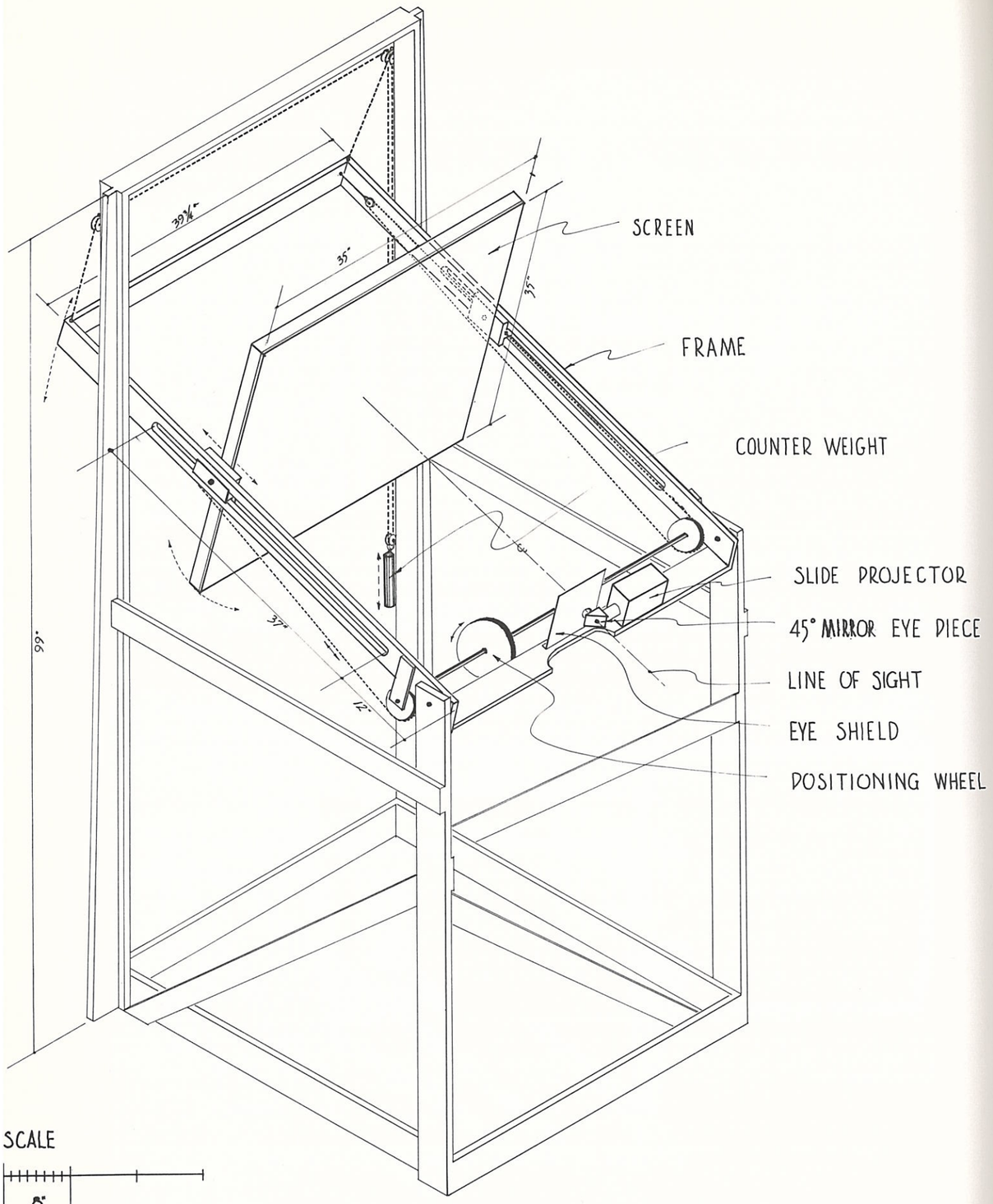


Fig. 12.3. Apparatus drawing for the tilting screen demonstration.

13. THE DISTORTED ROOM DEMONSTRATIONS

The distorted rooms are structures of various sizes and shapes that, when viewed from the proper point, appear to be normal rectangular rooms. Their design is based on the principle that any particular pattern of retinal stimulation, whether monocular or binocular, can be provided by an infinite number of external configurations. It is possible, therefore, to design an unlimited number of equivalent configurations all of which will appear identical. Several such rooms of different sizes and shapes and designed for both monocular and binocular observation have been constructed and are described in this section under four headings starting with rooms designed for monocular observation and concluding with binocular distorted rooms.

All of these rooms have several features in common. They all appear to be normal rectangular rooms. Objects placed within these rooms appear to be distorted while the rooms retain their normal appearance. Persons attempting to carry out simple actions in these rooms behave as if the rooms were actually rectangular, even though they previously have had complete knowledge of the true shape of the rooms. Even the simplest actions in these rooms are, therefore, initially unsuccessful.

13A. MONOCULAR ROOMS: LABORATORY-SIZE

Apparatus

Two different designs for laboratory-size distorted rooms are illustrated. The dimensions of these rooms are of the order of a four-foot cube. They are constructed of wood with all parts exactly proportioned to represent the parts of a normal room. Baseboards, window frames, etc., are all carefully cut out with this end in view. Illumination is provided by a single light in the ceiling. Painting simulates an ordinary room with brown floors, cream-colored walls and white ceilings and woodwork.

The general principles for the design of these rooms are illustrated in the accompanying drawings. Both rooms present to the retina the same pattern that would be produced by a normal rectangular room.

[The two distortions shown were selected out of the unlimited number of possibilities so that they might also be used in conjunction with the aniseikonic lenses described in the next demonstration. Room No. 1 is designed to compensate for the binocular distortions introduced by axis-90 glasses, while room No. 2 compensates for the distortions of in-cyclo glasses. In these cases the binocular indications are artificially made to supplement the monocular, resulting in much more definite and unequivocal effects.]

Viewing conditions

Each room is viewed monocularly from the proper point as shown in the illustrations.

Typical observations

The two rooms, when viewed under these conditions, appear to be rectangular and identical.

If an observer is led to either room blindfolded, he perceives, immediately upon opening one eye, a perfectly rectangular room. If he places his head in the proper position while using both eyes the room does not appear rectangular. If he then closes one eye, the room initially appears distorted and gradually appears rectangular. The length of time consumed in this process varies widely from individual to individual, sometimes lasting thirty seconds or more.

Objects placed in these rooms appear distorted in shape and size. Occasionally a local distortion is induced in a restricted area of the room (for example, an apparent depression in the floor) by an object placed within it, but in general the rooms resist efforts to make them appear distorted. Recurring patterns placed on the floor and walls are not effective; the patterns appear to distort while the rooms remain rectangular.

If an observer is given a pointer and asked to touch various parts of the room, he cannot do so accurately and quickly but behaves quite awkwardly, unexpectedly hitting the walls, floor, or ceiling. Performance is very little, if any, better if the observer has previously examined the room and become familiar with its shape and construction. Even under these conditions he acts as if the room were truly rectangular, as it appears to be.

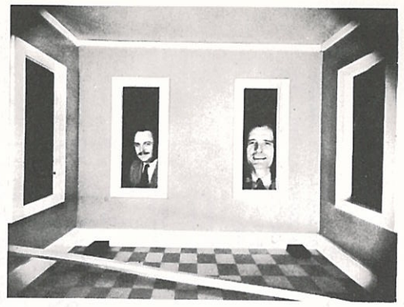


Fig. 13A.1. Monocular distorted room no. 1 from the viewing point.

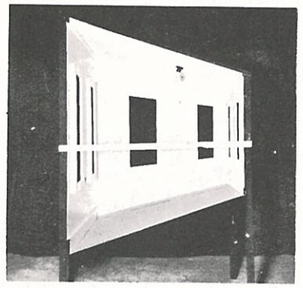


Fig. 13A.2. Monocular distorted room no. 1.

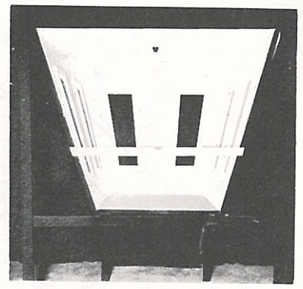


Fig. 13A.3. Monocular distorted room no. 2.

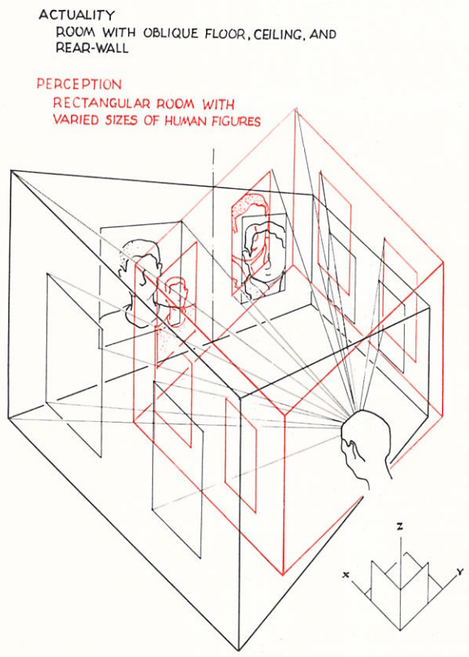


Fig. 13A.4. Typical observation using monocular distorted room no. 1.

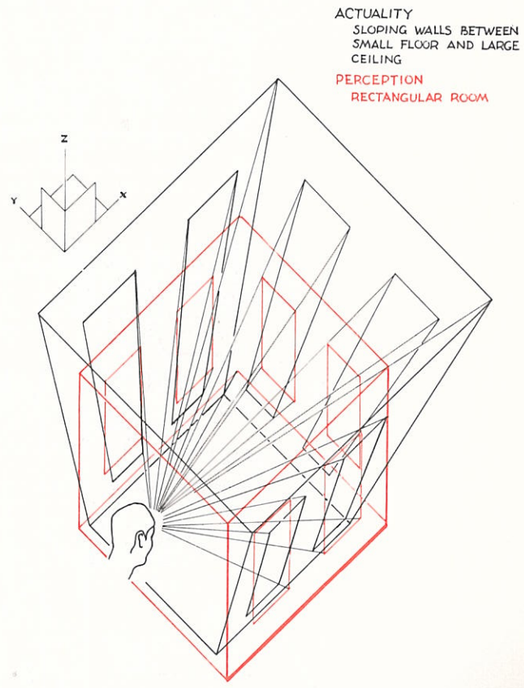
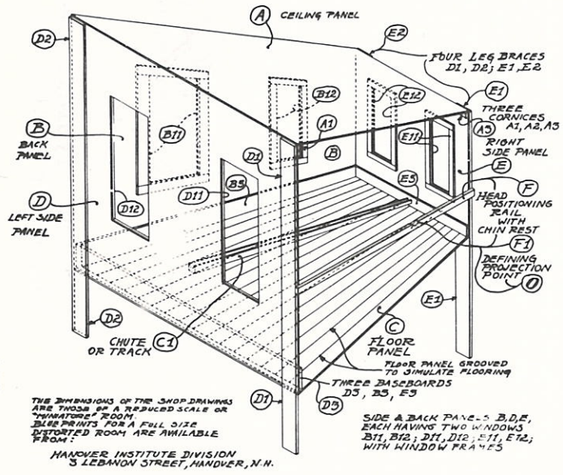
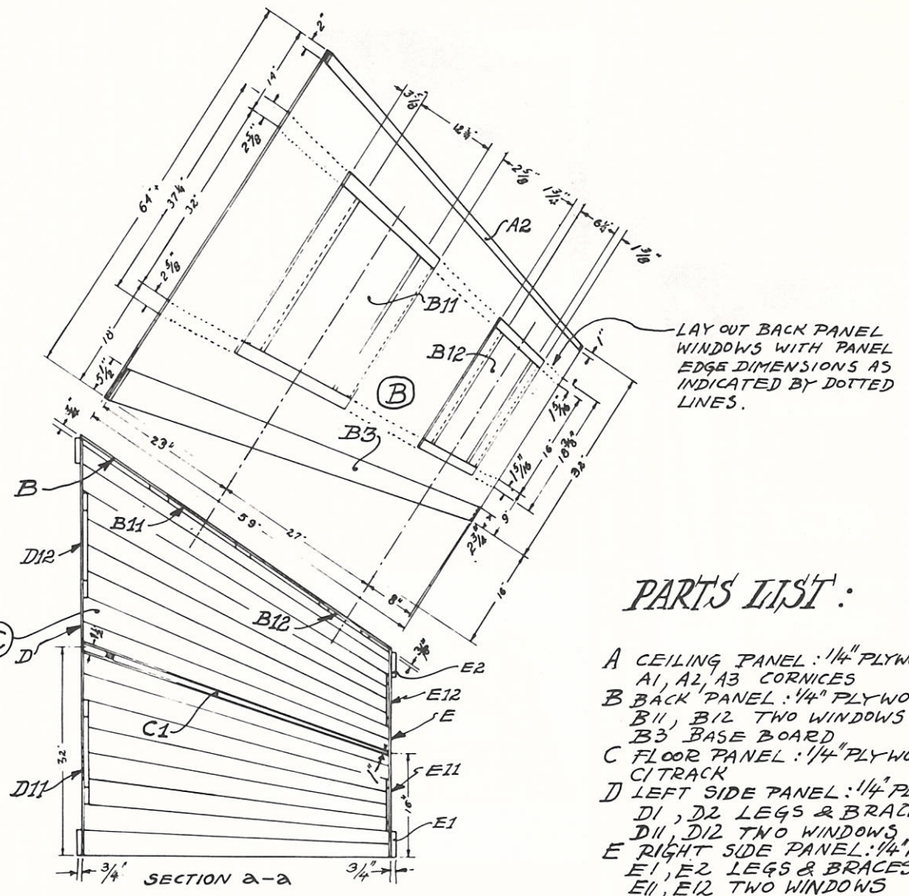


Fig. 13A.5. Typical observation using monocular distorted room no. 2.



THE DIMENSIONS OF THE SHOP DRAWINGS ARE THOSE OF A REDUCED SCALE OR "MINIATURE" ROOM. BLUEPRINTS FOR A FULL SIZE DISTORTED ROOM ARE AVAILABLE FROM:

HANOVER INSTITUTE DIVISION
5 LEBANON STREET, HANOVER, N.H.



DISTORTED ROOM

CEILING, BACK & SIDE PANELS: 1/4" PLYWOOD
WINDOW FRAMES, CORNICES & BASE BOARDS: 3/8" MOULDING
SCRATCH FLOOR PANEL TO SIMULATE FLOORING: 16 BOARDS
TAPER BACK PANEL BASE BOARD, CORNICE & WINDOW FRAMES AS INDICATED WITH LEFT & RIGHT SIDE PANEL DIMENSIONS LARGEST & SMALLEST, RESPECTIVELY.

PARTS LIST:

A CEILING PANEL: 1/4" PLYWOOD
A1, A2, A3 CORNICES
B BACK PANEL: 1/4" PLYWOOD
B11, B12 TWO WINDOWS
B3 BASE BOARD
C FLOOR PANEL: 1/4" PLYWOOD
C1 TRACK
D LEFT SIDE PANEL: 1/4" PLY W.
D1, D2 LEGS & BRACES
D11, D12 TWO WINDOWS
E RIGHT SIDE PANEL: 1/4" PLY.
E1, E2 LEGS & BRACES
E11, E12 TWO WINDOWS
F HEAD POSITIONING RAIL WITH CHINREST F1

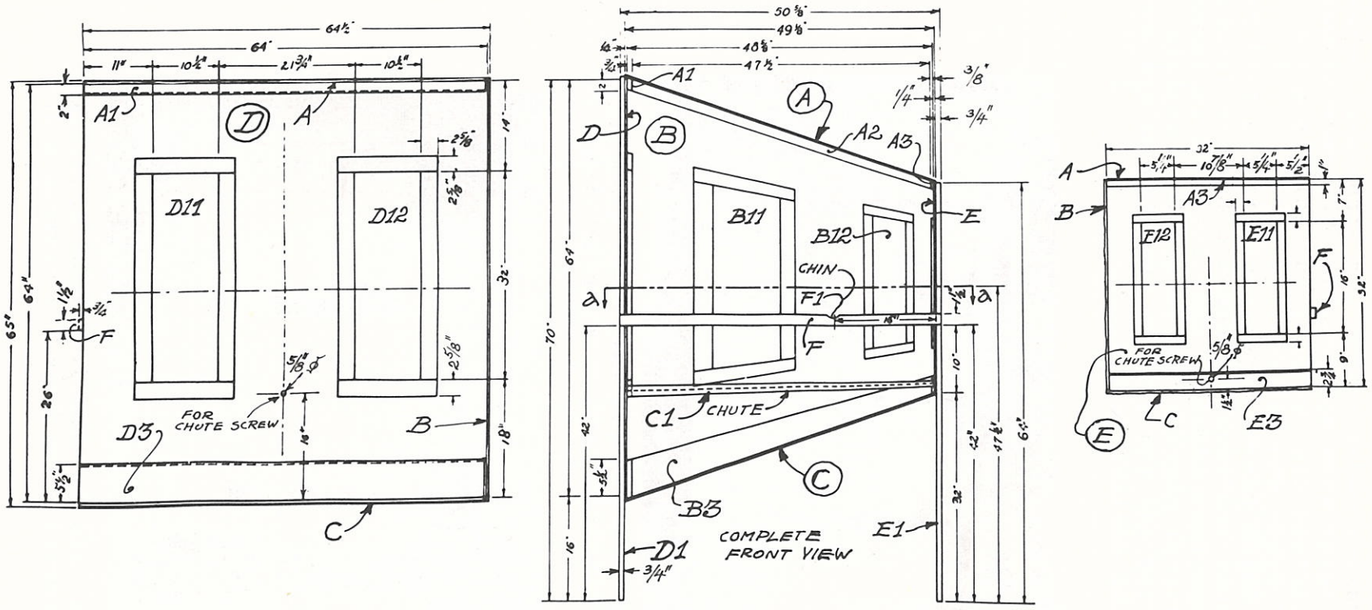


Fig. 13A.6. Apparatus drawing for monocular distorted room no. 1.

13B. MONOCULAR ROOM: FULL SIZE

The full size monocular distorted room is an enlarged version of monocular laboratory room No. 1. In size it corresponds roughly to a twelve-foot cube. Its construction is similar to that of the laboratory model except for structural details necessitated by the greater size and weight. The room illustrated has been built to withstand the weather, but this is not necessary if adequate interior space can be provided.

The effects which can be experienced in the full size room are similar to those previously described for the laboratory model with the important addition that the room is large enough to accommodate several persons and large-sized objects. The appearance of the room and the effects experienced are more compelling than in the smaller models.

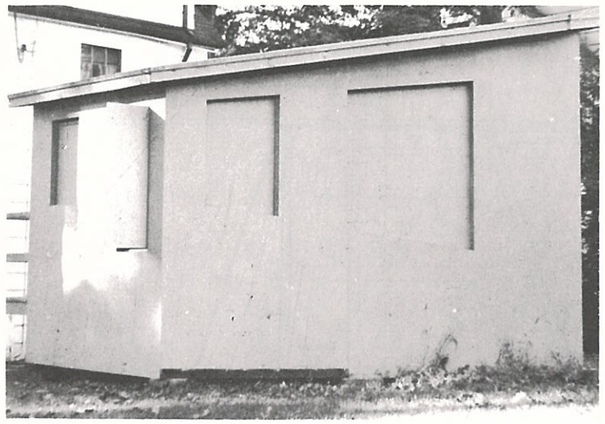


Fig. 13B.1. The full size monocular distorted room, exterior view.

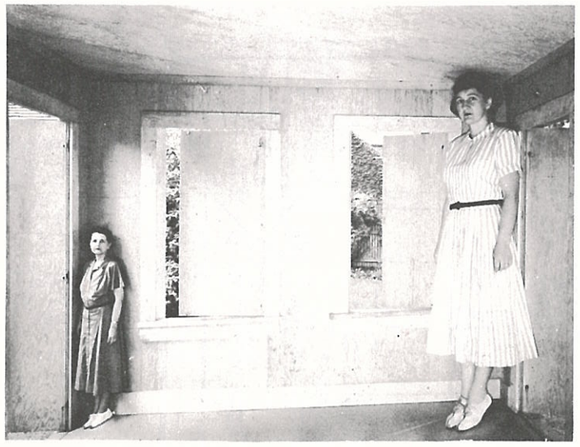


Fig. 13B.2. The full size monocular distorted room from the viewing point.

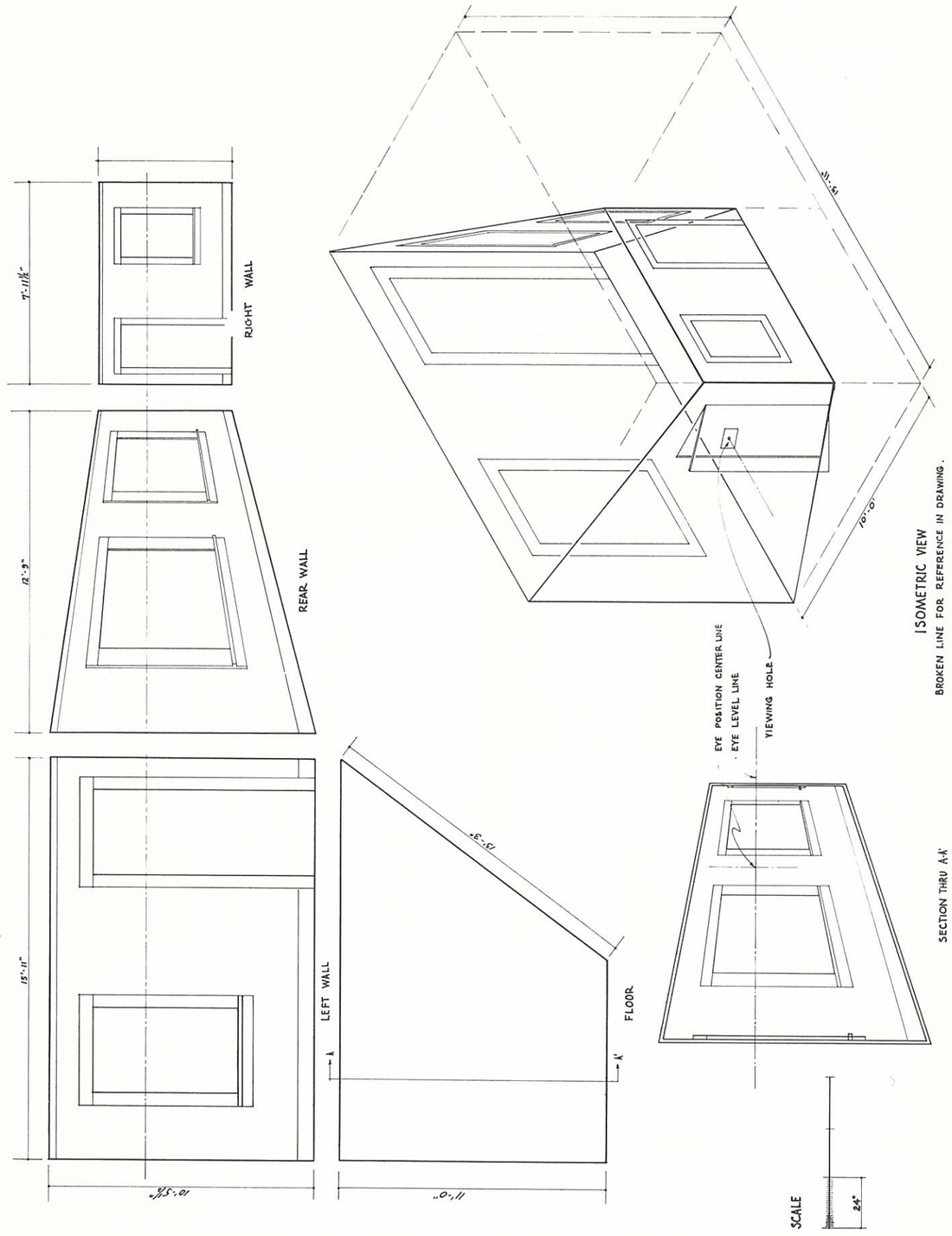


Fig. 13B.3. Apparatus drawing for the full size monocular distorted room.

13C. MONOCULAR ROOMS: THE "ARCHITECT'S ROOM"

The "architect's room" illustrates one way in which the principles underlying the construction of the distorted rooms might be utilized in architectural design. The demonstration consists of a scale model of a long narrow room. However, when viewed from a point corresponding to a door at one end, it appears to be an almost square room.

Apparatus

The "architect's room" consists of a model room made of plywood. On the inside surfaces are painted patterns of windows, floor, and ceiling as shown in the illustration. A special lighting arrangement provides even illumination throughout the interior.

Viewing conditions

The interior of the room is viewed monocularly through a peephole provided at one end. The peephole can be raised, permitting binocular observation.

Typical observations

Although in actual construction the room is long and narrow with only two windows at the far end, it appears to be an almost square room with four windows at the far end.

This effect is sufficiently compelling to be experienced to a greater or lesser extent for most observers when using binocular observation.

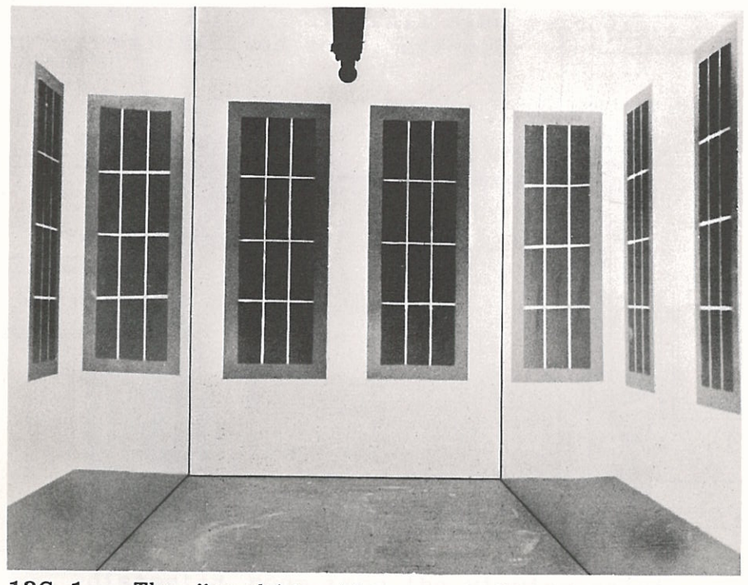


Fig. 13C.1. The "architect's room" from the viewing point with the outlines of the actual room drawn in.

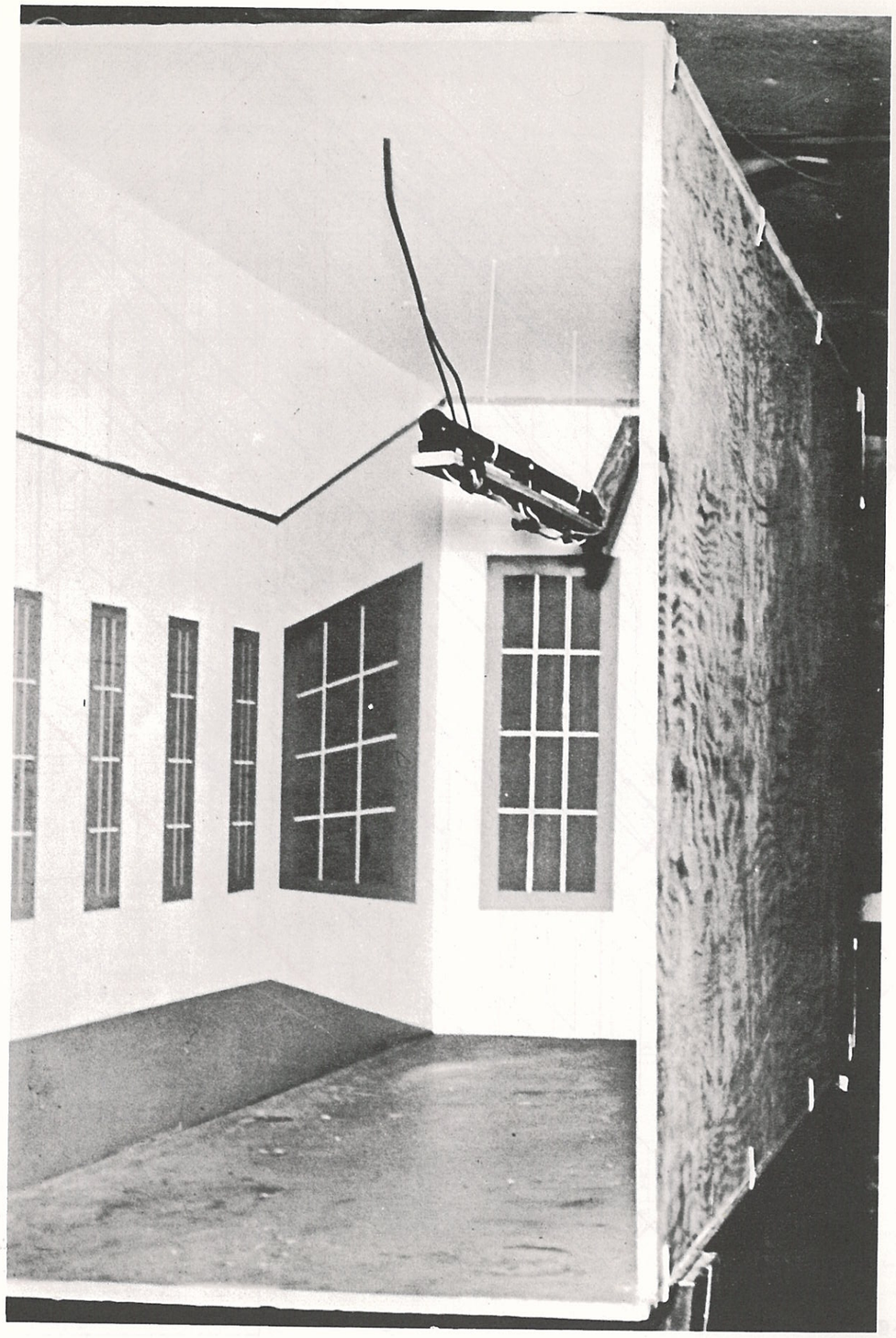


Fig. 13C.2. The "architect's room," exterior view.

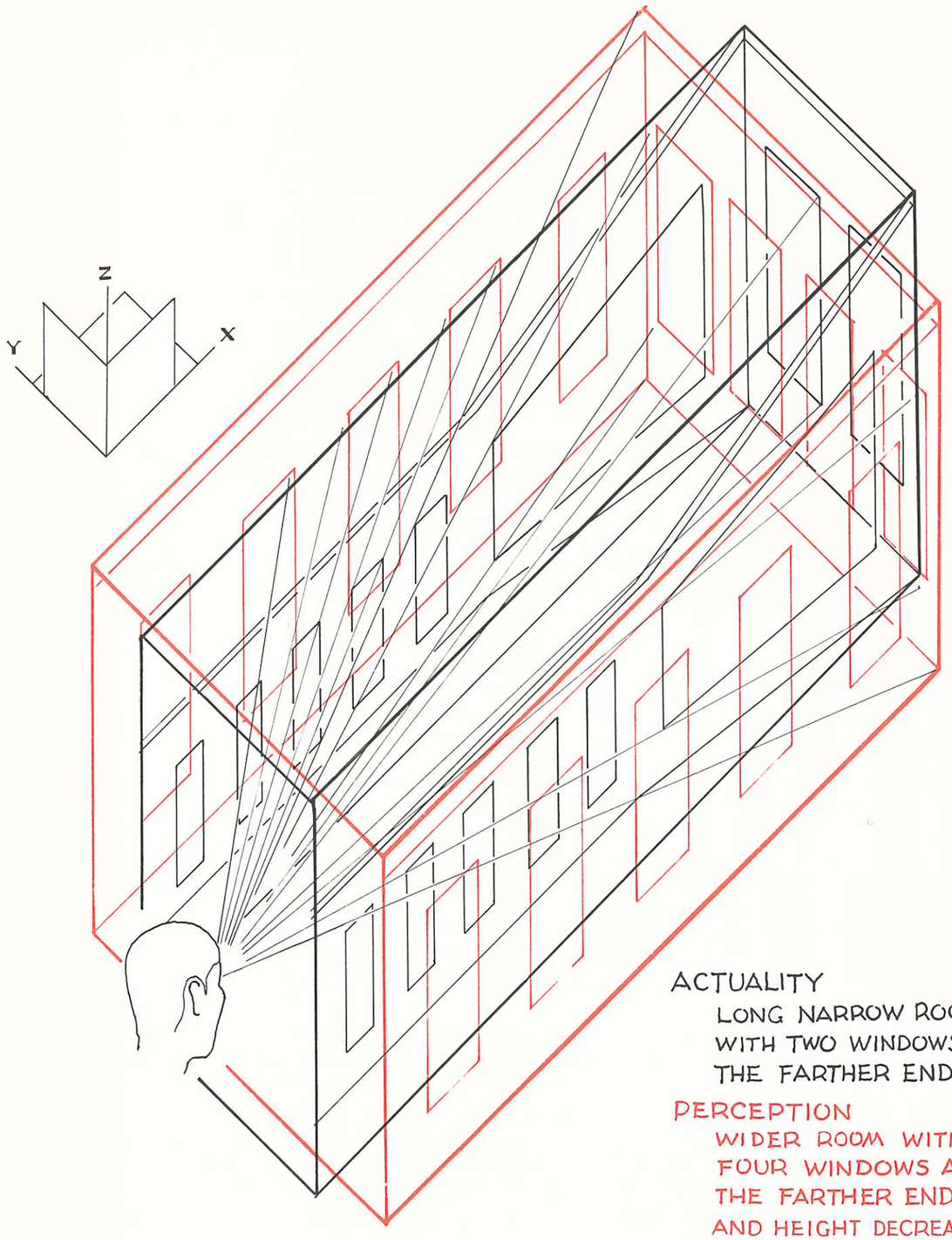
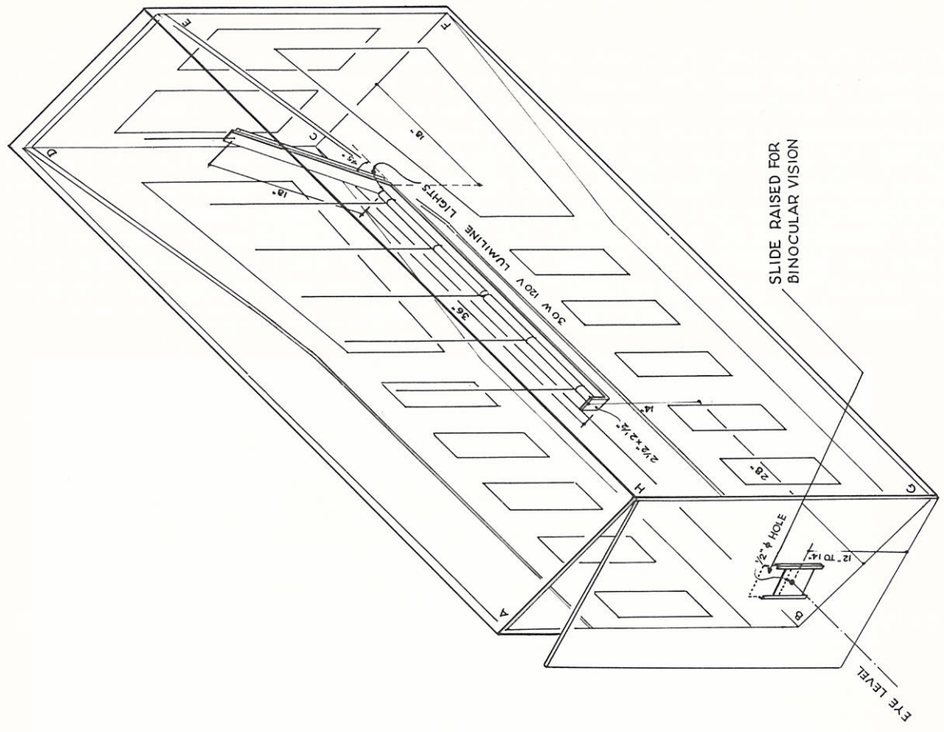
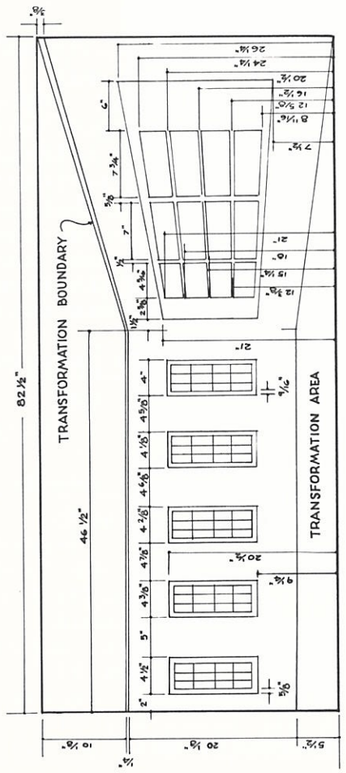


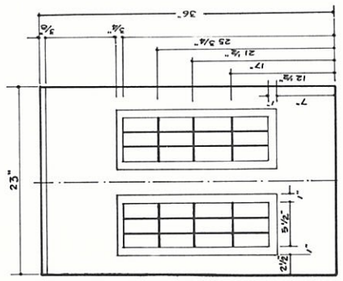
Fig. 13C.3. Typical observation using the "architect's room."





ELEVATION
A-B-C-D PLANE AND REVERSION OF E-F-G-H PLANE

NOTES
1/2" PLYWOOD FOR ROOM CONSTRUCTION
DARK BROWN PAINT FOR WINDOW FORM, FLOOR, TRANSFORMATION AREA AND TRANSFORMATION BOUNDARY
BLACK PAINT FOR ALL WINDOW-GLASS-PANE AREAS AND LIGHT SHIELD
MILKY BROWN PAINT FOR ALL OTHER AREAS
LIGHTING ADJUSTED TO GIVE UNIFORM ILLUMINATION
LOCATION OF LIGHT CONTROL ARBITRARY



ELEVATION
C-D-E-F PLANE

SCALE
8"

Fig. 13C.4. Apparatus drawing for the "architect's room" demonstration.

13D. THE BINOCULAR DISTORTED ROOMS

Two surfaces are defined as binocularly equivalent if every point on one surface provides the same binocular disparity as a corresponding point on the other surface. Two such surfaces will appear identical in binocular observation provided they are also monocularly equivalent. An infinite number of surfaces can be designed that are binocularly equivalent to any given surface. The binocular distorted rooms described in this section represent two out of the unlimited number of possible configurations that are binocularly equivalent to a rectangular room. One of the rooms described is an "interior room," i.e., it is smaller than the rectangular room to which it is equivalent. The other is an "exterior room," i.e., larger than the equivalent rectangular room.

Fig. 13D.1. The "interior" binocular distorted room.

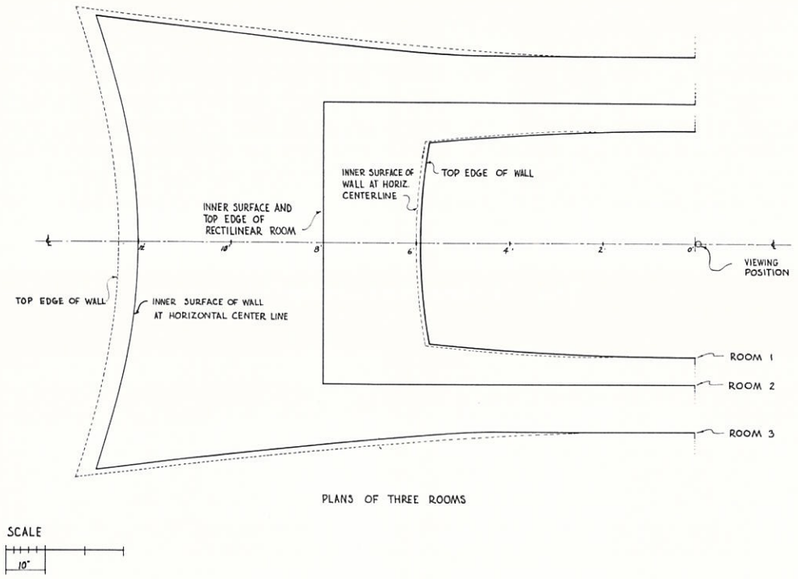


Fig. 13D.2. Horizontal cross-sections of the binocular distorted rooms
Room 1: The "interior" room.
Room 2: The equivalent rectangular room.
Room 3: The "exterior" room.

Apparatus

The two rooms are designed to be equivalent to a rectangular room 8' x 6'. One room, the "exterior" room, is larger and the other, the "interior" room, is smaller than these dimensions. The walls of these rooms are complex curved surfaces shown in cross-section in the diagram. The actual construction, undertaken by a shipbuilding concern, consists of plywood molded to a frame cut to the calculated curves. Similar patterns of floor boards, windows, etc., are painted in the proper scale and shape on the two rooms, thereby insuring that they will be monocularly as well as binocularly equivalent. Illumination is provided by four bulbs placed at the four corners of the front wall.

Viewing conditions

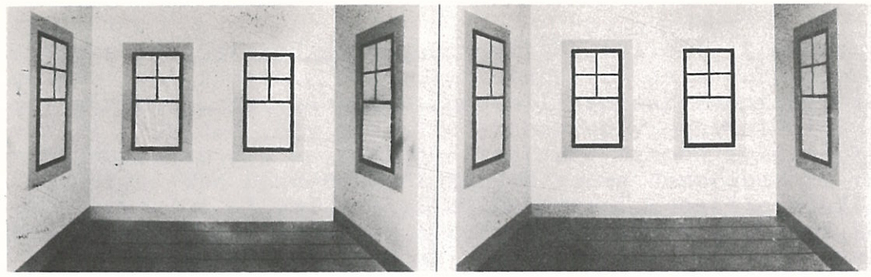
The rooms are viewed binocularly from the point indicated in the diagram.

Typical observations

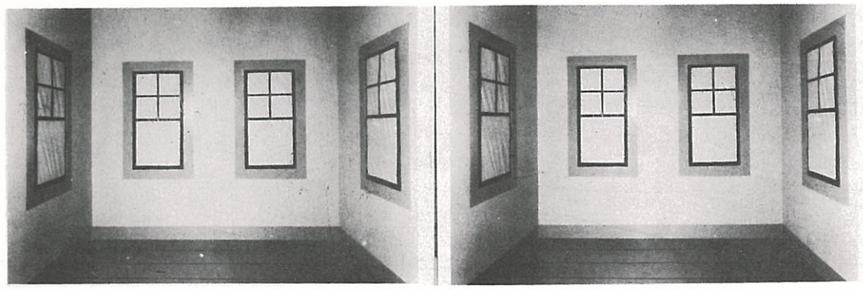
Observers who are blindfolded until they are in the proper viewing position, and are in this way shown first one room and then the other, report that both rooms appear rectangular and of substantially the same size and shape.

Apparent distortions in the size and shape of objects placed in these rooms can be observed.

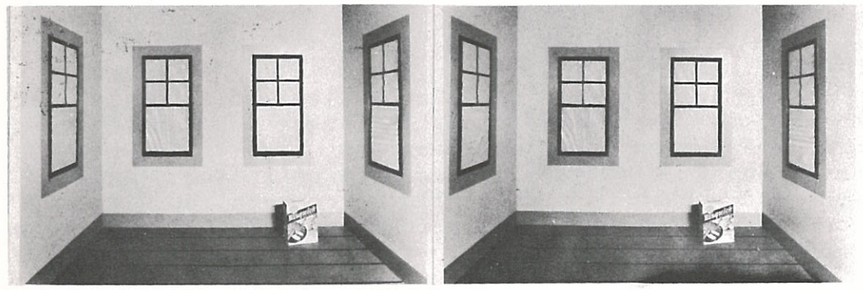
If observers are allowed to examine the rooms, or even to catch a glimpse of the exterior dimensions, before seeing them from the proper point, the rooms are reported to appear rectangular but of different sizes that closely approximate the actual sizes.



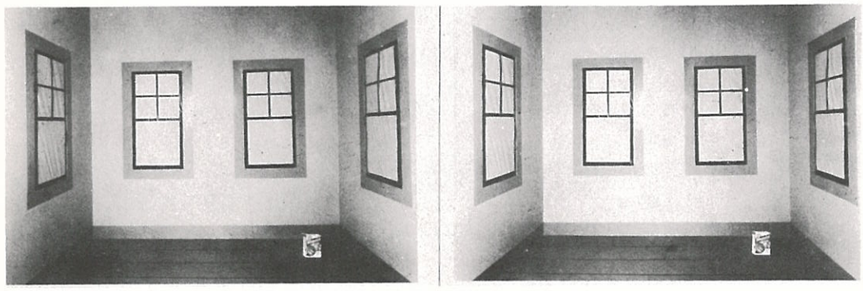
The "interior" room



The "exterior" room



The "interior" room with an object inside



The "exterior" room with the same object

Fig. 13D.3. Stereoscopic photographs of the binocular distorted rooms taken from the viewing position

14. THE ANISEIKONIC GLASSES DEMONSTRATION

Aniseikonic glasses produce distortions in binocular disparity without significantly affecting any other aspect of the retinal images. Although these lenses were designed for clinical use, they are also important tools for the experimental study of binocular space perception since they allow one to alter binocular disparities while viewing everyday environments without affecting any of the other distance indications. Most observers when wearing the glasses experience the greatest apparent distortion when viewing environments which have relatively few monocular depth indications and experience the least apparent distortion in environments in which there are relatively many monocular indications.

Apparatus

A. The lenses. Eikonic or size lenses enlarge the image on the retina along one axis only without in any other way altering its optical properties. The design and construction of these lenses are highly technical optical problems, a detailed discussion of which would be out of place here. Two size lenses that produce different magnifications along the same or different axes combine to form a pair of aniseikonic or unequal-size glasses. The two types of these glasses most useful for demonstration purposes are schematically described in the diagram and are illustrated in the photograph. Each of these glasses may be turned over, making a total of four different glasses that are available.

B. The leaf room. The leaf room provides an environment that offers a minimum of monocular depth indications. It consists simply of a cube of wire mesh (with one side open) mounted on a wooden frame. Attached to the wire mesh and completely covering the interior of the cube, with the exception of the open side, are oak leaves that have been chemically treated to preserve their freshness.

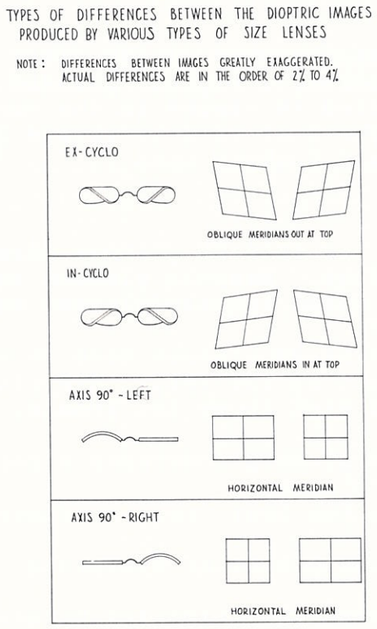


Fig. 14.1. Schematic representation of the aniseikonic glasses.

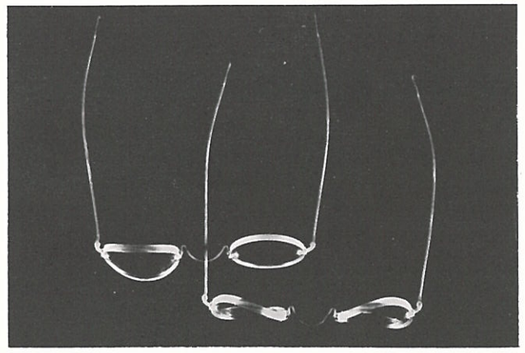


Fig. 14.2. Aniseikonic glasses.

The AMES Demonstrations in Perception

by
William H. Ittelson

together with

An Interpretative Manual

by
Adelbert Ames, Jr.

With a New Introduction

by
William H. Ittelson

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INTRODUCTION

The writings reprinted here represent the work of approximately the final decade of the life of Adelbert Ames, Jr. dating from the period of World War II until his death in 1955. This period in his life was devoted to the study of basic problems of visual perception - problems which had concerned him throughout his life, but which came to a focus in his thinking at this time. He now became convinced of the fundamental importance of understanding the perceptual process as a key to understanding human behavior.

Ames's method of working was basically modeled on the classic scientific pattern. He divided his time between the experimental demonstration of observable phenomena and speculation on their significance. On occasion, speculation would suggest to him an empirical question to which he would then devote his energies in order to devise an apparatus or a technique capable of answering the question. More often, however, his observations in the laboratory would pose for him conceptual questions. But in either event he was always deeply rooted in observations. The laboratory was his natural home.

Ames developed his unique empirical methodology which consisted essentially in devising what he himself termed "demonstrations." He was not interested in phenomena whose existence could be established only through the use of large numbers of subjects and tests of statistical significances. His aim was to demonstrate a particular phenomenon for all to see. When he could take a stranger off the street, show him the demonstration and be confident that the stranger would experience the phenomenon, then and only then would he consider the demonstration complete. Paradoxically, however, the demonstrations were not built in order to show phenomena to others. Ames's basic interest was always in demonstrating things to himself; however, an integral part of showing things to himself was the proof that the observations were equally available to all people.

Ames's method of writing was similarly idiosyncratic. He wrote during this period almost exclusively for himself. With this goal in mind his writing took the form of brief notes to himself, sometimes only a sentence or two in length, occasionally running over several pages. In each note he recorded either a particular question which was bothering him at the moment or a hint at an answer which he had developed.

Ames's work day also had a characteristic, though casual, organization. The early morning was devoted to writing his notes which he himself, in time, came to call his "Morning Notes." The remainder of the morning he devoted to correspondence or to conversations with the steady stream of visitors who over the years were increasingly attracted to his laboratory in Hanover. The afternoon was usually spent in the laboratory.

The tangible products of this decade of work, then, were two: a number of pieces of apparatus, the "demonstrations;" and a set of typewritten notes. The demonstrations were for years housed in a series of basement rooms made available by Dartmouth College. These demonstrations were vivid communications to anyone privileged to view them. But those who had this opportunity were necessarily limited to the small numbers who travelled to Hanover and who were personally conducted through the laboratory by Ames himself. Those who had this opportunity remember it as one of the significant experiences of their lives.

The "Morning Notes" were available only to a few of Ames's intimates and were, in any event, not intended for audiences beyond that small group. (Some of these notes were later edited and published by Hadley Cantril. The reader who wishes to understand the sense and spirit of Ames's thinking is referred to The Morning Notes of Adelbert Ames, Jr., Rutgers University Press, 1960.)

Although Ames himself was not interested particularly in disseminating his work and not at all interested in trying to convince others, some of us working with him at the time felt an obligation to make more widely available the fascinating and significant work he was doing. We wrote during this period a number of theoretical and empirical articles. Although he was most generous in his praise, none of these satisfied Ames himself, who was adamant in his belief that his work could be

communicated only through the demonstrations themselves. Continuing discussions along these lines finally resulted in two publications whose sole purpose was to make available to a larger audience what had previously been open only to those who were able to visit Ames at Hanover: the opportunity to view the demonstrations and to hear Ames's own explanation and interpretation.

A manual for constructing and operating the demonstrations was prepared by the author of this Introduction and published as The Ames Demonstrations in Perception, Princeton University Press, 1952. This volume contained working drawings for the demonstrations so that they could be constructed by any reasonably skilled mechanic, as well as descriptions of their operation and of the phenomena to be observed in each demonstration. The second publication was written by Ames himself and consisted essentially of demonstration-by-demonstration comments similar to those which Ames made when conducting a visitor through the laboratory. It lost, of course, the unique flavor of each individual exchange with the visitor, but nevertheless provided the next best thing to a personally conducted tour.

The subsequent history of these two publications shows that although fulfilling their purposes, they failed to reach large audiences. The Ames Demonstrations was issued in a small edition which quickly went out of print and has been totally unavailable for at least the past ten or twelve years. The Interpretative Manual was privately published and received a very limited distribution. The present volume, it is hoped, will be able to continue what the earlier publications initiated. For the first time, the two publications which were originally intended as complementary statements appear under a single cover. For the first time, a person with this volume in hand can construct for himself the demonstrations, can observe them, and can listen to the voice of their inventor state his own conceptions of their significance.

Although Ames himself preferred to let his work speak for him, the reader may well want to know a little more about this remarkable man. Ames was schooled at Harvard and trained in the law, a profession in which he quickly established a successful career. With success came the feeling expressed in his own words, that the "noose was slipping over my neck." The noose, of course, was the inescapable entanglements of a successful career in a profession for which he felt no abiding interest. With characteristic decisiveness he left the career of law and entered a career of painting, a career in which he was able to satisfy everyone but himself. He was troubled by the perceived differences between the representation of the object and the object itself and paused in his painting—temporarily he thought—to study that problem, an endeavor which was to last the rest of his life. In progressive stages he studied form and color in painting, constructing a large and delicately graded color chart to assist in the exact reproduction of external colors. He soon became convinced, however, that the direction his search must follow was not in the technique of the painter, but rather in the eye of the observer. He sought expert training in the physiology of the eye and in optics and settled in Hanover for the study of physiological optics. The outstanding event in this period of his career was undoubtedly the discovery of the perceptual defect which he labeled "aniseikonia" and the invention of aniseikonic lenses for the correction of this defect. This major work provided once again a turning point in his career. He was struck by the fact that the perceptual anomalies produced by aniseikonia could not, in all their completeness, be explained or predicted by known physiological and optical concomitants. He turned, therefore, to what proved to be the final interest in his life, the study of the psychology of visual perception.

This brief sketch of the high points of his career cannot hope to convey the full flavor of the man whom Whitehead called "an authentic genius" and whose work was described by John Dewey as "by far the most important work done in the psychological-philosophical field during this century." Lawyer, artist, physicist, physiologist, psychologist: no wonder Horace Kallen found in Ames "something suggestive of Leonardo."

Ames himself, however, was not fond of glowing praise or flattering comparisons. A truly humble man, he liked to recount a favorite anecdote in which he recalls climbing to the top of one of his beloved New Hampshire hills, and looking down at the village sprawled below. He remembers turning to his companion and saying, "I like to bear in mind that there isn't a single person down there who can't give me cards and spades and beat me in something." Ames's approach to all people was predicated on the assumption that everyone he met had something to offer him.

Ames was constantly learning, which, after all, is the one characteristic common to all great teachers.

Another favorite saying of Ames's was that the greatest tribute history could pay to a man was to remember his work and forget his name. Ames today would be satisfied on both counts. I have on my shelf a dozen current texts in Introductory Psychology. While I do not have the figures, it is a reasonable guess that these twelve books account for all but an infinitesimal fraction of the texts used in Introductory Psychology courses throughout the country at the present time. Of these twelve books, nine describe and depict in some detail one or more of the Ames Demonstrations, approximately as they are shown in the present volume. History clearly is remembering Ames's work, when the overwhelming majority of authors consider it an important and necessary part of an introduction to the field of psychology. However, in the nine texts on my shelf which reproduce one or more of the Ames Demonstrations, Ames's name is to be found in none. Neither the text, nor the index, nor the references, nor the captions in any one of these books, carry his name. Clearly history is also paying Ames the ultimate compliment of forgetting his name.

These observations also suggest that Ames's work today is an important and vital part of the contemporary psychological scene. It is this fact which has provided the impetus for the present volume. It is intended neither as an historical document nor as a tribute, however well deserved, but rather as a contribution to the work of the contemporary psychological investigator. It is my conviction that the significance of Ames's contributions will grow with the years. Interested psychologists will find reproduced here the original works exactly as they first appeared. Perhaps, almost certainly, were Ames here today, he would wish to modify some of the statements written a decade and a half ago. But he is not here and his original words must stand as written. This consideration has led us to include the demonstrations exactly as designed by Ames, even though in some cases worthwhile suggestions have been made for the simplification or modification of some of the apparatus. In short, no attempt has been made to "modernize" the text in any way. That will be left to the interest, the ingenuity and the wisdom of the reader.

In one respect only does the present work differ from the original. The first edition of The Ames Demonstrations in Perception contained a bibliography of some fifty titles representing, as completely as possible, an exhaustive listing of all published works at that time which referred to the Ames Demonstrations. To reprint that bibliography today would be meaningless. To try to provide a similarly exhaustive up-to-date bibliography would be a mammoth undertaking of dubious value. We have therefore substituted for the original bibliography a listing of all of Ames's published work, dating from the period represented by the material in this book. Ames wrote little for publication and the list is accordingly brief. But its inclusion makes the present volume a complete summary statement of the final works of this extraordinary man.

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