Extreme Perspectives:
Drawing for the Big Dome

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Fulldome
What is fulldome?
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- You’re sitting in one
- Large hemispheric dome
- With projected video
- Some use one projector with a fisheye lens
- Most use multiple projectors with “edge blending”
- Tilt varies between 0° and 30°
- Most are associated with museums or schools
- Approximately 600 large domes worldwide
What is a dome master?

- Image format which allows content to be shared between domes, even if they have different sizes, numbers of projectors, and tilts
- The dome master is a square image with a circle inscribed within it
- Dimensions vary from 1k (1024 x 1024) to 4k (4096 x 4096) and beyond
- Each planetarium processes the dome master to fit its own particular configuration
What is a dome master?

The black areas at the corners are ignored
What is a dome master?

Think of grabbing the image by the left and right sides and holding it over your head.
What is a dome master?

This is a 4096 x 4096 dome master.

720 x 480 standard-def TV image

1920 x 1080 hi def TV

Comparison of resolution with some familiar formats
What is a dome master?

The planetarium’s software “slices” the dome master into sections, one for each projector.
What is a dome master?

The “slices” overlap so that the edges can be blended to achieve a seamless final image on the dome.
Linear Perspective
Perspective

Perspective is an approximate representation, on a two-dimensional surface (the drawing), of a three-dimensional scene (the real world).

Jan Vredeman de Vries, Perspective (Leiden, 1604–5), plate 28. Courtesy, the Bancroft Library, Berkeley, California.
Rays of light travel from the object being drawn, through the picture plane of the drawing, to the viewer's eye.
The most characteristic feature of perspective drawing is that objects are drawn smaller as their distance from the observer increases.

Masolino, Herod’s Feast, 1435
Forced Perspective
Forced Perspective

Perspective, Trey Watkins, Martin Reinfried, Dennise Lite, Amy Lee & Cameron Brown, 2007
(image from Burning Man 2007)
Linear Perspective

- Works by representing the light that passes from a scene, through the imaginary rectangle of the drawing, to the viewer's eye.

- Is similar to a viewer looking through a window and drawing what is seen directly onto the windowpane.

- Each drawn object in the scene is a flat, scaled down version of the object on the other side of the window.

- Straight lines are used to solve the problem of how to depict the problem of the convergence of parallel lines.
Foreshortening

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.
Foreshortening

Julian Beever
Foreshortening

Julian Beever
a few terms...

• Perspective drawings typically have a horizon line. This line, directly opposite the viewer's eye point, represents objects infinitely far away. They have shrunk, in the distance, to the infinitesimal thickness of a line. Often the horizon line is not shown, but is merely implied.

• Any perspective representation of a scene that includes parallel lines has one or more vanishing points where those parallel lines converge.
A one-point perspective drawing means that the drawing has a single vanishing point, usually directly opposite the viewer's eye and usually on the horizon line. All lines parallel with the viewer's line of sight recede to the horizon towards this vanishing point.
One-Point Perspective

George Tooker, Government Bureau, 1956
Two-Point Perspective

A two-point perspective drawing would have two sets of parallel lines converging at two different vanishing points usually on the horizon line. Buildings and architecture are often drawn using two-point perspective to avoid convergence of the vertical lines.
Two-Point Perspective

George Tooker, Waiting Room II, 1982
A three-point perspective drawing has three sets of parallel lines converging at three different vanishing points. Note that vanishing points can occur outside of the picture plane and that not all vanishing points occur on the horizon line.
Three-Point Perspective

Terry Gilliam, Brazil, 1984
Other-Point Perspectives

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. By inserting into a three-point-perspective scene, a set of parallel lines that are not parallel to any of the three axes of the scene, a new distinct vanishing point is created. Therefore, it is possible to have an **infinite-point perspective** scene.
Zero-Point Perspective

Natural scenes often do not have any sets of parallel lines. Such an image would have no vanishing points and could be termed a zero-point perspective.
Curvilinear Perspective
Curvilinear Perspective

Curvilinear perspective is a graphical projection using curved perspective lines.

It was formally codified in 1968 by the artists and art historians André Barre and Albert Flocon in the book La Perspective curviligne, which was translated into English in 1987 as Curvilinear Perspective: From Visual Space to the Constructed Image and published by the University of California Press.

In 1959 Flocon acquired a copy of Grafiek en tekeningen by M. C. Escher. Flocon was strongly impressed with Escher’s use of bent and curved perspective which were so like the theories Flocon and Barre were developing. They started a long correspondence, in which Escher called Flocon a "kindred spirit".
The system uses curving perspective lines to approximate the image on the retina of the eye, which is itself spherical, more accurately than the traditional linear perspective, which uses straight lines, and gets very strangely distorted at the edges.
Five-Point Perspective

Four vanishing points are placed around in a circle, they are named N, W, S, E. And there is one vanishing point in the center of the circle.
Real-world examples of Curvilinear Perspective

Cloud Gate, Anish Kapoor, Millennium Park, Chicago, Illinois
Real-world examples of Curvilinear Perspective

Cloud Gate, Anish Kapoor, Millennium Park, Chicago, Illinois (detail)
Real-world examples of Curvilinear Perspective

Cloud Gate, Anish Kapoor, Millennium Park, Chicago, Illinois, (detail)
Real-world examples of Curvilinear Perspective

Hiroshima, Japan
Real-world examples of Curvilinear Perspective

La Geode, Paris, 1986
Real-world examples of Curvilinear Perspective

Echo Communications Satellite, NASA, 1960
Fisheye Photography
Fisheye Photography
Fisheye Photography
Examples of Curvilinear Perspective from Flocon and Barre
Examples of Curvilinear Perspective from Flocon and Barre
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Examples of Curvilinear Perspective from Flocon and Barre
Examples of Curvilinear Perspective from Flocon and Barre
Examples of Curvilinear Perspective prior to Flocon and Barre

Jan van Eyck, Arnolfini Portrait, 1434
Examples of Curvilinear Perspective prior to Flocon and Barre

Jan van Eyck, Arnolfini Portrait, 1434 (detail)
Examples of Curvilinear Perspective prior to Flocon and Barre

Jean Fouquet, Entrée de l'empereur Charles IV à Saint-Denis, ~1455
Examples of Curvilinear Perspective prior to Flocon and Barre

Parmigianino, Self-portrait in a Convex Mirror, 1524
Examples of Curvilinear Perspective prior to Flocon and Barre

Nicolaus Meldmann, The Siege of Vienna, 1529
Examples of Curvilinear Perspective prior to Flocon and Barre

Carel Fabritius, View in Delft, 1652
Examples of Curvilinear Perspective prior to Flocon and Barre

J. M. W. Turner, Petworth Park, 1828
M. C. Escher

Three Spheres, 1946
M. C. Escher

Three Spheres, 1946 (detail)
M. C. Escher

Eye, 1946
M. C. Escher

Still Life, 1934
M. C. Escher

Still Life, 1934 (detail)
M. C. Escher

Hand with Reflecting Sphere, 1935
M. C. Escher

Hand with Reflecting Sphere, 1935 (detail)
M. C. Escher

Balcony, 1945
M. C. Escher

Smaller and Smaller I, 1956
M. C. Escher

Circle Limit III, 1959
M. C. Escher

Snakes, 1969
M. C. Escher
Photoshop Techniques
Photoshop Techniques
Filter/Distort/Polar Coordinates
Photoshop Techniques
Filter/Distort/Polar Coordinates
Photoshop Techniques
Filter/Distort/Spherize
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Current Interest
Current Interest
David Chelsea

From his upcoming book “Extreme Perspective! Curvilinear And Beyond”
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Current Interest
Dick Termes
Current Interest
Dick Termes
Current Interest
Dick Termes

Which Way, 2003
Current Interest
Rackstraw Downes

Brooklyn Underpass
Current Interest
Rackstraw Downes

A Stop on the J Line (Alabama Avenue), 2007
Student Fisheye Drawings
(from the internet)

tAmAr shippony, fisheye-portrait, 2005
Student Fisheye Drawings
(from the internet)

Ethereal-Mind, Fisheye Life Drawing, 2007
Current Interest

David Hockney

David Hockney, Place Furstenberg, Paris, August 7, 8, 9
...and finally...

Curvilinear perspective represents the state of looking at the same time in many directions. In contrast...linear perspective is the image of a specific viewpoint and direction of view, and once that restriction is relaxed or abandoned, images can easily bend, flow or warp into unpredictable and highly expressive new geometries.

Curvilinear perspective in effect averages or summarizes the many possible views from a single viewpoint, much as David Hockney assembles an image from dozens or hundreds of localized, narrowly cropped photographs. In that context, curvilinear methods can be justified as visually syncretic and philosophically "postmodern".

Leonardo and many others after him identified "flaws" in linear perspective only because they considered the same perspective situation from two or more directions of view. Culturally we are no longer predisposed to see multiple perspectives or multiple points of view as disruptive affronts to orthodoxy.

- Bruce MacEvoy, 2007