12/28/81

"Goodman and Brownson on conventionality of perspective"

I

Unfortunately, in the standard discourse about paintings in art, the terms "represent", "realistic" and "looks like" (or "resembles") are symbiotically inter-related in a way that ~~Goodman, rightly, objects to~~ over-looks distinctions ~~which are~~ crucial for a coherent theory of art. For example, consider the following typical passage:

> "[An artist] may try to paint a picture that looks like a scene in nature or like something else that exists. Then anyone who looks at the painting can also imagine that he is looking at the scene or subject itself. The picture is said to represent the scene or subject. Or the painter may paint something he imagines... If a picture looks very much like its subject, it is said to represent the subject, and is called a realistic painting. If it contains little or no representation, it is called an abstract or non-objective painting."
> Thomas Munro, "Painting", World Book Encyclopedia, Vol 14, 1961, p.28.

In the first chapter of Languages of Art, Nelson Goodman makes a very neat distinction between representation and resemblance. Resemblance is a relation which is both reflexive and symmetrical (i.e., everything resembles itself, and if A resembles B then B resembles A). Representation is neither; seldom, if ever does an entity A, represent itself, and if A represents B it is seldom the case, ~~if ever,~~ that B also represents A. To say that A represents B is to say that A stands for, refers to, or denotes B. It in no way follows from A's resembling B that either A or B stands for, or represents, the other. Nor does the converse hold. A word-token, e.g., 'Plato' may stand for, refer to and represent a certain individual ~~object~~, without resembling that ~~object~~ in any way; and two word-tokens, e.g., two occurrences of 'Plato', may resemble each other exactly without either one representing the other.

Goodman's distinction opens the way to a coherent theory of art based on the language of an art form, i.e., the 'symbol system' whereby features of a work in that art-form are understood as marks or symbols related in certain "syntactical" ways to each other and in certain "semantical" ways to a field of referents. By discarding theories of art which tie representation to resemblance,

copying and imitation, Goodman is able to view written descriptions and paintings as equally artificial, equally symbolic, and equally referential. Though some paintings are indeed more 'realistic' or 'natural' than others, in the sense of relying more on our habitual ways of picking out, and identifying familiar objects in our world; this distinction can also be applied to written descriptions. But paintings as diverse with respect to "realism" as Klee's "Gedenkblatt an Gersthofen" and Andrew Wyeth's "Her Room", may be, in Goodman's terms, equally representational and equally informational. Thus representing is separated from resemblance or looking-like, and "realism" in painting is simply one type of representation, among many, based upon cultural habituation and inculcation.

It is in this context that Goodman attacks the traditional view that realism in painting is gained by/to laws of perspective geometry. The psychologist, James J. Gibson, for example, is quoted as expressing the tradition:

> "...it does not seem reasonable to assert that the use of perspective in paintings is merely a convention,... When the artist transcribes what he sees upon a two-dimensional surface, he uses perspective geometry, by necessity." 1

1 from James J. Gibson, "Pictures, Perspectives and Perception", Daedalus, Winter, 1960, p. 227.

In direct contradiction to this standard view, Goodman asserts,

> "...the artist who wants to produce a spatial representation that the present-day Western eye will accept as faithful must defy the 'laws of geometry'."2

2 Nelson Goodman, Languages of art, Hackett, 1976, p.16

Goodman apparently accepts perspective geometry as a system which is instantiated in the laws of the behavior of light rays. As laws of optics, they are scientific laws, objective and not conventional. But, claims Goodman, the rules of pictorial perspective - the rules of drawing lines that the artist is taught to use when he wishes to achieve a "realistic" picture - do not obey the"laws of geometrical optics". The rules of pictorial perspective, he claims, are conventions related to cultural habits rather than to laws of nature. His most striking argument is the following:

> "By the pictorial rules, railroad tracks running outward from the eye are drawn converging, but telephone poles (or the edges of a facade) running upward from the eye are drawn parallel. By the 'laws of geometry' the poles should also be drawn converging. But so drawn, they look as wrong as the railroad tracks drawn parallel...The rules of pictorial perspective no more follow the laws of optics than would rules calling for drawing the tracks parallel and the poles converging."3

3 Goodman, op.cit. p 16

Goodman uses this argument (and others) to support his thesis that conventions of symbolic representation, rather than resemblance relations, account for the distinctions between "realistic" and unrealistic paintings. If rules of pictorial perspective are derivable from the geometry of optics, then realism would be based on objective scientific laws. If pictorial perspective defies, or violates, laws of geometry, then "realism" in painting must be attributed to cultural, symbolic conventions.

But his argument, as Carol Brownson has held, is simply unsound. I agree with her, that he has misplaced what is conventional. It is not the geometrical rules (when correctly stated) that are conventional. Where conventionality enters into realistic painting it pertains to conventional positioning of artists or viewers relative to objects and of viewers relative to paintings. But within those conventions of positioning, the laws of pictorial perspective are derivable from the geometry of optics. As far as Goodman's distinction between representation and resemblance goes, I think he is entirely correct. Further, I agree with him that while "realistic" paintings are generally representations, a painting may be representative without being 'realistic' in the slightest degree. In short I am now about to quarrel with his theory of art. Although I shall show that his argument is unsound, and his thesis about the conventionality of pictorial perspective is false, his theory of art does not require this argument. Even if realism in painting rests on rules of perspective which are derivable from the geometry of optics, the choice of using these "realistic" rules is open to the artist; they constitute only of many alternative modes of representation in painting.

Thus I would like to offer an alternative account of what constitutes realism in painting, an account which agrees with Ms Brownson in its conclusion

but differs in its explanatory reasons.

II

I wish to define realism in painting as follows:

A painting of an object, or kind of object, is realistic if and only if the painting when viewed from the intended viewing position, produces in the viewer a configuration of visual images which would be produced by that same object, or kind of object, when viewed from some physically possible position under some physically possible conditions of lighting. [1]

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1 This definition omits several qualifications which should no doubt be made, but would unnecessarily complicate the ensuing discussion. First, it presupposes, without saying so, that the viewer has normal eyesight, and that there are no unusual or artificial optical devices intervening between the object or painting and the viewer. Thus we could have a realistic painting of the reflection of a chair in a concave mirror; but this would not be called a realistic painting of a chair unless there were chairs that looked like that without intervention of a mirror. On the other hand, we might speak of a realistic painting of the edge of a razor as seen through the microscope, as being a realistic painting of the edge of a razor even though no person could ever see the edge of the razor in this way with his unaided eye. Similarly, we could have a realistic painting of the surface of Saturn as seen through a very powerful telescope, although no human eye unaided by a telescope has ever seen the surface of Saturn this way, and this might also be called a realistic picture of the surface of Saturn, since it is presumably the way Saturn would look to an unaided eye if one got close enough. On the other hand the unaided eye can never get into a position of seeing the razor blade as it is seen through the microscope. Despite this, we would call it a realistic picture of the edge of the razor because we assume the microscope produces a configuration of images which would be optically produced for a small version of our eye (in a small insect perhaps) in an appropriate position very close to the razor edge. Again, nothing precludes a realistic painting of the kind of distortion produced by heat waves on hot pavement - for here nothing artificial or unusual interferes, though this would not be called a realistic picture of the road itself.

Secondly, we shall ignore questions about the realism of lighting. It is physically possible to see and identify a given object (e.g., a familiar roll-top desk, or wood-basket) under a great variety of different lighting conditions; the visual configurations from the same object, viewed from the same vantage point may be all shades of red, (in a red-light), all shades of blue or purple, or green, or have a wide variety of different colors and shades of colors - as on a cloudy day, under night lights, at sunset, in early morning sunshine, etc. Some combinations of lighting of the given object are no doubt physically impossible; the artist is free to paint his picture so that all the lines and shapes are "realistic" but the colors are physically impossible - then the picture is realistic geometrically, but not color-wise realistic. In what follows, we ignore realism or un-realism in colors, concentrating only on the geometrical configurations of images, since it is only the rules of perspective and their role in "realism" which we are addressing. These geometrical configurations are formed by the boundaries of areas of color; all that is required is that they be contrasting colors - it doesn't matter what colors they are. To be sure to get a sense of depth, of a thrid dimension which makes a painting of a three-dimensional scene look realistic, there are important rules with respect to variations in tone, darkenss and light. But such rules, strictly speaking, stand over and above the rules of perspective as such, and are related to positioning and type of light sources, rather than the geometrical character of the objects re viewer.

the account Goodman attacks

Now this account of realism in painting differs from Goodman's ~~way of approaching the matter~~ in two important respects. First, when Goodman attacks resemblance in the theory of perspective, the kinds of items which he supposes his opponents claim to resemble each other are "bundles of light rays". The argument he chooses to attack, runs, he says, as follows:

> "A picture drawn in the correct perspective will, under specified conditions, deliver to the eye a bundle of light rays matching that delivered by the object itself" 4

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4 Goodman Opus cit. p 11

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two configurations of received images,

In contrast my definition above speaks ~~only~~ of the resemblance between 1) the configuration of visual images produced by the painting, and 2) the configuration of visual images producible in a viewer by the object, or kind of object, painted. Clearly there is a difference between trying to match bundles of light rays and comparing configurations of visual images. ~~Among other things the configurations of visual images are, in some sense, contained in direct visual experience, while bundles of light rays are not.~~ That is, one can be immediately aware of configurations of visual images, while one can not be immediately aware of bundles of light rays in a such a manner as to tell whether different bundles "match". The comparison of bundles of light waves would theoretically be carried on by a scientists standing outside the viewer; the comparison of configurations of visual images is a comparison ~~of~~ by the viewer ~~amongst his~~ of his own experiences. The latter is the kind of thing an artist engages in when he tries, ~~in trying~~ to paint a realistic picture of physical object or scene. ~~engages in in~~ He shifts his eye back and forth from object to canvas and back again, comparing the visual impression gotten from the object and the visual impression gotten from the canvas. His aim is to produce a painting so that the visual configurations it gives resemble the visual impressions he gets when looking at the object. Obviously he is not comparing the object itself to the painting itself. The object is three dimensional with all sorts of parts, invisible inside - the painting is essentially different, But he is We are comparing the way two different things look; it is the ways-they-look which are compared, not the things themselves.

~~Now~~ Goodman has, apparently, some deep objections to this approach; objections which I believe are simply mistaken and misguided. He seems to feel that comparisons of this sort presuppose what he calls the "myth of the innocent eye".

That is, he thinks they presuppose that the eye comes to its work without a past, unprejudiced by affections or interest, unembellished by thought or interpretation, and uninfluenced by action in the ears, nose, fingers heart or brain. As opposed to this he argues that what the eye sees is regulated by need and prejudice; "It selects, rejects, organizes, discriminates, associates, classifies, analyzes constructs...and what it takes and makes it sees not bare, as items without attributes, but as things, as food, as people, as enemies, as stars, as weapons." (pp 7-8, Languages of Art). And he adds ominously,

> "The myths of the innocent eye and of the absolute given are unholy accomplices. Both derive from and foster the idea of knowing as a processing of raw material received from the senses, and of this raw material as being discoverable either through purification rites or by methodical disinterpretation." (p 8 LA)

Now I fully agree that the way a thing "looks" to me, as I ordinarily use that phrase, may Part of the problem here has to do with the variety of uses of phrases of the form 'x looks like ....'. Usually, in ordinary discourse what x looks like is, indeed, an item of food, a person, an enemy, a weapon, and so on. But there is also the perfectly possible and proper usage according to which we say that a penny looks like an ellipse when viewed from an angle but like a circle when viewed perpendicularly to the plane of its face, /that a rectangular table looks trapezoidal when you are not hovering over its center. In one, naive and uncritical sense of "looks" this would be false; but in another rigorous sense, familiar to artists, draftsmen, architects and philosophers, these and intelligent laymen, it is indubitably true. It takes indeed a certain effort to describe the visual configurations in these cases; for most practical purposes our perceptual judgments of three-dimensional size and shape - i.e., the way things "look" from the "natural standpoint" - are the relevant and important ways things look, But and it is only occasionally, as when an artist is trying to paint a realistic painting of an object, that the second sense of 'looks' is employed. Goodman surely will not deny that occasionally one correctly says that a penny looks elliptical, or that the top of a rectangular table appears trapezoidal,

That there is a 'given-ness' to the visual images which ~~which~~ thus unquesstionable, in my mind. clear beyond doubt.
appear, is also ~~quite~~ clear. Consider first the visual image produced by
or any of the constellations of fixed stars.
the full moon, or the sun, The visual image produced by the moon is
f-to and always of the same in visual size.
a circlular disc, never an ellipse, and never square or trangular, Its
Similarly for the sun, and stellar constellations.
visual shape is "inalterable to the will" as long as one looks at it.
the image of the moon that we are aware of
No interpretation allows us to construe/ being square or triangular.

easily and contrast
though ~~perhaps~~ we could imagine a string of strange lenses which would
similar
transform light from a square object into a/circular image. In the case

of the moon, the sun and the various constellations of stars, the visual

inversely
angles, and thus the visual images produced, are constant in visual size.
If the full moon has a diameter of 2° of visual angle, then
~~The full moon has a diameter of about 1.5° of visual angle;~~

~~that it is~~ it always occupies approximately one 50,000th [or 1/52525 approx]
The star Rigel in Orion is always 47° of visual distance from the star Capella in Auriga.
of the total visual field available from a given standpoint. We may think it

looks bigger than this - e.g. vis? , the "moon illusion" in which we judge it to
the image is easily shown not
be bigger when it is close to the horizon - but in fact it does not
visual
to change. In contrast to celestial objects, which do not change their position
away and
perceptibly to earthbound mortals, because they are so far change

their relationships so (relatively) slowly, ~~objects which are closer to~~
of physically constant size which are
~~us change their visual im~~ the visual images of objects closer to us change
the objects are
in myriad ways according as ~~they are~~ closer or farther away (~~in which the~~

~~visual image becomes smaller~~ and as we change the angles from which we view them.

may be -
Thus a nearby object ~~which~~ produces a trapezoidal visual image, ~~may do so be~~
has a trapazoidal face and
cause the object physically ~~our line of vision is perpendicular~~
out line of vision is not at the angle which would make it appear rectangular, or
~~to the plane face~~, or it may be produced by
the trapezoidal image may be produced by
a rectangular physical object which we are viewing from an acute angle. Similarly
one object may produce a larger than another
/or smaller visual image/either because
the two objects have
they are different physical sizes at the same distance away, and are
or some of the infinite combinations of size
the same size but different distances away, ~~with infinitely many variations~~

and distance. In all of this, it is a simple thing, though not commonly done,

to find the geometrical properties of the visual images and distinguish ~~these properties~~
inferences
~~"given" image from the perceptual judgments/and interpretations we draw from it~~

these properties, and the "visual image" described in terms of them, from the that we are looking at
common sense judgments about what we see - i.e.,/a table, a person, a weapon, etc., - which are associated with these images. In almost all of our daily acts of perception we do indeed see tables, chairs, houses and people, and there arises no question of whether to interpret a trapzoidal visual image as a table or a triangular visual configuration as a a pair of railroad tracks stretching out in front of us. ~~Only on rare occasions, in bad light, or~~ Should we wish to pause and analyze the visual images presented to us we could do so, but there is no point. Only occasionally do we see a shape and have to struggle to determine what it is. ~~whether to construe the triangular image before us as~~ But this does not seem to me in any way to nullify the view that, at any given moment, if our eyes are open and there is light, there is a specific configuration of visual images which is fair rigorously describable in terms of ~~relative visual distances and geometrial distiances and angles~~ a geometry with a fixed metric for distances and angles. This is what I, and many philosophers and psychologists before me, have spoken of as the visual given. It is not the phenomenological given - that is what we get in the "natural standpoint"; Rather, it is the phenomenal given, what is discriminated, to use Husserl's term, by "bracketing out" much of the natural standpoint.

Having gotten through these preliminaries, III I want to return to the problem raised by Goodman's attack, and suggest a different than usual answer to it. What is almost universally overlooked, is that the geometry of visual images is a non-Euclidean geometry. Except for Thomas Reid's "Geometry of visibles" I know of no prominent philosopher or psycnolggist who has grasped this fact or seen its relation to the problem at hand. ~~I want to try to make clear what this~~ Thus I want to first explain and defend the assertion that the geometry of visual images is a non-Euclidean geometry, then I want to show how this helps us to answer Goodman's arguments.

Several years ago I published an article, entitled "The Geometry of Visibles" in Nous (May 1974). In it I maintained that the actual geometry of visual images is a non-Euclidean, two-dimensional, bi-polar geometry. Such geometries are sometimes called Riemannian, after Georg Friedrich Riemann (1826-1866) who developed them. It is also recognized that such a geometry is modelled by the geometry of figures on the surface of a sphere, provided we let arc of a great circles represent straight lines. It is an error (though one widely adopted) to identify Riemannian Geometry with spherical geometry, - since a sphere is a three-dimensional object, and in three-space arc or great circles are curved, not stright. Nevertheless, this model may be used to facilitate an intuitive grasp of what I am about to say.

Suppose that each person's head were enclosed in a transparent plastic sphere, two feet in radius and with its center at the center of that person's right eye. (We will suppose the left eye is covered or closed). At any given moment, if you traced on that sphere any three dimensional straight line in your field of vision, the arc you would trace on the sphere would be the arc of a great circle; and no line which appeared curved to you would be traceable as the arc of a great circle. Alberti, in his treatise on perspective, proposed that you trace such lines on a flat pane of glass, or window, which was perpendicular to your line of vision. This, he indicated, would yield a picture in keeping with Euclidean perspective geometry which would give to the an image resembling the image given by the object which is seen through the pane of glass. He was entirely correct. But I am entirely correct, too, in replacing the flat plane of glass, with the spherical surface. Both would give images resembling the image given from the object seen through the transparent glass or plastic. The difference is this: Alberti is talking about the geometrical physical properties which must apply to the surface of the physical canvas. I am talking about the geometrical properties which apply to the configurations of image in our direct experience. They are not the same thing.

Most people educated people think that the triangles, rectangles, parallel lines, etc., which occur in the visual images they receive, are Euclidean triangles, rectangles, parllels, etc.. But this is simply false, as a little experimentation and a lot of critical analysis will quickly show. Euclidean geometry includes the follow theorems:

I. Two straight lines can never intersect each other at more than one point.

II. If two stright lines are intersected by a third line which is perpendicular to both of them, then the two lines never meet however far extended.

III. The sum of the interior angles of a triangle is always equal to two right angles.

IV. The sum of the interior angles of a quadrilateral is always equal to four right angles.

V. ETc..

None of these theorems hold of the configurations of visual images we directly experience. Consider:

I. You are standing on a perfectly flat plane, between two railroad tracks which run perfectly straight in front of you and behind you. The lines in the image of the railroad tracks are perfectly straight. Yet these straight lines intersect at two points, one in the image when you look ahead, and one in the image when you look behind.

It might be thought might objected that though indeed they do appear to meet, they can't be straight lines, since straight lines can only intersect ones. But this objection begs the question; it is based on Euclidean assumptions. Let us define a straight line as any line such that given any three points, A,B and C on that line, with B between A and C, the line is straight if and only if the sum of the distances between AB and BC equals the distance AC; an unstraight, curved or crooked line is one in which for some distances AB and BC, AC is sh orter than the sum of Ab and BC. In the two dimensional visual field distances between points are measured rigorously by a metric corresponding to the measurements of visual angles in three-space. For example when we say that in images two stars appear to be twice as far apart as two other stars, we are measuring distances in degree of arc measure. There are devices for exact measurement of this sort

of thing; but one can also, with practice, (and much shedding of habits) learn to make good direct estimates. Thus it is clear that in the field of visual images, straight lines projected always intersect at at least two distinct point. This is a theory of bipolar, two-dimensional, elliptic geometry.

II. You look down at your feet, while standing in between the two railroad tracks as before. Clearly, the images of the two tracks are straight lines. The railroad tie at your feet presents the image of a straight line perpendicular to both tracks. Nevertheless, as before, when you extend these two lines in both directions, they not only meet, but they meet twice.

It is a theorem of two-dimensional, bipolar, elliptical geometry that every pair of straight lines meet if sufficiently projected; there are no parallel lines in this sense, in elliptical geometry. There are no lines which are straight and equidistant at all points.

III. You are standing at night looking at the stars. The horizon is a straight line in front of you, you imagine a two perpendiculars to this horizen, and you project them in you imagination straight upward. They intersect at the zenith directly overhead. If they were 30° arc apart on the horizon, the angle of intersection is 30°. But then you have a triangle whose interior angles equal 90°+90+°30°= 210°; i.e., its interior angles add up to more than two right angles, or 180°.

In fact, if you think about it, you see that the interior angles of a triangle could add up to almost 540° or six right angles, depending on how large it is. Only when the image is it are very small, does the sum of interior angles of a triangle become close to 180°. It is a theorem of two-dimensional bipolar elliptical geometry that the sum of the interior angles of eve ry triangle is equal to more than 180°.

IV. You are walking towards a doorway, or a rectangular picture frame. You know very well that in Euclidean, three dimensional space, the sum of the interior angles of the doorway or picuture frame are measured as being equal to four right angles, or 360°. Perhaps you think that you are seeing four right angles as you look at each angle. But in fact you are not. The closer you get the wider the angles appear. As you walk through the doorway each of the four angles appears as a 180° in your configuration of visual images; each They "flatten out". As you walk through the doorway, the images from each of the four conners of the doorway aproahh 180° and disappear. Tf you are close enough, or a physical quadrilateral is large enough relative to your distance from it, the sum of the interior angles approach eight right angles or 720°.

In order to get on, I will assume that my audience accepts, at least for purposes of discussion, my thesis that in a strict and rigorous sense the field of visual configurations which is given, has straight lines and curved lines, easily distinguishable to the viewer; that it has a metric for distances and for angles of intersection of its straight lines, and that it obeys the principles of two dimensional, bipolar, elliptical geometry, rather than Euclidean geometry.

IV

The next problem is, what does this contribute to the discussion of Goodman's attack on rules of pictorial perspective? Before proceeding, let me see if I can heighten the sense of paradox which Goodman introduced.

Goodman said that in pictorial perspective we must defy the laws of optical geometry because while we are told to draw railroad tracks as converging, we draw telephone poles or edges of buildings which are parallel as parallels. By strict laws of the uniform optical geometry, he says, the telephone poles also should converge, but if they did so they would not look right. This, and several other arguments of Goodman's are intended to show that rules of pictorial perspective which require that parallel verticals should be depicted by parallel lines, are merely conventional.

Let us add to this sense of paradox the following. Suppose I sit between two railroad tracks facing west and draw a picture in which the tracks sre depicted as converging at a point in the middle of the picture. I then turn around and draw a picture of the tracks going east; again the lines converge in the middle of the second picture. Now suppose I want to put the two pictures together to show what it is like to see the tracks in both directions at once. If I put the two pictures together into one picture, instead of two parallel lines, I get a diamondshaped result; but this would put angles at the two points where the pictures meet, and surely there is no angle when I look down at my feet where the east and west portions of the track which were pictured meet. What has gone wrong? It might be thought that I would have to extend the the size of the two pictures downward so as to get the full ninety degrees of visual field involved in each case. But no matter how I enlarge the pictures

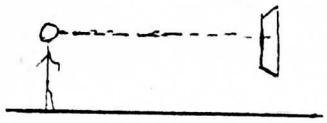
downward, both will represent the tracks with Euclidean, plane angles, into one picture we and on putting the two together will still have a diamond shape, though depicting somewhat larger. Does this suggest that merely horizontal parallels as converging is also a convention?

This, like Goodman's argument, would be an unsound inference. But what is the explanation?

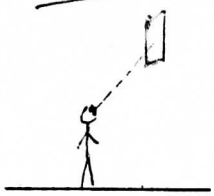
Let us reconstruct what goes on when an artist looks at an object and tries to draw a realistic picture of it on a flat, physical canvas. On my account there are two geometrical transformations going on. the three-dimensional, Euclidean First, there is a transformation, or projection from arrangement of the physical objects to be depicted, to the two-dimensional, elliptic (non-Euclidean)geometry of the visual images in the artist. This may be modeled as a central projection from three-dimensional Euclidean space onto the surface of a sphere; the lines run from the center,(that is,the eye of the artist)to points in three-space, and the projective images are the configurations on the surface of the plastic sphere where it is intersected by these lines. The second transformation or projection is from these same non-Euclidean given two dimensional/elliptical figures in the artists's visual field to a two-dimensional, flat, Euclidean plane which is the physical canvas. This transformation may be modeled as a central projection from figures on the surface of a sphere to a flat plane. ~~tangent to the sphere.~~ To state all this another way, a viewer of the picture an intended standing in position in front of it, gets a non-Euclidean configuration of images; the picture is said to be realistic if this configuration some or other resembles some configuration which he would get had he stood in position relative to the physical objects which were depicted. Alberti, and writers on and optical geometry pictorial perspective/generally, ingore the intermediate projections in the non-Euclidean configurations of visual images. But these steps must be attended to if we are to resolve fully, the apparent paradoxes

Handout

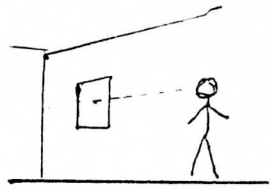
R.B.Angell 12/28/81



Convention #1: The intended position of the viewer is such that the central line of vision is perpendicular to the plane of the picture.



Alt #2



Alt #3

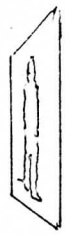
Rejected alternatives of intended positioning of the viewer; #2. Viewer below looking up. #3.viewer to one side.

I. A realistic picture which is made - as almost all are - with the intended position of convention #1, will produce a visual image, or kind of image, like the image produced by the actual objects, only when the viewer stands in approximately the intended position.

Portrait from intended position #1.

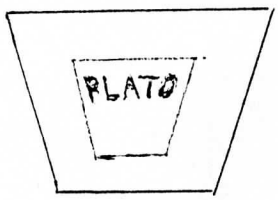
No human being can look from any angle to be 50 times as tall as wide,(E.g. 6'3" tall and 1.5" thick); or as wider than they are tall: This is a fact about the real world.

Portrait from position #2

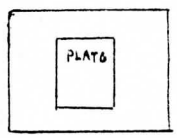


Portrait from Position #3.

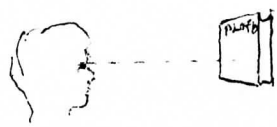
II. If the intended viewing position were different than Convention #1 - if it were position #2 for example - then the pictorial rules for drawing would be different. If position #2 were intended (as it occasionally is) then to produce an image like that produced by parallel lines on a plane perpendicular to the line of sight, one would draw the lines as diverging towards the top of the picture. If one wished the frame to look rectangular from that position, one would use a trapezoidal frame and canvas:



Realistic picture painted with intended position #2 in mind, as it would look from position #1.



Realistic picture painted with intended position #2 in mind, as it would look from position #2.



[We suppose this is a picture of a book seen with the line of sight perpendicular to its cover].

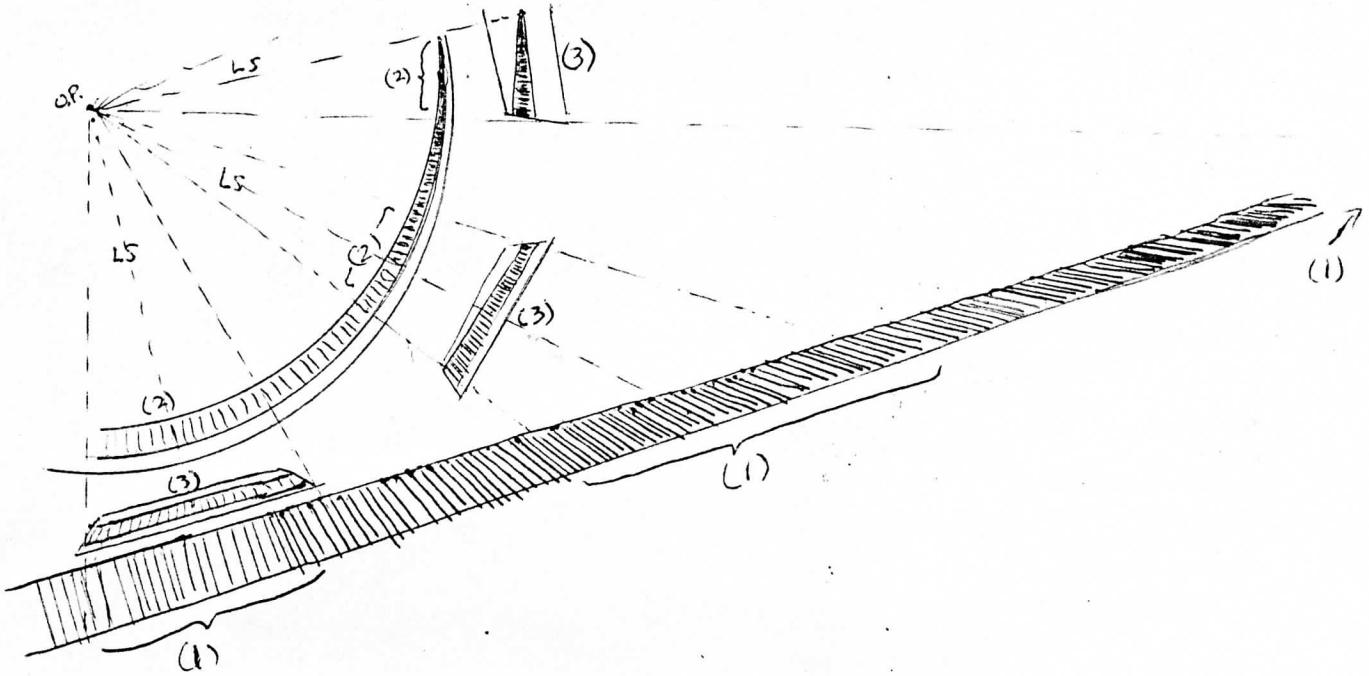
III. It is important to note that though the rules of perspective drawing in this case would be different from the usual ones, they are no less rigorously derivable from the geometry of optics and perspective.

Thus the conventionality implicit in rules of pictorial perspective come entirely from conventions on viewing positions, not from conventions about geometry.

The two geometrical transformations involved in constructing a "realistic" picture: I. A transformation from (1) the three-dimensional Euclidean physical objects in the line of sight of the artist, to (2) the two-dimensional, non-Euclidean, configuration of visual images in the artist.

II. A transformation from (2) the two-dimensional, non-Euclidean configuration of images of the artist, to (3) the two-dimensional, Euclidean, flat plane of the canvas or picture

A. Three pairs of transformation where the intended viewing position is to be with the line of sight perpendicular to plane of the picture.



B. Three pairs of transformations where the intended viewing position is to be below the perpendicular to the picture but perpendicular to the horizontals in its frame.