A METHOD OF ANALYZING LINEAR PERSPECTIVE FOR PRESENTATION
TO JUNIOR AND SENIOR HIGH SCHOOL STUDENTS

APPROVED:

[Signatures]

Major Professor

Minor Professor

Director of the Department of Art

Dean of the Graduate School
A METHOD OF ANALYZING LINEAR PERSPECTIVE FOR PRESENTATION
TO JUNIOR AND SENIOR HIGH SCHOOL STUDENTS

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By

180034
L'Louise Dial Lacy, B. S.

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CHAPTER I

INTRODUCTION

Statement of the Problem

Most boys and girls have a natural desire and ability to draw. However, one of the most difficult phases of the teaching of object reproduction is getting the student to understand the simple laws of perspective, which will make an object appear three-dimensional, not flat like the surface of the paper on which it is drawn. The application of the laws of perspective will not only make an object appear to have three dimensions, but will also cause it to appear either near to the eye or in the distance—in other words, place it in space.

If an untrained person, either an adult or a child, is asked to draw a simple object, such as a table, he will try to draw it as he knows it through kinesthetic and tactile experience instead of the way it appears to him visually. He draws the table top as a rectangle and makes all four legs equal in length because that is the way he knows them to be; or, in case of a pail, he makes the bottom flat instead of elliptical. He draws his concept of the table or pail instead of the perceptual image as it appears in perspective.
The general purpose of this study is to develop a series of peep shows, or visual models, which will enable the young student to understand what the laws of perspective are, how they were found, and why his drawings will appear to have three dimensions if he follows the rules. The study is based upon a widely accepted idea—that it is much easier for most people to understand and remember a principle when they can actually see how it works. When rules are merely memorized, one is not assisted by reason, which is essential for useful retention.

Procedure

In this series of peep boxes, the goal is to enlist the reasoning faculty of the student from the very first. One problem will grow out of another and be dependent on the foregoing, as in geometry. Each step will be accompanied by demonstration so that there can be no doubt concerning its correctness. In this way the student will gain the power to work out any new perspective problem for himself.

This knowledge of perspective should be used as a guide to drawing, and not as a rigid mechanical device. With this working knowledge the student will be able to create representational drawings to fit his own moods and desires.

It is hoped that through these demonstrations the rules for achieving proper perspective will be so clear that they will become a part of the permanent knowledge of the student.
An effort has been made to keep the number of illustrations to a minimum in order to avoid confusion, so that anyone, whether he is talented or not, may readily learn to draw accurately in perspective.

The methods used in gathering information for this thesis have been chiefly those of research, experimentation and critical analysis. An extensive survey was made of general art literature and periodicals in order to develop an organized history of perspective. The idea of the peep boxes was suggested by perspective diagrams made by Renaissance artists.¹

Importance of the Subject

Art experiences are essential to the fullest development of all people at all levels of growth, because they promote imagination, creativeness and a deepened understanding of the problems of other individuals. Art encourages freedom of expression and emphasizes emotional and spiritual values.

With art needing no further justification as a subject worthy of serious study, every art student should realize that to portray objects properly he must have a thorough understanding of perspective; that is, he must understand how to represent on a flat surface various objects so that

¹For an extensive discussion of these works, see: William M. Ivins, Jr., On the Rationalization of Sight.
they appear to have the same size, shape, and position in relation to other objects as the actual objects appear to have when seen by the observer from a particular location.

Once the theory of perspective has been mastered, it may be applied to many types of drawing. The architect uses perspective in showing how his buildings will appear three-dimensionally; in this way he gives his clients an idea of how both interiors and exteriors will look. Likewise, the interior designer must make perspective drawings to show his clients just what to expect, and the sculptor must understand perspective in order to correct the optical illusion which occurs when a large installed work is viewed from the observer's position below. With few exceptions great painters have also been masters of perspective, realizing that a working knowledge of perspective is necessary in giving plausibility to their compositions.

**Definition of Terms**

In the explanation of the peep boxes several technical terms will be used which may need definition for those who are not familiar with the nomenclature of linear perspective. These terms, which are listed and explained in the following paragraphs, must be understood before the student can possibly study the science of perspective drawing intelligently.

**Linear perspective.**—Perspective is the representation of figures and objects not as they are, but as they appear in
space. It is a science, dependent not upon the accidents of vision, but upon the exact laws of reasoning. Perspective has an intimate connection with mental perceptions and with the ideas that are impressed upon the brain by the appearance of all things that surround one. If one sees everything as depicted by plane geometry—that is, as a map—there would be neither differences in views nor variety of ideas, and the appearance of the various aspects of the world about one would be monotonous. Since everything is seen in perspective, one's mind is subjected to countless phases of thought, making the visual environment constantly interesting.

**Picture plane.**—All ordinary perspective drawing is based upon a simple conception that, between the eye of the observer and the object to be drawn, there stands a transparent plane, a sort of window, called the picture plane, on which the form of the object is projected. Since vision is impossible without light, it is assumed that a ray of light enters the eye from each point on the object. On the way from the object to the eye, each of these rays passes through or, in technical language, pierces the picture plane. The point where the ray from any given point on the object pierces the picture plane is the perspective projection of that point. When all the rays from all the (visible) points on the object have produced their respective perspective
projections, the sum total is the perspective projection upon the two-dimensional picture plane of the three-dimensional object beyond.

Station point.—The station point is the point where the eye of the observer is located when viewing an object. This point is of major importance, since it has so much to do with the construction and general appearance of the perspective of the finished product. The station point must, of course, have a position in plan and also a position in elevation.

Horizon.—The most natural way in which to think of the horizon is that it is the "line" where a plane surface of the earth seems to meet the sky. This "line," neglecting curvature, appears to be in horizontal alignment with the eye level whether one views this apparent line of juncture from the ground, the deck of a boat or from a high altitude.

Vanishing points.—All receding horizontal parallel lines, if sufficiently extended, will meet at the same point on the horizon. This point is called the vanishing point.

Ground plane.—The horizontal plane of the ground on which the object or objects rest is called the ground plane.

Scope of the Problem

Generally speaking, perspective representation is divided into two broad classifications—-aerial and linear. As the name implies, aerial perspective has specific reference
to the combined effect of distance and atmosphere that separates an object from the observer; however, this study deals only with a method of teaching linear perspective.

Chapter I serves to introduce the problem, to define the terms and to show the general limitations of this paper.

Chapter II contains a brief survey of the history of linear perspective from the remote days of the caveman, through the successive civilization of man and to the present time. In order to survey so vast a field, unsparing eliminations have been necessary and only periods in which significant progress was made have been considered.

In Chapter III an effort has been made to explain thoroughly the basic principles of linear perspective in a manner not too technical for the beginning student. To make the text clear, photographs and working drawings of the peep boxes to be used in the classroom demonstrations are included.

Chapter IV summarizes the findings and presents the conclusions and recommendations of the writer.
CHAPTER II

THE HISTORY OF PERSPECTIVE

In this discussion of the history of space and its corollary, perspective, the purpose is to present a simple analysis of the spatial characteristics of the periods in history that offer a definite style. A detailed analysis of the various cultural factors which may affect the representation of space has been omitted. Functions, technique and historical influences are all active agents in forming a particular spatial style. An exhaustive study of these questions, however interesting they may be, is beyond the scope of this thesis. That these agents are the possible sources for the explanation of certain forms should be recognized, but attention here will be given only to the problems of space.

Primitive

Primitive man had a limited understanding of space. For him, each experience was confined to its own space and he felt little, if any, need for comparing and measuring, for he did not inherit visual experiences from preceding cultures as a foundation for his education. His visual comprehension of the figures he represented was not connected
with the understanding of the surrounding space. He was little concerned with background, weight, top or bottom. For him, each element lived its own life in complete spatial independence.\(^1\)

In the art of the prehistoric European caveman the surface of the wall or ceiling became the picture plane, used as it was found, rough and uncolored. He might have chosen a particular spot for his drawing that was especially adapted to the curve or bulge of the animal formed, but this was not framed in any way.\(^2\)

With few exceptions, the caveman drew only animals. These animals usually appeared alone, but in a few cases he drew groups of animals. These animals had a profile body and head, and frontal eye and hoofs. Usually all branches of the horns were visible.\(^3\) Although this combination of points of view was optically inaccurate, an astonishing degree of resemblance to the real animals was obtained.

The Bushmen, a primitive tribe of people in South Africa, observed and recorded the movements of animals with more understanding of technical perspective than any other artist group untrained in scientific optics. By making figures close to them large and those in the distance small, they achieved the sense of space.\(^4\)

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\(^1\)Gyorgy Kepes, *Language of Vision*, p. 69.
\(^3\)Ibid.
Painting before the fifth century A.D. is often referred to as the childhood of art.\(^5\) In fact, the art of Europe previous to this time, primitive art and the drawings of children have fundamental similarities. The form of the objects and figures is a combination of the kinesthetic, tactile and visual impressions it makes on the artist. However, adult art differs from the drawings of children in that it has always been comprehended by the public. It generally had a communal purpose. Most of this art was religious, although some of it was magical, lyrical or narrative. Regardless of his artistic flaws, the primitive or Early European artist was a mature craftsman who represented a cultural tradition.

Egyptian

As compared with the art of primitive man, the Egyptian art which flourished between 3000 B.C. and 500 B.C. presented several advances in spatial evolution. The picture plane was part of a surface which had been constructed, either a brick wall or one that was cut into the rock. It was not a surface made especially for representation—for example, a panel—but it was plastered and stuccoed to offer a smooth ground. The picture plane was broken by inscriptions that were not separated from the figures and objects.

\(^5\)Bunim, op. cit., p. 13.
The presence of hieroglyphs between the figures indicated that the picture plane was not felt to be a material part of the environment of the figures, but that it was simply a necessary structural support, mechanical rather than artistic in nature. There was an occasional appearance of sections of decorative borders and a base line. The base line might appear under a single object or under the whole scene as a collective ground line and lower limit of the picture plane.⁶

In the individual figures, profiles and frontal views were combined to give the impression of a flat, two-dimensional form. The peculiar angularity of the figures resulted from the fact that each part was drawn in its most easily recognizable shape, which is its most characteristic attitude. The feet were drawn in profile, regardless of the pose of the figure. To draw a shape that would be immediately recognized as a foot was more easily accomplished in profile than from a point of view from which the foot would have to be foreshortened—as, for example, a front view. The profile view was maintained from the feet through the hips; but at the waist the body half turned so that the shoulders were represented facing front, again because they are readily identified in that position. For the same reason, the head was in profile, but the eye was in full front.⁷

Then the figure consisted of an alternation of the facing and profile positions, each designed to be legible, even if the results seemed incongruous to the eyes conditioned by "realistic" painting.

An obvious way of emphasizing one figure in a group was to enlarge the figure. The husband was drawn larger than the wife, and both were pictured as larger than the servants. In many instances where a row of figures was represented, each figure overlapped the one next to it. This is a form of composition which may indicate a concern for the expression of depth in the scene. The suggestion of depth is limited, however, because all the figures appear to be standing on the same level.

The absence of the application of the principles of perspective in these representations had other consequences. If several persons in a row were engaged in the same action, or if several objects of a kind were to be recorded, the artist drew one in the required position and then repeated the front half of his outline as often as was necessary, producing a row of overlapping forms. For objects in the ground plane or parallel to it, a cross-section was made or painted as if it were seen from above. Finally, in the details of nature, the artist reduced many objects to sizes to fit into the general pattern.

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8 Bunim, op. cit., p. 15. 9 Cheney, op. cit., p. 25.
The bulk of Egyptian decoration consisted of these foregoing formulas, established early and followed by generations of artists. Rigid though the rules were, the Egyptians were still capable of indicating a variety of action without violating these principles (Figure 1a).

Chinese

Perspective and composition in Chinese art grew from the bas-reliefs, where the method of superposition of registers gave different planes of action. The picture plane was made of an altogether new material—silk or paper. A complete story was told on a long scroll or wall hanging, thus offering many points of vision in one painting.

The word perspective meant a different thing to the Oriental from what it meant to the Occidental. The Chinese had a form of inverse perspective. Instead of drawing objects as they appeared, smaller in the distance and larger as they came closer to the observer, they were portrayed to appear just the reverse. Parallel lines widened in the distance instead of converging into a single point\(^{10}\) (Figure 1b). Usually distance was indicated by tonal gradation and varying scale of the objects.\(^{11}\)

Painting for the Chinese was a form of handwriting. For both writing and painting, a brush was used. The artist

\(^{10}\)Ibid., p. 295. \(^{11}\)Art News, 1944, p. 24.
conceived his design; and having completed the mental image of what he intended to paint, he swiftly transferred it with a sure stroke to the silk or paper. His art sought to interpret the life essence, the motion, the inspiration that lies within and behind the object. In indicating a form, he tried to paint as little as possible of what he saw so that his composition of rhythmic lines might be an inspiration to the observer.

Since this is the case, the important thing to grasp at first is the basic formula the Chinese artist had for transmuting nature into art. In the representation and the interpretation of the world around him, he had no superiors and few equals. His approach was one of reverence and respect. He saw beneath this outward loveliness the great creative forces of life. The artist studied his subject from every angle, seeking its essential structure, its natural movements, and its behavior under various conditions. Only in this way was he able to comprehend and then depict its inward qualities. To the Chinese, nature was a world of symbols. Each flower, tree, plant, bird and insect held some special meaning. Whatever he painted, his aim was not only to portray the object itself, but also to suggest its spiritual qualities and its relation in the scheme of the universe.  

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He painted not what he saw, but what he felt; he suggested rather than revealed.

This essential purpose, rather than scientific accuracy as achieved through perspective, dominated the artist. The composition of the Chinese was open and spacious; it had no unnecessary details, very few figures and no dramatic display. The observer would perceive at once only the suggested vastness of space, and perhaps a balance of masses and an impressive rhythm of lines and planes.

Persian

Persian painting as we know it today is largely limited to miniatures. Yet fine and exquisite work by no means exemplifies the earlier painting as it was known to exist. Of painting in its more impressive aspect we have very little knowledge. Murals have been found in a few sites of Persia and the neighboring countries, but only in a ruinous condition. They serve, however, to suggest something of the grandeur of wall-painting as it may have once existed. That so few works remain is due to the ruthless destruction of Persian cities and castles during the Middle Ages. The frescoes that probably once faced these walls are forever lost.

Thus the paintings which have come down to us are chiefly the brilliant and charming miniatures with which Persian books were adorned. Scientific works, including medicine, astronomy and physics; popular books of natural history; the
romantic and mythical poetry; universal and local histories; legends and fables—these form the literature of the day, which was enhanced by miniatures of the Persian artist. ¹⁴

Persian paintings were primarily diagrams; their purpose was to present ideas as clearly as possible, and not to show things as they appeared. For instance, night-scenes were as bright as day; only stars or a moon indicate that the sun has gone down. There was no real perspective; instead, there was a convention which removed the more distant objects nearer to the top of the picture. Also, there was no natural scale. Trees and mountains were made to fit whatever space was available for them. Everything was drawn to please the eye and illuminate the mind rather than to recall the real world. ¹⁵ The design tended to fill all the available space and was so composed and connected as to give the optical illusion of infinity. ¹⁶ Figures were flat and with but a hint of perspective. Parallel lines were drawn parallel, and the tile floor in the court and rugs on the floor appeared to be hanging vertically (Figure 1c). The painting was not conceived from the point of view of natural appearance, but of pattern and vivid color. Each detail of the figures and the costumes was drawn with the surest, yet most delicate, lines. ¹⁷

¹⁴ Museum of Fine Arts, Boston Exhibition of the Week, July 31 to August 6, 1937, Painting in Persia, from a pamphlet on file at the University of Texas library.
¹⁵ Persian Exhibition, New York, 1940, ibid.
¹⁶ New York Times, April 21, 1940.
¹⁷ Cheney, op. cit., p. 364.
Renaissance

The tri-dimensional concept of space which culminated in the Renaissance had a slow development. Little by little, artists tried to place backgrounds in their pictures and produce the third dimension. They felt that parallel lines seemed to converge, and that sides of buildings, seen at an angle to the picture plane, descended while the corresponding base lines ascended. There was a feeling that objects grew smaller in size as their distance from the edge of the picture plane increased.

In spite of much experimentation, it was not until the beginning of the fifteenth century that it was proved that all parallel lines in the picture plane vanish at the same point (Figure 1d). The rate of conversion in a foreshortened plane is determined by the distance of the spectator from the picture plane. The point of conversion corresponds to the level of the eye. Although these relations were not expressed in terms of distant point, station point, point of sight or vanishing point, they were explained in a form that made it practicable to the artist.

As soon as this discovery was made, men began studying and developing perspective; but it was not until the 1630's that, for the first time, a mathematician attacked the

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18 William M. Ivins, Jr., On the Rationalization of Sight, p. 10.
However, it was the mathematician and not the artist that gave us the terminology that we use today. Ivins makes the statement that the most important thing that happened during the Renaissance was the emergence of the ideas that led to the rationalization of sight. The problems arising from the change in concept—the quest for a mathematical method of perspective which should serve both the practical need of optical realism and the aesthetic desire for compositional unity, as well as those of foreshortening and anatomy—were solved in the Renaissance. The form had developed into a systematic and unified representation of space. Truly, the contributions of the mathematicians and artists of the Renaissance make the period a great one in the history of perspective.

Modern

Almost as soon as the Renaissance mathematicians introduced the principles of perspective, its painters began to find the fixed system of space representation less than satisfying. One by one, new styles of art were developed; some have disappeared and others have been modified into another style. The apparent chaos of modern art can be partly attributed to its being too close to us; time has not yet

\[19\text{Ibid.}, \text{p. 10.}\]  
\[20\text{Ibid.}, \text{p. 7.}\]
assorted what has been of real significance from what has been a passing whim and novelty of the day. Probably the work of all has seemed more complex to their contemporaries than to their descendants.

That the progressive artist of the twentieth century revolted against his predecessors is obvious. He is no longer interested in making objects appear as they are but in producing visual experiences not to be found in unaided nature.

With the invention of the camera we have witnessed the conclusion of one epoch of painting history; it is the epoch predominantly characterized by the attempt to copy and create a permanent record of nature's appearances. Soon after the camera was invented, a new phase of painting art appeared, which was to lend importance to a heretofore minor art.

While this direction was new and different, it was nevertheless related to the past. Painters discovered that one observation point was not sufficient to give the spatial essence of an object; so the painter moved around the object, penetrated it and used all means available to the spectator and to other objects. All the sharpened tools of perspective were focused in one simultaneous representational sequence, and represented the projection of several points of view in one picture.\footnote{Kepes, \textit{op. cit.}, p. 95.} They sought to order space in a perfectly
measured relationship of color and line by concentrating on only the essential qualities of form (Figure 1e).

In explaining the new concept, Biederman quotes John Dewey as follows:

Every work of art abstracts in some degree from the particular traits of objects expressed. Otherwise, it would only, by means of exact imitation, create an illusion of the presence of things themselves. The ultimate subject matter of still life painting is highly realistic—drapery, pans, apples, bowls. But a still life by Chardin or Cezanne presents these materials in terms of line, planes, and color in perception. This reordering could not occur without some measure of abstracting from physical existence. Indeed, the very attempt to present three-dimensional objects on a two-dimensional plane demands abstraction from the usual conditions in which they exist. There is no a priori rule to decide how far abstraction may be carried. In a work of art the proof of the pudding is decidedly in the eating. . . .

It is everywhere accepted that art involves selection. Lack of selection or undirected attention results in unorganized miscellany. The directive source of selection is interest; an unconscious but organic bias towards certain aspects and values of the complex and variegated universe in which we live. In no case can a work of art rival the infinite concreteness of nature. . . . The one limit that must be overpassed is that some reference to the qualities and structure of things in environment remain. Otherwise, the artist works in a purely private frame of reference and the outcome is without sense, even if vivid colors or loud sounds are present.22

Every historical period in which radical changes in method of representation have taken place casts a new light upon the past and the future. In each stage of development a more or less common object was being sought, but at the same time differing degrees of realistic recording were

determined by the increasing ability of man to visualize. The different movements have a common denominator; they all strive to objectify a new spatial conception. Art is the response to a fundamental human demand. Its primary purpose is to interpret the visible order of events which surround man. It is, therefore, both natural and inevitable that the steps which the artist takes toward formulating and portraying spatial experiences are conditioned by his ideas and conceptions of the ordering of social existence.
Fig. 1—Five ways to draw the table: (a) Egyptian, (b) Chinese, (c) Persian, (d) Renaissance, (e) Modern.
CHAPTER III

PEEP BOXES

In approaching the study of perspective in the public schools, the writer has endeavored to keep in mind modern educational methods. Since visual education has proved to be effective in all fields of education, it should aid in the study of linear perspective. There are many high-school art departments which do not include the study of linear perspective in their curriculum. This is probably because the young student cannot understand or is not interested in learning the many rules required to make accurate perspective drawings.

There are various methods of making perspective drawings, some of which are uselessly complicated. If accurately applied, however, all sound methods will produce exactly the same results. The use of peep boxes is a simple way to show the student how the rules of perspective were deduced, and making their own constructions impresses the rules upon them. This method was first used during the Renaissance and for many years very accurate drawings were made without the knowledge of the scientific rules of perspective as later deduced by the mathematician.
In experimenting with high-school pupils during the winter of 1949-1950, the writer found that five peep boxes would adequately explain all the rules. In the series there were two peep boxes illustrating parallel perspective, two illustrating angular perspective and one illustrating oblique perspective (see Figures 2, 6, 10, 13, 15). The boxes were constructed from white illustration board and put together with two-inch gummed paper. The objects to be seen in perspective were painted gray and black to give contrast, and the strings representing the vanishing lines were of braided casting line. The student was first required to construct the box from the given dimensions, view it from above, then place his eye exactly at the station point and observe the change that took place in the object. He was then required to make a drawing of what he saw from the station point.

The first peep box illustrating parallel perspective (Figure 2) was 23 inches long, 20 inches wide and 7½ inches high. This size, after many differently sized boxes were tried, seemed to be the smallest that would give students a good view of the object with the vanishing lines (strings).

A checkerboard 4 inches by 4 inches wide, composed of 16 squares, was drawn on the bottom of the box with its sides parallel to the sides of the box. This square was placed 8 inches from the front of the box, 8 inches from the back and
Fig. 2.—The first peep box showing parallel perspective 6 inches from the right side. It was found through experiments that to view the checkerboard in its true perspective, it should be the same distance from the front of the box as it was from the back, or, in other words, it should be the same distance from the eye level as it was from the station point. At each intersection of the squares, on the front and left sides, strings were attached and drawn together at one point (vanishing point) on the horizon. The horizon was located 5½ inches above the ground plane. This point was exactly in the middle of the checkerboard and exactly opposite the peep hole (station point). The strings represented the line of vision between the eye and the checkerboard.
From the front right corner of the checkerboard another string was attached and stretched to a point on the horizon whose distance from the vanishing point was the same as the distance from the vanishing point to the station point. When viewed in perspective, this line formed the diagonal of the checkerboard (Figure 3). This figure also illustrates how the orthogonal lines on the checkerboard vanish to the single vanishing point.

A templet was made of cardboard in the shape of an isosceles triangle. The base of the templet was made the length of one side of the checkerboard and the vertex was at the height of the station point. The templet was held at the far edge of the...
checkerboard in an upright position. Where each string touched the templet, a mark was made and through these points parallel lines were drawn. These lines were used later to locate the horizontal lines of the checkerboard when drawing it in perspective (Figure 4).

After constructing the box, the student was required to make a drawing of his model. He began his drawing by marking off the width of the squares of the checkerboard on a working line. Next he viewed the object from the station point and drew on the checkerboard orthogonal lines which appeared to converge.

Fig. 4.—A templet showing how the horizontal lines of the checkerboard were located.
in one point (Figure 5a). Now the templet (Figure 5b) was placed over the drawing and the parallel lines extended to complete the checkerboard drawn in perspective (Figure 5c).

![Fig. 5.—A working drawing of Figure 2](image)

The second model was constructed 30 inches long, 14 inches wide, and 8 inches high. A square checkerboard was again used, this time to illustrate angular perspective (Figure 6). The checkerboard was placed 6½ inches from the front of the box and at an angle of 30 and 60 degrees with the center line. The horizon and station point were placed 6 inches above the ground plane. The elevation position of the station point determines the height of the horizon, since the horizon is always at the eye level. Lines forming the two front sides of the squares were extended until they reached the vertical plane, and perpendiculars were drawn at this point. These proved to be important
Fig. 6.—An overall view of the second peep box showing angular perspective.

lines because—with the vanishing lines which they crossed—when viewed from the station point, they marked off the squares of the checkerboard in perspective (Figure 7). It was impossible to obtain a photograph of this view since the picture had to be taken from the station point and the visual cone of the camera did not extend this distance.

On the ground plane, directly below the station point, lines were drawn parallel to the sides of the checkerboard. These lines were extended until they reached the back of the box, and at these points, perpendiculars were drawn on the vertical plane. These perpendiculars, at their crossing
with the horizon, located the vanishing points. This illustrates the fact that the farther the observer is from the object, the farther apart the vanishing points will be.

Fig. 7.—A drawing showing the perpendiculares where the division of the squares was obtained.

Strings were connected at the intersections of the squares on the left and right sides of the checkerboard. Those on the left were stretched to the right vanishing point and those on the right were stretched to the left vanishing point.

To make a perspective drawing of this model the student began by making a large right triangle with an altitude drawn to the hypotenuse (Figure 8). The three points
Fig. 8.—A working drawing showing the checkerboard drawn in angular perspective.

A, B, C of the triangle represented the station point and the right and left vanishing points. The altitude represented the line of centers. Realizing that the object to be drawn was 6 inches from the station point, a point D on the center line was chosen. At this point lines were drawn to the two vanishing points.

The student again viewed the checkerboard from the station point and measured the intersections of the vanishing lines on the perpendicular to the right (MN in Figure 7) and marked off these divisions on DB beginning at D (Figure 8). Likewise, he marked off the intersections of the vanishing lines on the perpendicular to the left (OP in Figure 7) and made similar divisions on line AD, beginning at D.
(Figure 8). From these division lines on AD, lines were drawn to the vanishing point A. From the division lines on DB lines were drawn to B. This completed the drawing of the checkerboard in perspective (Figure 9).

![Checkerboard drawing](image)

**Fig. 9.**--Same peep box as Figure 6 but viewed from the station point.

In constructing the third model, the student was required to place several small boxes in parallel perspective. It was suggested that he use differently sized boxes and paint them with tempera. The third model in this series (Figure 10) shows three rectangular boxes in parallel perspective. This model had the same dimensions as the first model (Figure 2), which also illustrated parallel perspective;
therefore, the eye level, vanishing point and the station point have the same position as those used previously.

Fig. 10.—The third model showing solids in parallel perspective.

A rectangular box, $\frac{4}{4}$ inches long, $\frac{4}{3}$ inches wide and $1\frac{1}{2}$ inches high, was placed 3 inches from the station point and parallel to the back of the peep box. Superposed upon this was a smaller box, 1 inch high, 2 inches wide, and 3 inches long. Each box was pasted in position so that it would remain fixed. Strings were then attached to the two upper front corners of each box and stretched to the vanishing point. These four lines defined the vanishing lines in the perspective drawing (Figure 11).
Fig. 11.—Two rectangular boxes in parallel perspective as seen from the station point.

Another box, 1½ inches high, 2½ inches wide and 3½ inches long, was placed 5 inches to the left of the other boxes and 10 inches from the station point. This box also was placed with the front side parallel to the sides of the peep box. Strings attached to the two upper corners and the lower right-hand corner of the front side of the box were stretched to the vanishing point (Figure 12).

On the right side of the box, which was placed to the left of the station point, a semi-circle was painted and diagonals and a bisector of the rectangular plane were
drawn. This is the method used in locating the center of any square or rectangle.

Fig. 12.—A rectangular box in perspective showing how a semi-circle is drawn in a vertical plane.

In drawing solids in parallel perspective, the front plane, or vertical plane, remains in its true shape and the horizontal planes are drawn as the checkerboard was drawn in the first model.

The horizon, or eye level, may be above, below, or in the middle of an object. Model IV (Figure 13) shows an arrangement of the eye level cutting through the object to be seen or drawn in perspective.
Fig. 13.—An overall view of the fourth model

This model was constructed the same size as Model II (Figure 6) with the eye level, station point and vanishing points in the same position. The box used in this model was $5 \frac{1}{2}$ inches tall and had a square base whose side was $3 \frac{1}{2}$ inches. It was placed $6 \frac{1}{2}$ inches from the station point, making angles of 30 and 60 degrees with the line of center. Two strings were attached to the two corners nearest the observer. One string at the top and one string at the bottom was stretched to the left vanishing point, while the other two were stretched to the right vanishing point.
This model was used only to show that lines above the eye level converge downward while those below the eye level converge upward (Figure 14).

Fig. 14.--A perspective view of an object which is both above and below the horizon.

The third and last type of perspective dealt with in these experiments is oblique perspective. As the name implies, the plane is oblique to both the vertical plane and the horizontal plane. A box with a pitched roof (representing a house) was used in the fifth model to illustrate oblique perspective (Figure 15). The dimensions were 4 inches wide, 4 inches long and 3 inches high at the center.
of the roof. The peep box was constructed 29 inches long, 17 inches wide and 16 inches high. The sides of the model had to be made higher than those of the other models to take care of the vanishing point of the oblique plane.

![Image](image_url)

**Fig. 15.**—An overall view of the fifth model showing oblique perspective.

The box was placed 6½ inches from the front of the peep box and at an angle of 30 and 60 degrees with the center line of vision. The horizon and station point were placed 6 inches above the ground plane. The vanishing points were located in the same manner as those in the other models illustrating angular perspective. A string was attached to the lower front corner of the house, and the string's two
ends were stretched to the left and right vanishing points. Also, strings attached to the roof at the front corner of the left side and the back lower corner of the same side were stretched to the third vanishing point. This point is directly over the right vanishing point and 6 inches above it (Figure 16). A change in slant of the roof would lower this point or raise it; and the greater the pitch, the higher the vanishing point would be. The vanishing point of the back side of the roof would fall below the level of the box.

Fig. 16.—A perspective view of a house showing oblique perspective.
The center of the house was again found by drawing diagonals of the plane of the right side and erecting a perpendicular at the point of intersection. This perpendicular, when extended, located the center of the roof.
CHAPTER IV

SUMMARY AND CONCLUSIONS

Summary

The purpose of this study was to devise a method whereby students of high school level could enjoy and understand the study of linear perspective. This experiment did not introduce a new method, but tested the method first used by the artists of the Renaissance. The study is based upon the idea that it is much easier for most people to understand and remember a principle when they can actually see how it works. The students were required to construct the peep boxes from the given dimensions and then make a drawing of the view from the peep hole. The experiment consisted of a series of five peep boxes designed to help the student to understand how laws of perspective were developed and why his drawings will appear to have three dimensions if he follows the rules.

Chapter I introduced the problem, defined the terms that would clarify the text and showed the general limitations of the problem.

A brief survey of the history of linear perspective from the early days of the caveman to the present time was made
in Chapter II. Since the beginning of time man has been confronted with the problem of space and it is interesting to note how each approached this problem and solved it. In order to survey a field so large, only significant periods were considered.

In Chapter III the method of constructing the peep boxes to be used in the classroom was explained. Accompanying this explanation are photographs of the five peep boxes used in the experiment and working drawings to show their construction.

Conclusions

As a result of the outcome of this study, the following conclusions were drawn:

1. The peep boxes were simple enough for any junior- or senior-high-school student to construct and the materials used were easily obtained.

2. After the student got an overall picture of the models, the vanishing lines, the eye level and the station point, then viewed the object from the station point and saw it in perspective, he was able to draw the object correctly. This showed that the method was valid.

3. By first becoming interested in drawing objects three dimensionally by omitting the technical terms and the scientific laws of linear perspective, many students sought further knowledge of the laws of perspective.
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