

Perspectives on Perspective

Sarah C. Melville*
Department of Humanities and Social Sciences
Clarkson University
Potsdam, NY 13699
E-mail: melville@clarkson.edu

Duncan J. Melville
Department of Mathematics
St. Lawrence University
Canton, NY 13617
E-mail: dmelville@stlawu.edu

Abstract

A picture plane is a two-dimensional space that can be approached in many different ways. Different cultures have evolved various conventions for depicting images in space and a study of these representational conventions can, therefore, illuminate important cultural conceptions. In this workshop, we explore the use of artistic conventions as a cultural lens. As illustrative exercises, participants will create and critique pictures using two of the most mathematical representational systems, the ancient Egyptian grid system, and Renaissance perspective as first described by Leon Battista Alberti.

Flattening the World

Since the earliest cave and rock art, people have sought to record their experiences of the world on two-dimensional surfaces. What they choose to record reflects what is important to them, but so too do the techniques used. In this workshop, we will look at a number of ways cultures have chosen to encode representations of space on a two-dimensional surface and use them to frame the cultural issues and questions of meaning embedded in the artifacts.

We will focus on two case studies where important artistic concerns demanded the use of mathematics. The first is how the functional requirements of Egyptian art were served by the development of the grid system, and the second is how the rise of humanism and the privileging of a particular point of space and time led to the introduction of true perspective. We will explain the cultural background and participants will have the opportunity to deconstruct, and to construct, pictures using these two techniques. This type of hands-on classroom activity helps students recognize why and how cultures choose to represent objects in space in a certain way, and how mathematics allows them to fulfill their purpose.

The canon of proportions in Ancient Egypt

Probably the most striking feature of ancient Egyptian art is its remarkable uniformity; only slight changes in emphasis, costume or accoutrements allow viewers to distinguish between objects from different eras. But this fact does not betray a lack of creativity or ability on the part of Egyptian artists, nor does it suggest that Egyptian culture was so stagnant or mired in tradition that it entirely rejected innovation. For over three thousand years composition and style were governed by specific conventions in order to ensure that viewers could instantly decode the meaning of any image and that the image itself could fulfill its intended function, whether as a message to the public, as a representative of the living in the afterlife, or as a connection between the mundane world and the spiritual plane. To the Egyptians, the image was eternal; it was imbued with power and the very essence of life itself. Accordingly, the artist's

goal was to depict the essential and timeless characteristics of an object rather than how it looked at a specific moment or from a particular point in space [1]. A flat, two-dimensional picture plane was perfectly well suited to the task.

Since it was necessary to portray the essential nature of a given object, artists showed as much of it as possible and to that end, they often combined different views to create a composite image. For example, Figure 1 shows a garden pond from a bird's eye view, but the trees, water plants and fauna from a frontal perspective. This was done to include as much of the whole scene as possible.



Figure 1: *Painting of a pond in a garden from the tomb of Nebamun. 18th dynasty.*

The human form was also subject to the essentialist principle described above: the head was shown in profile with a frontal eye and eyebrow; the chest, shoulders and hips were frontal, but one nipple/breast, the small of the back, the legs and feet were all shown in profile. In order to ensure that artists could consistently meet the ideal standards when depicting the human form, Egyptian artists developed a mathematical grid system to govern proportion. The grid system, which was implemented during the Old Kingdom (3rd millennium BCE) and endured with occasional adjustments into the Ptolemaic period (c. 323 to 27 BCE), did not stifle artists' creativity nor was it intended to allow unskilled laborers to produce art mechanically. Rather, the grid system guaranteed that the human figure would consistently be portrayed in its appropriately perfect form. A typical figure drawn according to the canon looks like this:

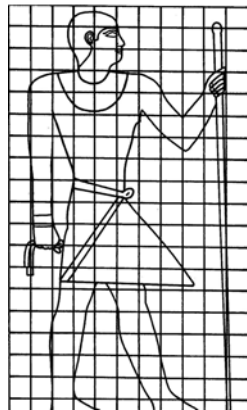


Figure 2: *After Robins [1] and Iverson [2].*

The Egyptian canon of proportions: an exercise for students

In the following exercise students take a modern photograph of a human figure and transform it into an essential composite using the standard Egyptian canon of proportions given below. Any clear photographic image will suffice, but students respond well to familiar figures such as celebrities. Using digital or Polaroid photos of the students is another option. Remember that the picture must conform to both ideal representation in terms of pose and proportionality of body.

For pose, you need

- Head in profile
- Full eye and eyebrow
- Frontal chest and shoulders
- Profile nipple/breast
- Profile small of back
- Full view navel
- Profile legs and feet
- Both feet from inside

For canon of proportions and the grid, you want: 18 squares from hairline to soles of feet.

- H0: Soles of feet
- H3: Middle of calf
- H6: Top of knee
- H9: Lower edge of buttocks
- H11: Small of back (for men)
- H12: Elbow
- H14: Nipple
- H16: Junction of neck and shoulders
- H18: Hairline

Also

- Vertical line through ear bisects figure
- Shoulders 6 squares wide for men, 4 or 5 squares for women
- Armpits 4 squares wide for men, a bit narrower for women
- Feet 3 squares long.

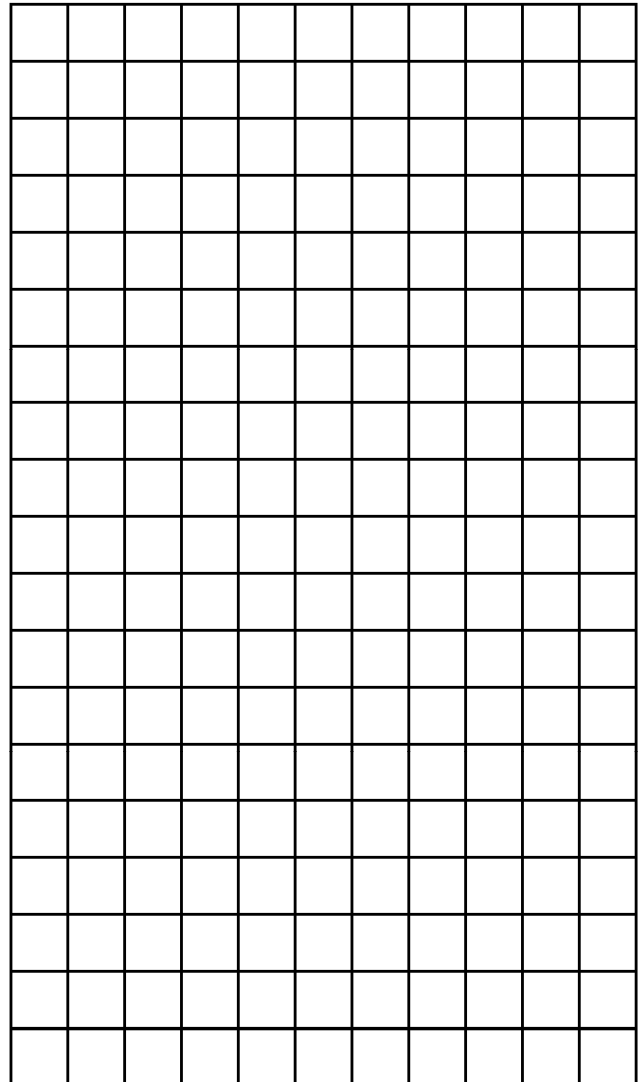


Figure 3: *A grid for a standing figure.*

Alberti on Perspective

An entire humanistic approach to art is summed up in Alberti's description of preparing to draw, "I inscribe a quadrangle of right lines, as large as I wish, which is to be considered to be an open window through which I see what I want to paint. Here I determine as it pleases me the size of the men in my picture..." [3]

In early fifteenth-century Italy, the rise of humanistic philosophy led to a complex restructuring of the roles of viewer, artist, and representation centered in Florence. A philosophic focus on the individual, and individual experience, thoughts, actions and creativity was bound to have an impact on art. Study of the natural world implied an observer, and this, too, carried over to representation. Painting was to be about people, about specific individuals engaged in specific acts, frozen at a moment in time, and observed by the artist from a specific location. That is, a scene is represented as if through an 'open window' by someone standing at a particular distance from the window.

While these ideas were first articulated and demonstrated by Brunelleschi around 1415, they were first written down some twenty years later by Leon Battista Alberti. Alberti came from a wealthy Florentine family that had been exiled from Florence in one of its periodic political upheavals. Alberti became a Papal Secretary in 1431 at the age of 27 and was sent in the Pope's service to Florence in 1434. Arriving in his hometown, he encountered the artistic ferment there and wrote the first account of the perspective style, *On Painting*, in two versions, Italian for artists, and Latin for patrons.

The basic technical problem in perspective painting is that a distance vertically up the picture represents a distance back horizontally in the scene represented. How far up should represent how far back? Alberti roundly criticizes some of the techniques then in use and lays out his own scheme for creating a projective grid. Once the grid has been constructed, the artist knows the appropriate scale for the people and buildings that filled Alberti's vision of art. Alberti also shows how to use the grid to draw other simple shapes in correct perspective while conceding that after locating a few key points, the artist can fill in the details freehand.

As inheritors of the western Renaissance and having spent our whole lives watching naturalistic perspective representations on a glass window, it can be hard to step back, and realize that what seems obvious to us was originally radical and came from a particular philosophy. Choosing to represent a scene meant forgoing all the cultural markers that earlier painting had used so that it could be read by viewers. If size no longer denoted importance, how was one to know who was important in a painting? Looking through a window limits the use of well-known symbols and reduces a painting to a single frame from the narrative sequences that were often embedded in earlier forms of art. Fixing a point to look at the scene from fixes a point for the viewer to observe the scene. The artist dictates where the viewer should stand and thus re-arranges the relationship between the artist-craftsman and viewer-patron. Returning to the first text on perspective, when the theory was new and being laid out for the first time can help us to reflect on these issues and look at the art, and our own cultural assumptions in a new way.

Albertian Perspective: an exercise for students

In the following exercise, students create a simple scene of buildings and people using Alberti's directions from 1435.

The first step is to fix the scale of the painting by deciding 'the size of the men in my picture'. Dividing the height of a figure in three gives Alberti a scale he can use across the base of his picture. He conveniently bases his scale on a Florentine unit of measurement, the *braccio*, of about 23 inches.

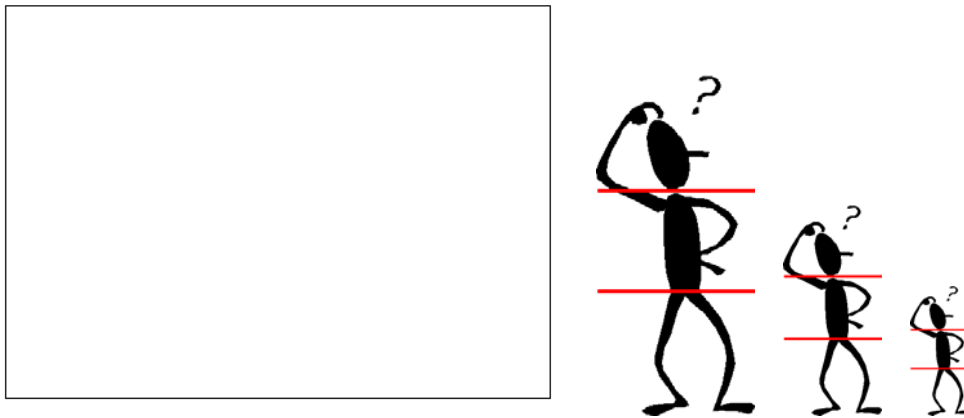


Figure 4: *Choosing 'the size of the men'*

The next step is to choose a 'centric point' (the point at infinity) equal to the height of a man and join it to the points marked on his base (these are the orthogonals). Now Alberti chooses a position for the observer, for 'a painted thing can never appear truthful where there is not a definite distance for seeing it'. Given the height of the centric point and distance of observer to painting, Alberti shows how to create the horizontals for the projection of a square grid. He makes a copy of the marks across the base of his picture, locates the observer and joins the dots. Where the lines cross the picture plane marks the heights of the horizontals.

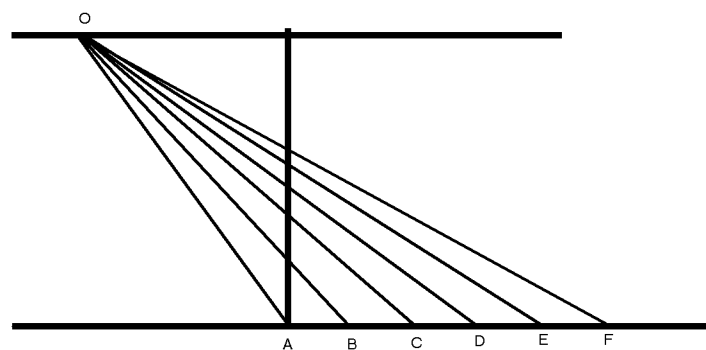


Figure 5: *Constructing the horizontal heights.*

Transferring the heights to his original rectangle, Alberti marks the horizontals for his square grid. The resulting grid is the classic 'pavimento'.

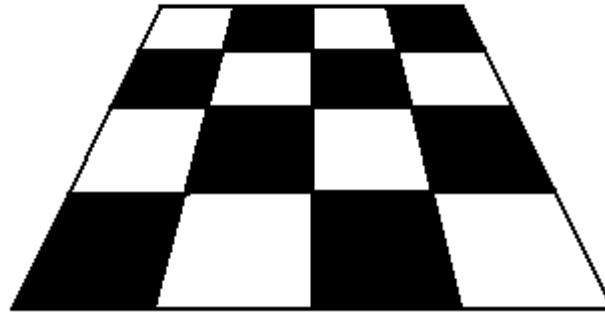


Figure 6: *An Albertian perspective square grid.*

As the horizon at infinity is chosen as the height of the people, all figures in the grid will be as tall as the horizon, and a building that is, say, three times the height of a person, will appear three times that height in the picture. Hence, Alberti has keyed all three axes to his scale.

References

- [1] Gay Robins, *Proportion and Style in Ancient Egyptian Art* (Austin, University of Texas Press, 1994).
- [2] E. Iversen, *Canon and Proportions in Egyptian Art* (London, Humanities Press, 1975).
- [3] Leon Battista Alberti, *On Painting*, trans. J.R. Spencer, (New Haven, Yale University Press, 1966).