Picture Box Redux: New Perspectives on Pictorial Imaging

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Abstract

Artists have used the Picture Box to solve problems of near and far perspective in painting and drawing throughout history. It’s development dates back thousands of years with elements of its evolution evidenced in Prehistoric rock paintings from Europe and Africa and Ancient Egyptian Bas relief.

Picture Box elements have resurfaced at various times, and in various art-forms including Stage Design, Photography, Cinema, and Animation.

Stage Designers represent far perspective on shallow platforms by positioning realistic props in front of painted back-drops. Photographers use depth of field to isolate foreground figures and blur background imagery. Film directors construct elaborate sets and choreograph complex camera movement to force perspective and point of view. Disney’s horizontal multiplane camera allowed two dimensional images to be photographed in three dimensional space.

More recently, we have seen the Picture Box evidenced in Computer Graphics Imagery, (CGI) Objects viewed by virtual cameras are rendered in a pyramid-shaped volume known as a viewing frustum; which is structured in many ways, not unlike, the Picture Box.

While technologies evolve and adapt, the Picture Box continues to provide a solution for representing near and far perspective in image making.
Introduction: The Picture Box

The picture box is a method used to structure pictorial content in terms of near and far perspective. The technique has been used throughout history, with its origins evidenced in the earliest types of pictorial representation and evolving to its most elaborate exemplars in painting from the early renaissance. The technique itself is an attempt to rationalize perceptions of the experience of human vision and apply these to the the flat, rectangular surface of the picture.

Human peripheral vision is limited to the environment that we see before us, not including, those areas too far to either side of us, too high above us, or too low below us; as these tend to blur and lose colour definition, before becoming imperceptible. The included visualized area is often depicted as a cone of vision (O'Rourke, 1998.), commencing at the viewer’s eye position and extending towards a targeted location on the horizon and widening to encompass the maximum extent of the viewer’s field of view.

By restructuring the base of this imaginary cone, as a rectangle, in order to relate it to the most common of picture structures; the cone then becomes a pyramid. If within this pyramid, we estimate a range between the viewer and the horizon, defined by the near and far limits in which objects may appear in sharp focus, then we are left with a box-like structure, sitting in single-point perspective, within which, as Graham points out, “true measurements can be suggested convincingly.” (Graham, 1970.)

The usage of the picture box, however, has not been limited to two dimensional picture making because it’s structure is based on the human visual perception of three dimensional space and as such, may be applied to both two dimensional and three dimensional artistic mediums.

*Picture Box: Redux* charts the progress of the picture box, as has been *brought back* from its historical origins in picture making as a method for the organization of representational space in the related art forms of stage design, lens-based media, animation and most recently, computer graphics.
Historical Perspectives

The pictorial representation of near perspective would seem to have been a concern of the artist from some of the earliest known examples of picture making, such as those found in prehistoric cave paintings. As free drawings or vignettes, these examples suggest unlimited depth, (Graham, 1970), due to the limitations of the found surfaces upon which they were made.

Graham suggests, that it was not until the advent of architecture that the problem of measuring depth became significant.

The wall has always been a key to the understanding of pictures. How the artist accepts or rejects the wall as a limitation of graphic depth always affects his attitudes toward, and his concepts of, picture structure. (Graham, 1970 p.150)

Early examples of this acceptance of the wall, may be evidenced in Egyptian art.

If we imagine the rear plane of the picture box moved forward towards the viewer to within a very short distance of the front picture plane, this rear wall then functions as a sort of a backdrop or shut-off plane. (Graham, 1970) The resulting shallow box affords the artist the opportunity to employ the effect of limited sculptural depth, known as bas-relief. [Figure 1]

The bas-relief technique employed by the Egyptians, who utilized an incised line and shallow wall carving technique, offers some of the earliest examples of an applied picture box technique.

But it is in the early Renaissance that we see the fully matured picture box technique applied to painting. In this example by Van Eyck from 1435, The Madonna with Chancellor Rolin, [Figure 2], the structural influence of the picture box is clearly visible.

The accurately proportioned figures sit, in a structured interior space, beyond which, through a window, may be seen a landscape environment. This classic example of Sacre Conversazione painting applies conventions of near perspective, to the figures positioned in the room and far perspective for those elements of background imagery observed outside and beyond the structure of the room.

In this way, near perspective techniques such as plan and elevation, may be employed within the confines of picture box structure, while far perspective techniques, such as overlapping planes and tonal lightening may be applied, beyond the picture box area.
Stage Design

Historically, stage designers have represented near and far perspective by positioning props and actors in front of painted back-drops on shallow platforms. Presentational space, in theatrical performance, refers to the space occupied by actors, scenery and objects (McKinney, 2009) and scenographers are concerned primarily with the organization of this space.

Writing in 1902, Adolphe Appia, expressed his frustration, with the then, current trend for the use of elaborately, painted sets as an illusion of real space, (McKinney, c2009) when he writes:

“Our present stage scenery is entirely the slave of painting-scene painting-which pretends to create for us the illusion of reality. But this illusion is itself an illusion, for the presence of the actor contradicts it. In fact, the principle of illusion obtained by painting on flat canvas and that obtained by plastic and living body of the actor are in contradiction.” (McKinney, c2009, p 199)

Appia, felt that a unification of the scene elements of actor, prop and backdrop was necessary, and finding inspiration in *Eurhythmics*, a series of musical exercises developed by Jacques Delcroze, he began to develop his own idea of *Rhythmic Space*.

In the application of his ideas to restructure the presentational space of the stage, Appia used architectonic mass in the form of steps, platforms, pillars and walls, to accentuate the three-dimensionality of the stage area. (McKinney, c2009) He modelled the actors in light and grounded them with shadow and he simplified the backdrop to an almost abstract element.

In Appia’s designs for *Orpheus and Eurydice*, [Figure 3] we can see the structure of the picture-box emerge in the presentational space of the theatre. The architectonic elements of scenography, provide a structured interior space in which to place the three-dimensional figures of the actors in near perspective, accentuated by light and shadow. The simplified backdrop, now unified with the other scene elements, acts as a shut-off plane to limit far perspective.
Lens-based Media

Photographers, too, use a picture box-like technique to organize perceived three-dimensional space in image capture strategies; but it is the technical limitations of the lens, and specifically depth of field, which provides the opportunity.

Since depth-of-field, may be described as; “the distance between the nearest and furthest parts of an subject that can be imaged with acceptably sharp detail at one focus setting of the lens”, (Langford, M. 1986) then we could, perhaps, draw a parallel, between the limits of lens depth-of-field and the near and far planes of the picture box.

Depth of field is often illustrated as a pyramid of view commencing with the lens of the camera and progressing towards the horizon. The resulting truncated pyramid forming a box-like structure in which subjects may be composed in clarity and focus.

Photographers use this technological phenomenon to their advantage, by keeping close, near-perspective subjects, in focus, and positioning background elements, in the out of focus range, defined by the depth-of-field of the camera lens. In this way, out of focus picture elements tend to blur, producing a textural backdrop, which gives the effect of a shut-off plane and thus limits problems of far perspective.

The application of the picture box method may be seen in cinema technique as well. Hitchcock’s Rope, provides an interesting example, notable both for its elaborate set design and the application of real-time filming technique.

In his book, The Architecture of Image: Existential Space in Cinema, author Juhani Pallasma, compares Hitchcock’s Rope to Van Eyck’s The Madonna with Chancellor Rolin. (c. 1435) noting that both exhibit an engagement with “the duality of the focused interior and the distant view” (Pallasma, 2007 p.50) and citing the applied scenography in Rope as a cinematic reference to the early renaissance painting.

Both the painting and the scene from the film, consist of in-focus foreground figures in near perspective, separated from background imagery in distant perspective, by an interior, room-like structure. [Figure 4]

That the background element in the Hitchcock film is a model suspended beyond the rear wall of the set and those in the painting are rendered on Van Eyck’s canvas in pigment is inconsequential, since both provide picture box solutions to the organization of near and far perspective in representational space.
When Disney released *The Old Mill* in 1937, scenes filmed using Disney’s innovative vertical multiplane camera were seen for the first time. As part of the gear up towards feature film production, the short provided a testing ground for the new technology.

The device allowed multiple layers of 2D sequential artwork to be photographed in actual 3D space, in a large vertical, stage-like, structure; resembling in many ways, a physical embodiment of the picture box.

As well as Disney, other animators had experimented with multiplane camera set-ups and as early as 1923, German animator, Lotte Reiniger, improvised one such arrangement in her production, “The Adventures of Prince Achmed”.

She described the device as follows:

“...the whole contraption looked like a four poster bed, the camera being supported by sturdy wooden beams...” (Russet, 1988)

Using this set-up, Reiniger would animate character elements on one level, while effects animator, Berthold Bartosh worked on another level. Foreground elements could be isolated on a top level, whilst background elements would be photographed on a bottom level.

Former Disney animator, UB Iwerks, had, in fact, built a rudimentary multi-plane camera system as early as 1932, in the basement of his studio, with “...parts of an old Chevy...” (Culhane, 1986) and costing in the region of $350.00. Unlike the vertical set-up of the Disney camera, this device was structured horizontally with its camera, fixed in place. (Maltin, 1980 p.196)

Disney’s device was distinct from these earlier prototypes, by both the complexity of its engineering and the staggering development cost of over $70,000.00 (Maltin, 1980); £1.5M in today’s currency. The frame of the camera, allowed up to six, independently lit picture elements, to be placed as far as 14 feet away from the lens, maximising the depth-of-field. [Figure 5]

According to Frank Thomas, the complexities of the “multiplane” were not limited to its development:

"There was also a time factor in just shooting the film; to get the depth of field in the focus for such a distance, a time exposure of some eight or nine seconds was required for every frame of film." (Thomas 1981, p. 309).

Structurally though, Disney’s device was a large, physical, picture box. Layers of artwork were positioned inside the real space of the camera stand interior, just as figures and object elements in renaissance painting were composed in the near perspective stage area of the picture box structure. Background elements, photographed on the bottom most layer of the multi-plane camera, functioned as a shut-off plane to limit far perspective in the resulting pictorial imagery of the animated film; just as the distant landscape elements in the historic painted examples, were rendered flat on the rear plane of the underlying picture box structure.
Computer Graphics Imagery

More recently, we have seen the Picture Box evidenced in Computer Graphics Imagery (CGI), as a method for dealing with the organization of perceived representational space. The way in which virtual cameras see the field of view, and how computers manage the rendering of objects placed within it, are subject to similar concerns and aesthetics as those examples seen in other related mediums.

This should come as no surprise, considering the CGI camera, is an attempt to simulate the human field of vision, for digital rendering; just as the picture box, is an attempt to simulate human peripheral vision for pictorial composition.

CGI objects viewed by virtual cameras are rendered in a pyramid-shaped volume known as a viewing frustum. Near and far clipping planes define the extent of the area to be rendered. Rendering limits must be applied to prevent a software program from attempting to render, “the infinite space of an endless Cartesian coordinate system.” (O'Rourke, 1998).

The structure of this area and its purpose parallel those of the picture box in that it is an attempt organize and manage the placement and rendering of objects in near perspective.

Cubic environment mapping is another aspect of CGI rendering which offers a structural parallel to the picture box. Ned Green, a computer scientist at the New York Institute of Technology, first proposed the theory was, in 1986. He proposed that a virtual camera could be placed at the center of a cubic primitive, upon the interior six sides of which, linked image textures of a sky, could be projected. Green’s example of one such linked image texture may be seen in Figure 6. As may be seen in the example, six square image textures, are arranged in a “T” shaped pattern, surrounded by a non-rendering black border region. When this image map is applied to the interior surface of the cubic primitive, all rendered views link to each other to form one three-dimensional whole.

In his paper, “Environment Mapping and Other Applications of World Projections”, Greene seems to be describing a CGI version of the picturebox when he says;

"A world projection of the distant environment centered at a typical camera position can be used to render distant objects in the scene, while the near environment is rendered from 3D models at each frame and then composited with the distant environment." (Greene, 1986)

So similar to the picture box, Greene’s two-pronged approach to CGI rendering consists of compositing “distant environment” textures with “3D models”, just as renaissance painters combined approaches for representing near and far perspective elements in pictorial compositions.
Conclusions

While technologies evolve and adapt, evidence seems to show that the Picture Box continues to provide a solution for representing near and far perspective in representational art.

As these examples show, the evolution of the Picture Box continues to provide a necessary solution for dealing with problems of near and far perspective, that result from the way in which humans perceive the world around them.

The problem of formatting the human cone of vision into a pyramid in order to relate it to the rectangle of the painting or screen, or the box of the stage, requires the necessary application of a structural solution, for the inclusion of near and far subject elements in a complete representational environment and an environment not necessarily limited to two-dimensional representation.

A picture box redux may therefore be evidenced, in the continued application of picture box solutions, throughout the history of representational artforms from renaissance examples such as the Van Eyck painting, through Appia’s sceneography, Hitchcock’s cinematography; the physical structure of Disney’s technical innovative multiplane camera, and most recently Greene’s strategy for CGI rendering.

In recognizing this redux in the application of Picture Box technique, it is hoped that practitioners from the breadth of the representational mediums identified here, in the above examples, may embrace the term Picture Box for describing this method of structuring near and far perspective, in the areas of Scenography, Cinema, Animation and CGI, just as the term has been used in the past, to describe this structural method applied in painting.
Figures

Figure 1  (Graham, 1970)  Sketches of the Picture Box structure.
Figure 2  Jan Van Eyck, The Madonna with Chancellor Rolin. (c. 1435)
Figure 3  (McKinney, c2009)  Adolphe Appia, Stage design for Orpheus and Eurydice (Photograph by C.W.Gluck, Hellerau, Jaques-Dalcroze Institute, 1912-13)

Figure 4  Scenographic Diagram from September, 1948 issue of Look Magazine on the making of Hitchcock’s Rope.
Figure 5  (Thomas, 1995)  Diagram of Disney's Multiplane Camera.
Figure 6  (Greene, 1986)  Cubic Environment Map
Bibliography