewed by each eye when both eyes are open),[8] binocular fusion or singleness of vision (seeing one object with both eyes despite each eye's having its own image of the object),[9] and binocular rivalry (seeing one eye's image alternating randomly with the other when each eye views images that are so different they cannot be fused).[10]

Binocular vision helps with performance skills such as catching, grasping, and locomotion.[11] It also allows humans to walk over and around obstacles at greater speed and with more assurance.[12] Optometrists and/or Orthoptists are eyecare professionals who fix binocular vision problems.



Principle of binocular vision with horopter shown

世間會發明『立體眼鏡』

Stereoscope

A **stereoscope** is a device for viewing a stereoscopic pair of separate images, depicting left-eye and right-eye views of the same scene, as a single three-dimensional image.

A typical stereoscope provides each eye with a lens that makes the image seen through it appear larger and more distant and usually also shifts its apparent horizontal position, so that for a person with normal binocular depth perception the edges of the two images seemingly fuse into one "stereo window". In current practice, the images are prepared so that the scene appears to be beyond this virtual window, through which objects are sometimes allowed to protrude, but this was not always the custom. A divider or other view-limiting feature is usually provided to prevent each eye from being distracted by also seeing the image intended for the other eye.

Most people can, with practice and some effort, view stereoscopic image pairs in 3D without the aid of a stereoscope, but the physiological depth cues resulting from the unnatural combination of eye convergence and focus required will be unlike those experienced when actually viewing the scene in reality, making an accurate simulation of the natural viewing experience impossible and tending to cause eye strain and fatigue.

Although more recent devices such as Realist-format 3D slide viewers and the View-Master are also stereoscopes, the word is now most commonly associated with viewers designed for the standard-format stereo cards that enjoyed several waves of popularity from the 1850s to the 1930s as a home entertainment medium.

Devices such as polarized, anaglyph and shutter glasses which are used to view two actually superimposed or intermingled images, rather than two physically separate images, are not categorized as stereoscopes.

Old **Zeiss** pocket stereoscope with original test image

Principles

Stereo card of a stereoscope in use (1901). (␣)

A simple stereoscope is limited in the size of the image that may be used. A more complex stereoscope uses a pair of horizontal periscope-like devices, allowing the use of larger images that can present more detailed information in a wider field of view. The stereoscope is essentially an instrument in which two photographs of the same object, taken from slightly different angles, are simultaneously presented, one to each eye. This recreates the way which

in natural vision, each eye is seeing the object from a slightly different angle, since they are separated by several inches, which is what gives humans natural depth perception. Each picture is focused by a separate lens, and by showing each eye a photograph taken several inches apart from each other and focused on the same point, it recreates the natural effect of seeing things in three dimensions.

A moving image extension of the stereoscope has a large vertically mounted drum containing a wheel upon which are mounted a series of stereographic cards which form a moving picture. The cards are restrained by a gate and when sufficient force is available to bend the card it slips past the gate and into view, obscuring the preceding picture. These coin-enabled devices were found in arcades in the late 19th and early 20th century and were operated by the viewer using a hand crank. These devices can still be seen and operated in some museums specializing in arcade equipment.

The stereoscope offers several advantages:

- Using positive curvature (magnifying) lenses, the focus point of the image is changed from its short distance (about 30 to 40 cm) to a virtual distance at infinity. This allows the focus of the eyes to be consistent with the parallel lines of sight, greatly reducing eye strain.
- The card image is magnified, offering a wider field of view and the ability to examine the detail of the photograph.
- The viewer provides a partition between the images, avoiding a potential distraction to the user.

A stereo transparency viewer is a type of stereoscope that offers similar advantages, e.g. the View-Master

Disadvantages of stereo cards, slides or any other hard copy or print are that the two images are likely to receive differing wear, scratches and other decay. This results in stereo artifacts when the images are viewed. These artifacts compete in the mind resulting in a distraction from the 3d effect, eye strain and headaches.

想拍照『視差』

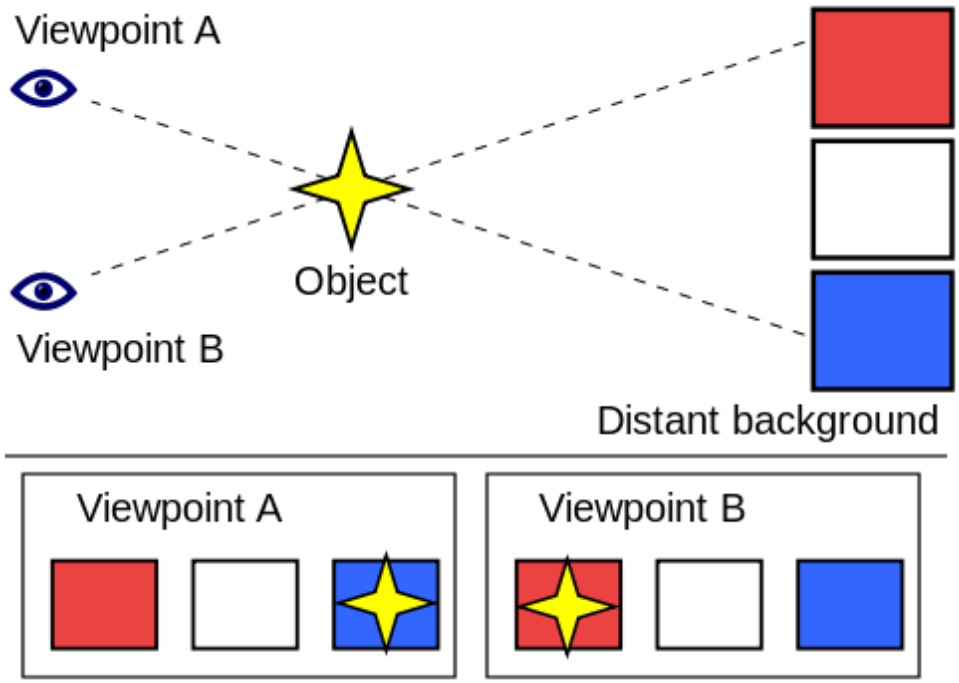
Parallax

Parallax is a displacement or difference in the apparent position of an object viewed along two different lines of sight, and is measured by the angle or semi-angle of inclination between those two lines.[1][2] The term is derived from the Greek word παράλλαξις (*parallaxis*), meaning "alternation". Due to foreshortening, nearby objects have a larger parallax than more distant objects when observed from different positions, so parallax can be used to determine distances.

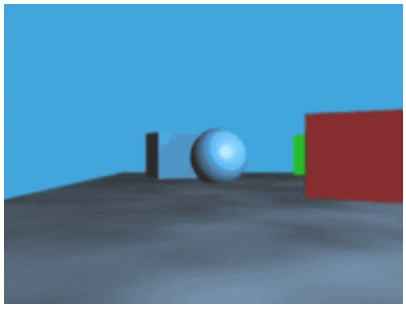
To measure large distances, such as the distance of a planet or a star from the earth, astronomers use the principle of parallax. Here, the term "parallax" is the semi-angle of inclination between two sight-lines to the star, as observed when the Earth is on opposite sides of the Sun in its orbit.[3] These distances form the lowest rung of what is called "the cosmic distance ladder", the first in a succession of methods by which astronomers determine the distances to celestial objects, serving as a basis for other distance measurements in astronomy forming the higher rungs of the ladder.

Parallax also affects optical instruments such as rifle scopes, binoculars, microscopes, and twin-lens reflex cameras that view objects from slightly different angles. Many animals, including humans, have two eyes with overlapping visual fields that use parallax to gain depth perception; this process is known as stereopsis. In computer vision the effect is used for computer stereo vision, and there is a device called a parallax rangefinder that uses it to find range, and in some variations also altitude to a target.

A simple everyday example of parallax can be seen in the dashboard of motor vehicles that use a needle-style speedometer gauge. When viewed from directly in front, the speed may show exactly 60; but when viewed from the passenger seat the needle may appear to show a slightly different speed, due to the angle of viewing.



A simplified illustration of the parallax of an object against a distant background due to a perspective shift. When viewed from “Viewpoint A”, the object appears to be in front of the blue square. When the viewpoint is changed to “Viewpoint B”, the object *appears* to have moved in front of the red square.



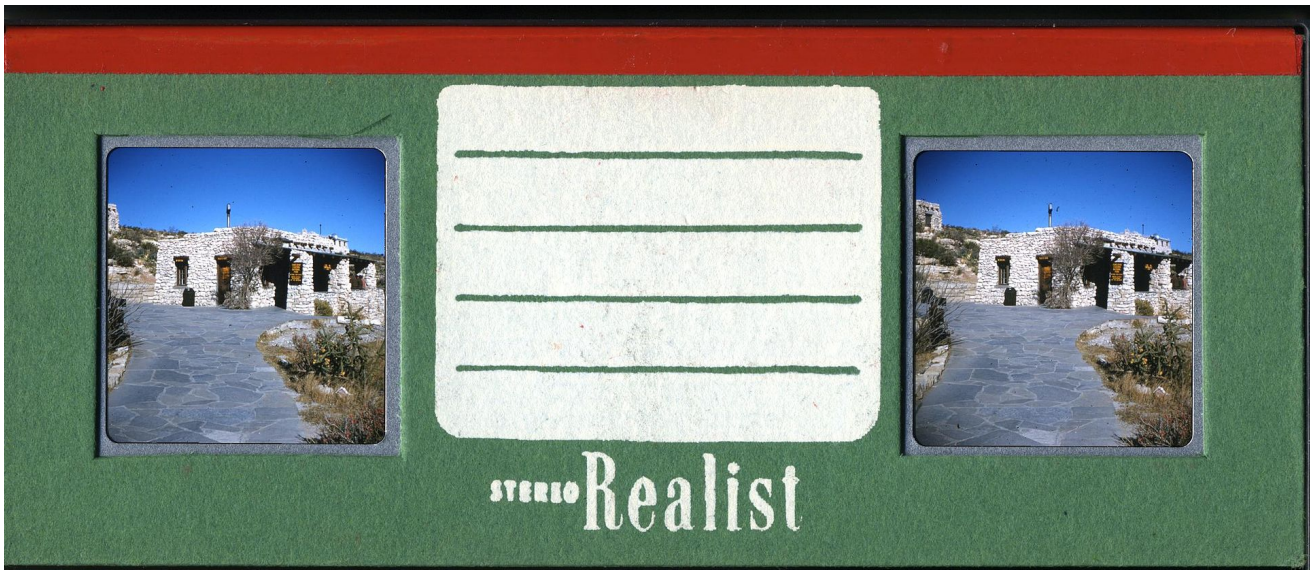
This animation is an example of parallax. As the viewpoint moves side to side, the objects in the distance appear to move more slowly than the objects close to the camera.

照片嗎？

Stereo Realist

The **Stereo Realist** is a stereo camera that was manufactured by the David White Company from 1947 to 1971. It was the most popular 35 mm stereo camera ever manufactured[1] and started the era of popular stereo photography of the mid 20th century.

A Stereo Realist camera.



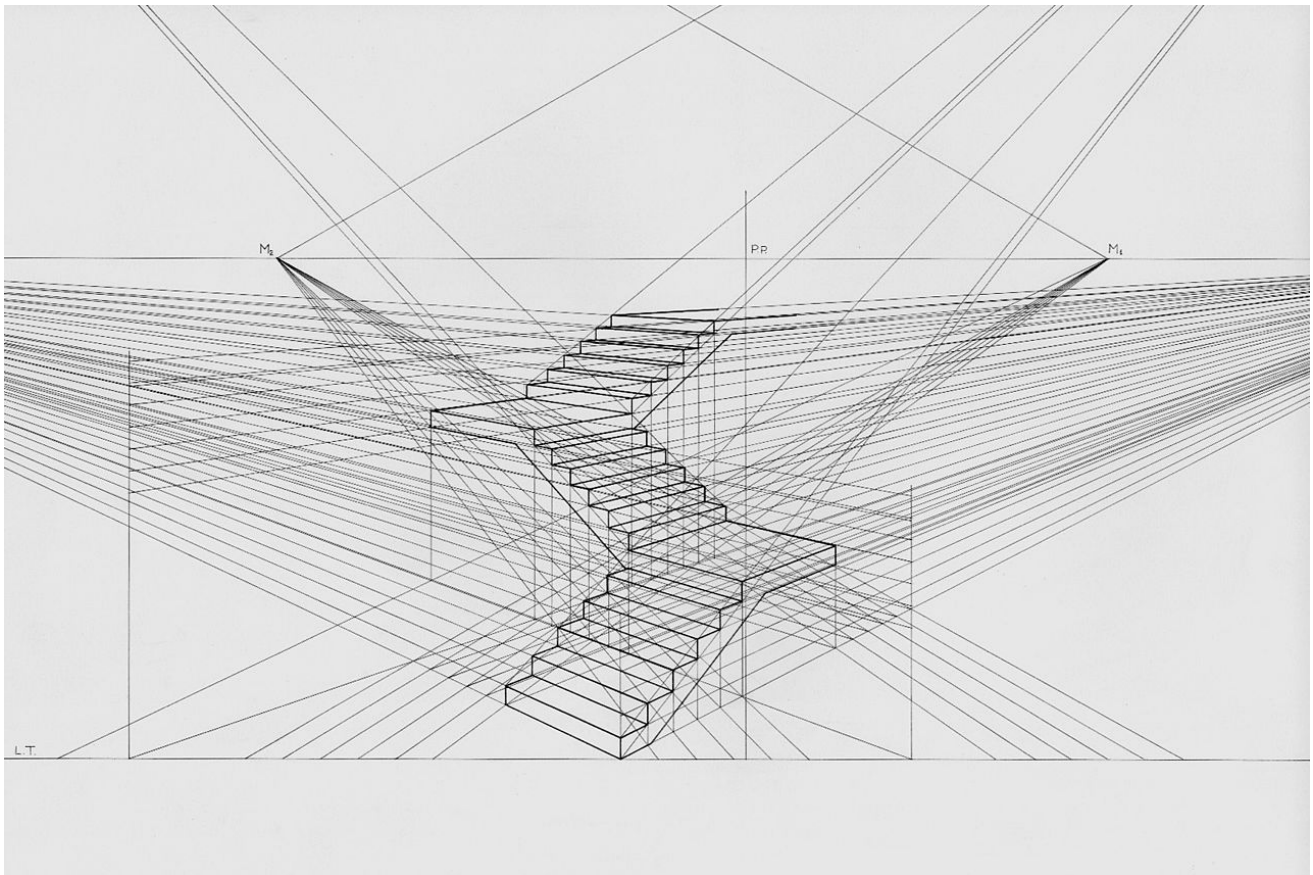
Slide mounted by the Realist mounting service.

當畫家與建築師開始捕捉『眼見實景』時

Perspective (graphical)

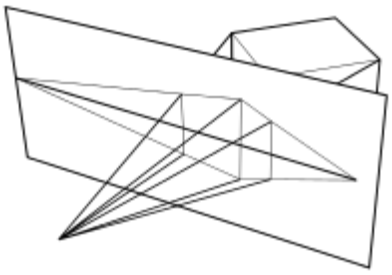
Perspective (from Latin: *perspicere* “to see through”) in the graphic arts is an approximate representation, generally on a flat surface (such as paper), of an image as it is seen by the eye. The two most characteristic features of perspective are that objects are smaller as their distance from the observer increases; and that they are subject to *foreshortening*, meaning that an object’s dimensions along the line of sight are shorter than its dimensions across the line of sight.

Italian Renaissance painters and architects including Filippo Brunelleschi, Masaccio, Paolo Uccello, Piero della Francesca and Luca Pacioli studied linear perspective, wrote treatises on it, and incorporated it into their artworks, thus contributing to the mathematics of art.

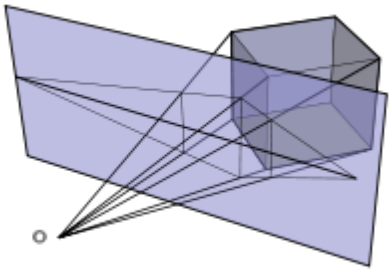


Staircase in two-point perspective

Overview



A cube in two-point perspective



Rays of light travel from the object, through the picture plane, and to the viewer's eye. This is the basis for graphical perspective.

Linear perspective always works by representing the light that passes from a scene through an imaginary rectangle (realized as the plane of the painting), to the viewer's eye, as if a viewer were looking through a window and painting what is seen directly onto the windowpane. If viewed from the same spot as the windowpane was painted, the painted image would be identical to what was seen through the unpainted window. Each painted object in the scene is thus a flat, scaled down version of the object on the other side of the window.[1] Because each portion of the painted object lies on the straight line from the viewer's eye to the equivalent portion of the real object it represents, the viewer sees no difference (sans depth perception) between the painted scene on the windowpane and the view of the real scene. All perspective drawings assume the viewer is a certain distance away from the drawing. Objects are scaled relative to that viewer. An object is often not scaled evenly: a circle often appears as an ellipse and a square can appear as a trapezoid. This distortion is referred to as foreshortening.

Perspective drawings have a horizon line, which is often implied. This line, directly opposite the viewer's eye, represents objects infinitely far away. They have shrunk, in the distance, to the infinitesimal thickness of a line. It is analogous to (and named after) the Earth's horizon.

Any perspective representation of a scene that includes parallel lines has one or more vanishing points in a perspective drawing. A one-point perspective drawing means that the drawing has a single vanishing point, usually (though not necessarily) directly opposite the viewer's eye and usually (though not necessarily) on the horizon line. All lines parallel with the viewer's line of sight recede to the horizon towards this vanishing point. This is the standard "receding railroad tracks" phenomenon. A two-point drawing would have lines parallel to two different angles. Any number of vanishing points are possible in a drawing, one for each set of parallel lines that are at an angle relative to the plane of the drawing.

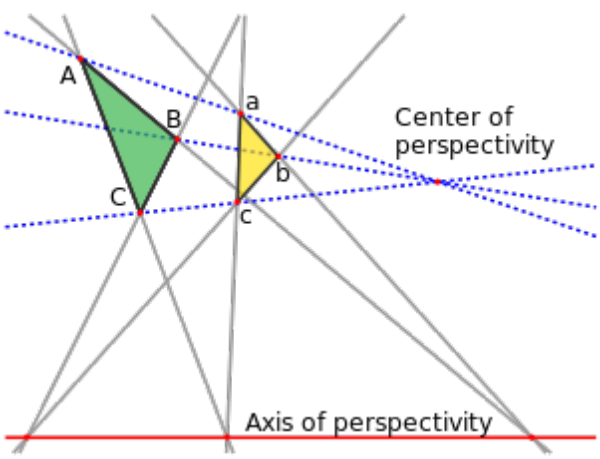
Perspectives consisting of many parallel lines are observed most often when drawing architecture (architecture frequently uses lines parallel to the x, y, and z axes). Because it is rare to have a scene consisting solely of lines parallel to the three Cartesian axes (x, y, and z), it is rare to see perspectives in practice with only one, two, or three vanishing points; even a simple house frequently has a peaked roof which results in a minimum of six sets of parallel lines, in turn corresponding to up to six vanishing points.

In contrast, natural scenes often do not have any sets of parallel lines and thus no vanishing points.

一門『透視幾何』就已悄悄興起◎

Perspective (geometry)

Two figures in a plane are **perspective from a point** *O* if the lines joining corresponding points of the figures all meet at *O*. Dually, the figures are said to be **perspective from a line** if the points of intersection of corresponding lines all lie on one line. The proper setting for this concept is in projective geometry where there will be no special cases due to parallel lines since all lines meet. Although stated here for figures in a plane, the concept is easily extended to higher dimensions.



Two perspective triangles, with their perspective axis and center