PROJECT "ME"

# A REPORT ON THE LEARNING WALL SYSTEM

by

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# THE LEARNING WALL SYSTEM

In real life situations, the child uses his entire body as a perceptual and creative instrument, thus, it would seem that an optimal learning situation would provide for the same type of total involvement. Unfortunately, most conventional classroom situations limit the use of sensory-motor modalities (children are required to "sit still", "pay attention", "listen" and "look".) In an effort to remedy this situation and to simulate a more natural and life-like learning environment, Media for the Exceptional has designed and developed the Learning Wall System.

Project "ME" was established at the Dubnoff School for Educational Therapy to explore the premise that mediated programs could be designed that would greatly enhance the education of young handicapped children. It was immediately decided that certain criteria must be met:

1. The child should be involved by interacting with the programs, motorically as well as verbally.
2. A constructive release for hyperkinetic drive should be provided as well as strong motivation for attending.
3. Immediate feedback should be built into the program in order to motivate learning through positive reinforcement.
4. Perception should be enhanced by providing large, clear visual information linked to an auditory presentation.
5. Opportunities for intermediate motor practice should be provided.



There has been great emphasis in early childhood education on gross-motor training for handicapped children and, also, much has been evolved to train fine-motor coordination. We found, however, that little attention has been paid to providing for visual-perceptual-motor training on a level that would bridge the gap between gross- and fine-motor performance. Those teachers who recognized its importance felt constrained to painstakingly innovate and create their own materials using large flannel boards, chalkboards, mirrors, posters, etc. We knew we must find a new tool, superior to existing methods.

Early in the history of the Dubnoff School, Mrs. Irene Chambers, Project "ME" Materials Designer, utilized the interactive learning prinicple by projecting pictures and words on a wall. These large scale images were than traced by the student. In the mid-sixties the Dubnoff School Visual-Perceptual-Motor Programs were developed. Many ideas for presenting intermediate motor practice were incorporated in the teacher's guides in order to provide for an orientation to the fine-motor pre-writing exercises. Once again, however, a great deal of preparation time and effort was called for on the part of the teacher.

The practical solution, which is the basic principle underlying the Learning Wall, was provided by Jack Schaefer, Director of the Reading Guidance Institute, Whittier, California. He had conceptualized that using rear projection on a large, floor based screen would provide an opportunity for children to interact motorically with the image without an occluding shadow. He further postulated that mediated programs could be designed to provide guided movement activities on a two dimensional vertical plane. This would serve to provide the teacher with a readily accessible tool with which to bridge the gap between gross- and fine-motor performance. Mr. Schaefer agreed to allow Project "ME" to use his concept as the basis for a new type of programming for young, handicapped children. To this end a 4' x 5' flexible, floor based, rear projection screen was constructed and program design initiated.



Morton Heilig, Media Specialist, was assigned to further develop the potential of the interactive, rear projection technique. Privately, he had designed and patented several experiential systems which elicited much more than passive viewing response from the audience, and so was uniquely suited to extrapolate the initial ideas and solve the technical and human engineering problems involved.

Through his efforts, combined with the cooperation of the Project "ME" staff, the Learning Wall System has been brought to its present state of development.

## THE LEARNING WALL ROOM

Before describing the structure and operation of the Learning Wall System it should be established that the Wall is only a part, albeit a major one, of a total environment called the Learning Wall Room.

The Learning Wall Room is 11 feet wide x 21 feet long x 8 feet high. (These are the dimensions of an already existent room that proved satisfactory to our needs.) It's walls are painted a flat dark orange. The ceiling and doors are dark brown and the floor is covered with rust carpeting. The prime thoughts guiding the room's decor were:

1. to eliminate all audio and visual distractions. (The average classroom with it's hard sound-reflecting surfaces, bright windows, light fixtures, paintings, etc. is loaded with distractions.)
2. to provide a physically comfortable setting with air conditioning, soft carpeting etc.) that is pleasant and reassuring in character.



THE LEARNING WALL ROOM CONTAINS:-

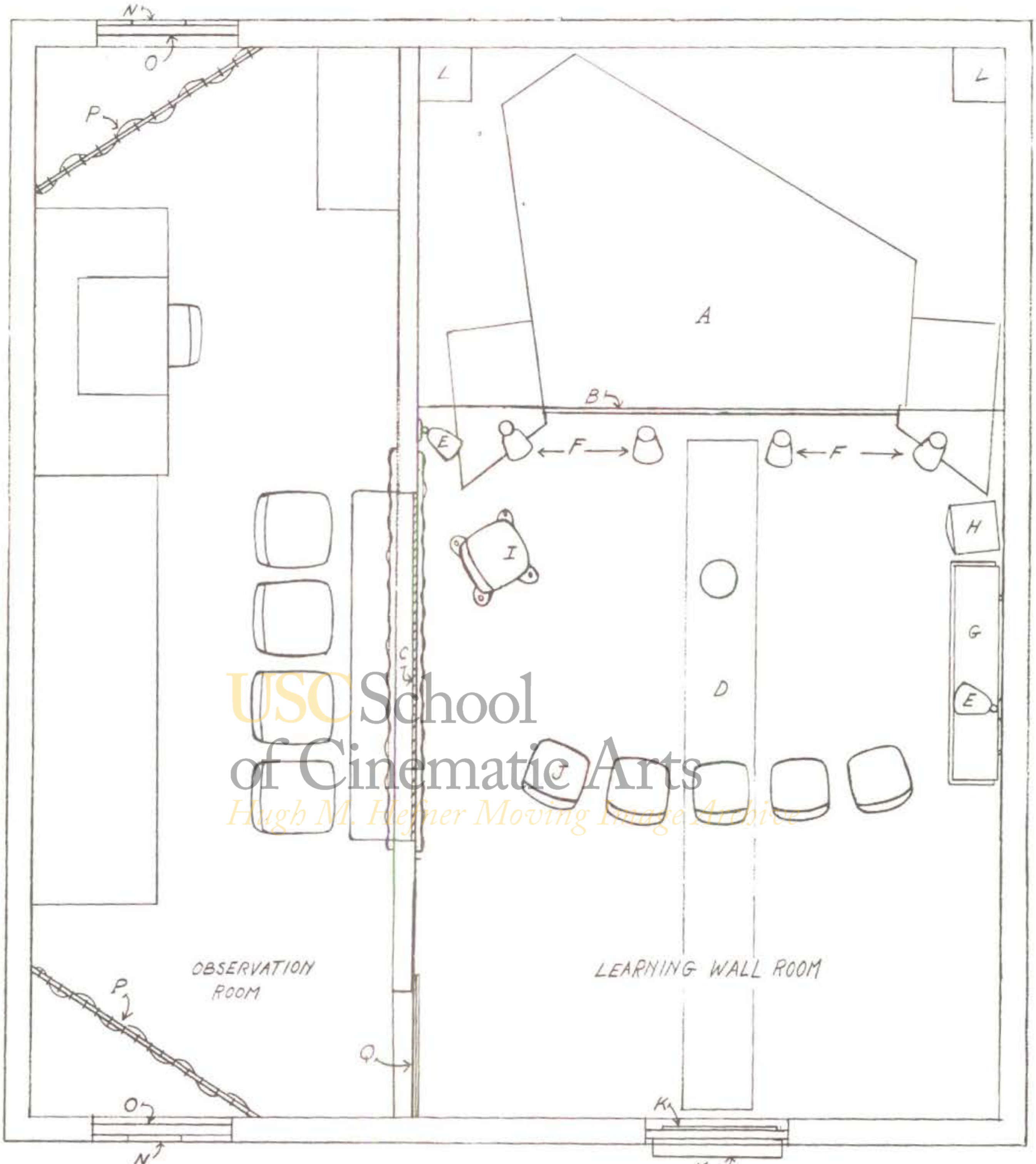
1. The Learning Wall which occupies one-third of the room's total area. (See Fig. I-A) (It will be described in detail in the next section)
2. Orange curtains above the screen which conceal the empty space above and behind the Learning Wall screen. (Fig. I-B) (Fig. 2)
3. A one-way mirror on the side wall behind the teacher which enables observers to watch a class in session without being detected by the students. (I-C) (3) (4)
4. Overhead lights that are turned on before and after each session. (I-D)
5. Special teacher lights that illuminate the teacher for better communication without distracting the students or deteriorating the screen image. (I-E)
6. Four overhead lights that project a powerful, but narrow, beam of light from the ceiling to the floor three feet in front of the screen. (I-F) (6) (7) (The function of lights will be explained in greater detail under Reflection Programming.)

7. Light Box (see Stick On Programming) (I-G)
8. The Teacher's Chair, student sized with casters that allows the teacher to move across the floor quickly without standing up. (I-I) (11)
9. Four or five Student's Chairs lined with soft cushioning for comfort. Limiting the number of students to five in our facility provided each child with maximum screen visibility, sufficient opportunity to participate, more individual attention from the teacher, and less distraction from other students. (If a larger room were available, we recommend that the number of students be limited to 8 in order to insure that each child has adequate opportunity to interact with the screen.)
10. A large Record Chart with attached pencil. This chart is mounted on the exit door so the teacher will not forget to fill in the date, name of the program and the names of her students before leaving the room. This information is used in program evaluation. The chart is covered with a brown curtain and is mounted on a masonite board which can be easily dismounted for outside conferences. (I-K) (13) (14) (15)
11. Two exhaust fans for ventilation. (I-L)
12. Air inlet covered by a light shield in the botton of the door. (I-M)



The Observation Room, which is parallel to the Learning Wall Room, is 7 feet wide x 21 feet long. One side has one-way mirror 6 1/2 feet wide x 3 feet high. (I-C) (4) Since the light level in the Learning Wall Room is very low while a class is in session, the Observation Room must be pitch dark if the one-way mirror is to work properly. To guarantee this, the doors at either end of the Observation Room are protected by reversable signs that read "Do not enter - Testing", (I-N) and they are covered by opaque shutters. (I-O). Inside, heavy black curtains are mounted on a 30° angle. (I-P). This enables one to enter or leave the room without passing light. A sliding door (I-Q) connects the two rooms.

A Learning Wall Room which provides for maximum concentration and physical comfort is the optimal setting for the Learning Wall. Though not indispensable - it is highly desirable.

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# FIG-1

GENERAL HORIZONTAL PLAN OF THE LEARNING WALL ROOM AND OBSERVATION ROOM

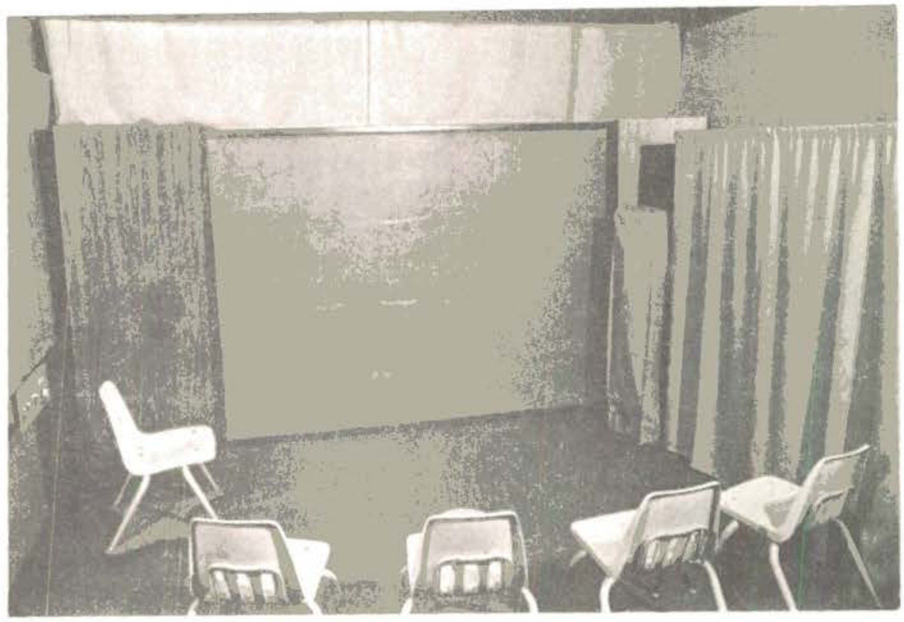


Fig. 2



Fig. 3

Fig. 4

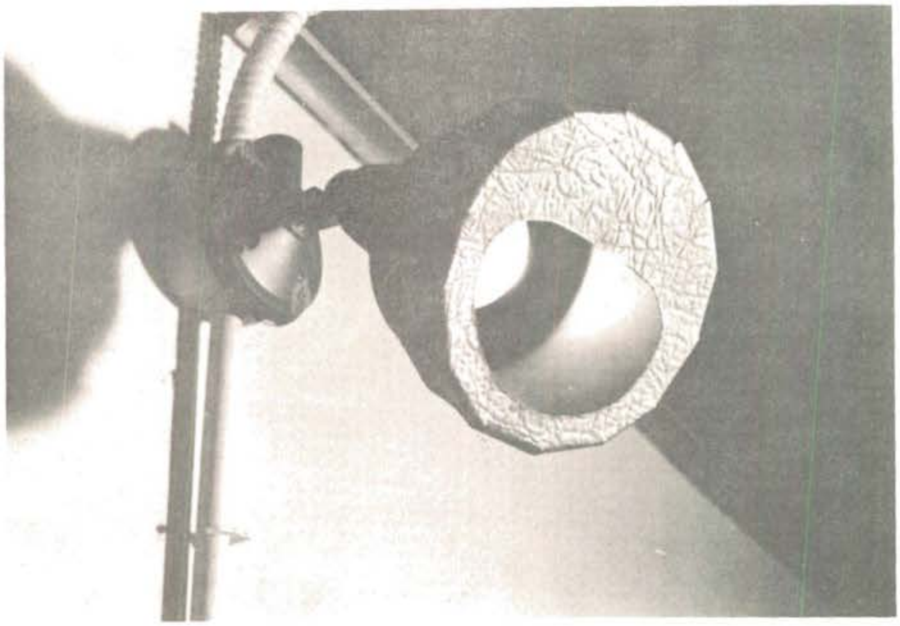


Fig. 5

Fig. 6

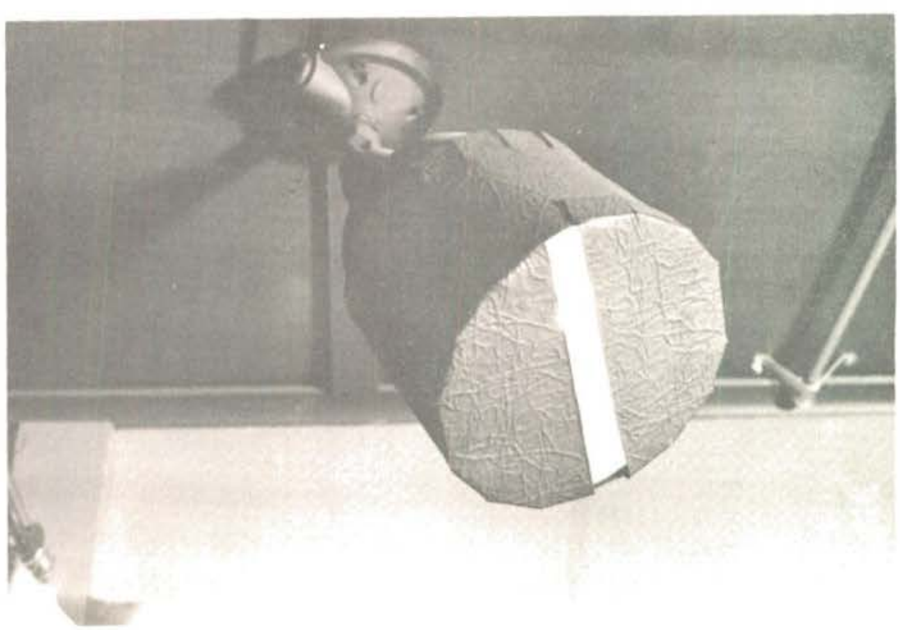


Fig. 7

## THE LEARNING WALL

The objective of the Learning Wall was to overcome many of the limitations of current audio visual presentations, such as:

1. Small screen sizes- 2 feet x 3 feet or less.
2. Sensorially disjointed- sound often coming from the back of the room.
3. Inaccesable- screen several feet off the ground and beyond the child's reach.
4. Front projection - if a student stands in front of the screen he obscures the image with his own shadow.
5. Equipment that is cumbersome and difficult to use- the average teacher loathes setting up and breaking down.
6. Non-participatory nature- the student must "sit still", "be quiet", and "watch the picture" and is never invited to participate, physically or verbally.



Obviously, then, to counteract these limitations we required a system that had the following characteristics:

1. The image should be very large (life size), extending to the limits of a child's vertical reach and beyond the limits of his horizontal reach.
2. Projection should be sensorially harmonious with the sound coming from the picture area.
3. The image should be accessable, at floor level.
4. The image should be rear-projected, thus allowing a child to stand directly in front of the screen without blocking the image with his own shadow.
5. All projection equipment and speakers should be out of sight and have their mechanical noises silenced.
6. All projection equipment should be preset and readily accessable so that all the teacher has to do is load them and press a button. Also, the loading and unloading of programs should be done at a position from which the teacher can remain in full control of her class.
7. The pace of the programming should be fully controlled by the teacher and/or the student, so that it can be tailored to each

student's progress.

8. The screen should be able to take the student's physical and verbal responses in a variety of forms.

9. The screen image should be capable of informing the child of the correctness of his response and provide other forms of reinforcement and motivation.

## LARGE IMAGE

To allow the child the maximum amount of movement in front of the image it was decided that the screen should start from the floor and rise vertically as high as an average 4 year old can reach, i.e., 54 inches (we work primarily with an early childhood population). Since the pictures on normal 2 x 2 slides and on all filmstrips have a vertical to horizontal ratio of 5 units to 7, the 54 inch vertical automatically established the horizontal dimension of the screen to be 75 inches. (2)

Viewing a rear projected image 54 inches x 75 inches from a distance of 12 or 15 feet is a very pleasing experience. The perceived image is considerably larger than that of home TV or the 70mm motion picture theater. (Size of perceived image being determined by actual screen size and the distance of the viewer from the screen). But apart from the increase in size, the experience is conventional. The situation changes radically, however, when the student stands one or two feet from the screen. At this distance, he is almost enveloped by the image and the closeness of the screen literally invites the child to touch it and react upon it. This is very desireable, but viewing a 54 inch x 75 inch picture at a range of 12 inches places demands on the projection system it was never designed to meet. Poor definition, hot spotting and the jolting disappearance of the "world" during slide changeover are three major problems.



Resolution is marginal when projecting from a 35 mm film strip. The picture frames are 2 or 3 generations removed from the original 2 x 2 slides and only 1/2 their size. Only by utilizing high resolution film stock and excellent cameras, copying techniques and projectors, will projection from 35mm film strips be acceptable. Resolution is quite acceptable when projecting sharp

2 x 2 slides with a Kodak Carousel projector. A Dukane filmstrip projector and Kodak Carousel slide projectors are the visual projectors utilized in Project "ME's" Learning Wall.

Hot spotting is a problem commonly encountered in rear projection. A hot spot, (a concentration of brightness on the eye-lens axis) is created because the light energy traveling to the eye in a straight or relatively straight line (16-A) is greater than the light energy that is bent at a sharp angle by the diffusion surface of the screen. (16-B) Since, as one approaches the screen the difference between the angles of the direct ray and the edge ray increases, the hot spot increases. In our preliminary tests the edges of the image, (for a child working a foot from the screen) were so dark that picture information lying at the screen's margin could not be seen.

The problem was solved by using a high quality professionally coated diffusion screen (instead of a piece of frosted plastic) and by projecting through a long focal (narrow angle) projection lens with a long 22 foot throw. This significantly reduced the angular difference between the direct beam (16-C) and peripheral beam (16-O) The 22 foot beam is folded through three mirrors (I-O) (17) (19) (20) This reduces the amount of space required behind the screen from 23 (22 + 1 foot for the projector) to 6 feet. For economy, plate glass rear surfaced mirrors are used. The loss of definition caused by the mirrors is not appreciable and the image achieved through this projection system is devoid of hot spotting, and generally satisfactory.



When the image occupies only 10% of the visual field its disappearance during a slide change is not traumatic. But when the image occupies 60%, the sudden blacking out is truly jolting. The problem was satisfactorily solved by preventing the screen from going black. Instead of using one Carousel projector, two were used in conjunction with a dissolve unit that blends the cross over from one to the other. This has given a very pleasing visual fluency to the programs.

The Dukane filmstrip projector also gives satisfactory results by virtue of its instantaneous pulldown. It is so fast that one is never bothered by a period of darkness between frames.

Fig. 8

Fig. 9

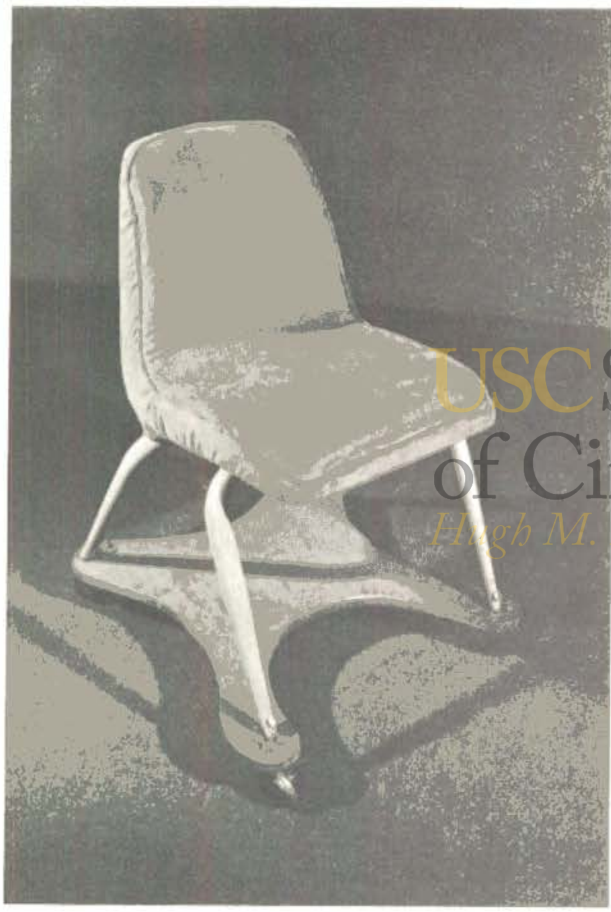
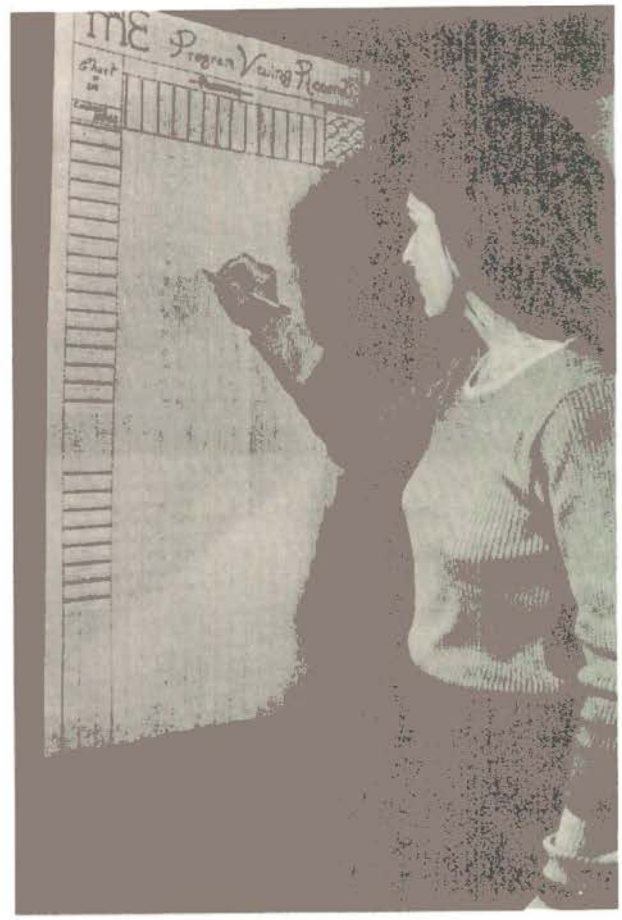


Fig. 11

Fig. 10

Fig. 14



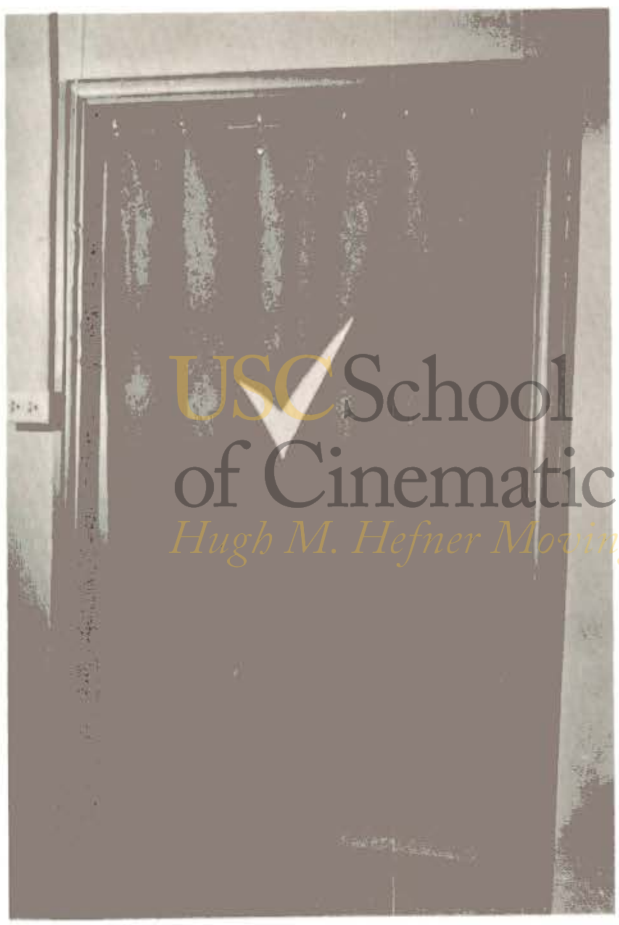



Fig. 13



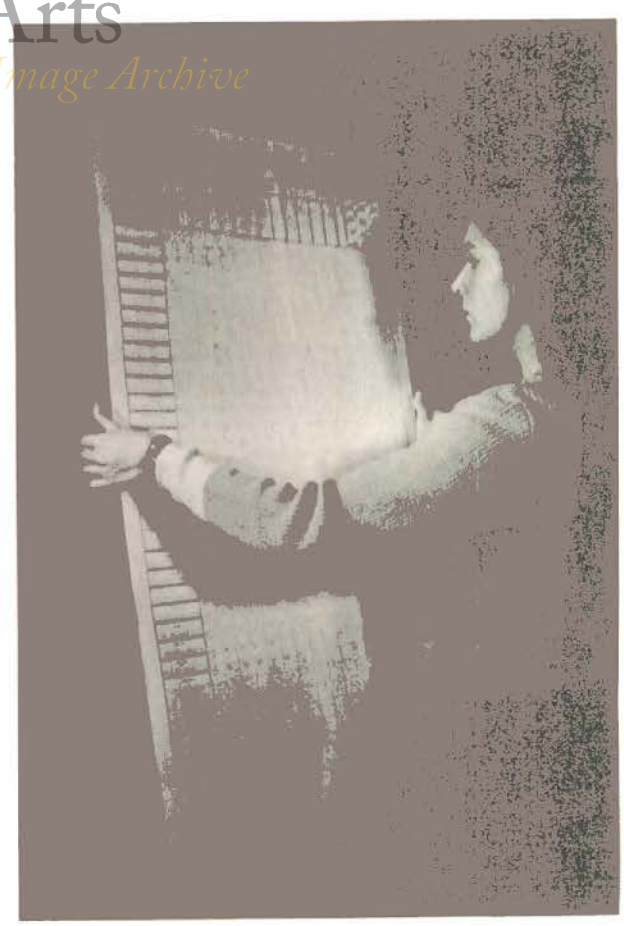
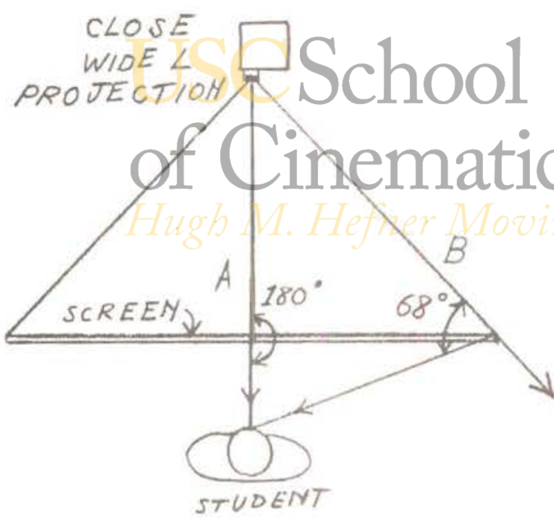
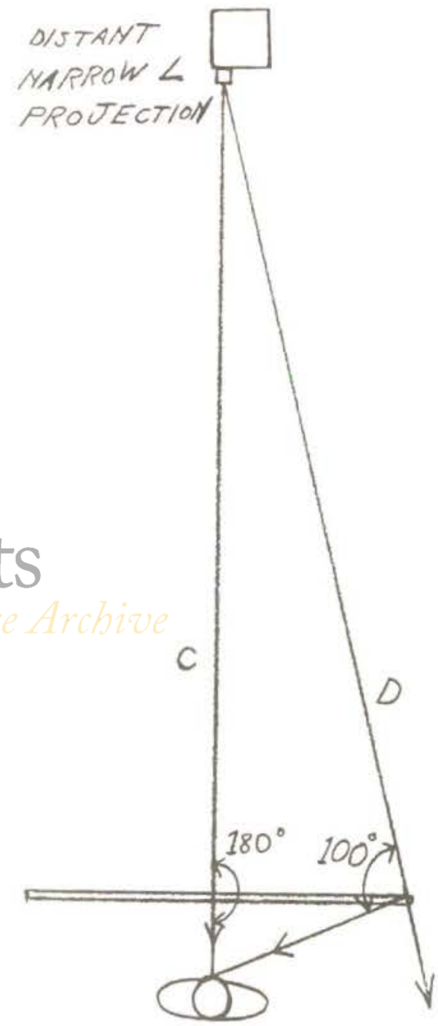


Fig. 15

# FIG-16



CLOSE
WIDE ∠
PROJECTION
A
B
180°
68°
SCREEN
STUDENT

DISTANT
NARROW ∠
PROJECTION
C
D
180°
100°

## SENSORY UNITY

When viewing an image from a distance the position of the source of sound is not critical. However, when working close to the screen, if the sound comes from the rear of the room or from the side it is very disturbing. Having the screen at floor level leaves no room for putting a speaker on the floor, and the rear projection eliminates placing the speaker behind the screen (both positions being normal in conventional projection). The problem of directionality was solved by placing one speaker at ear height (center height 30 inches) on each side of the screen. (18 A and B) Whether being fed by a monaural or binaural tape, the perfect balance of the sound creates the realistic illusion that it is coming from the screen.

## PROJECTION CABINET

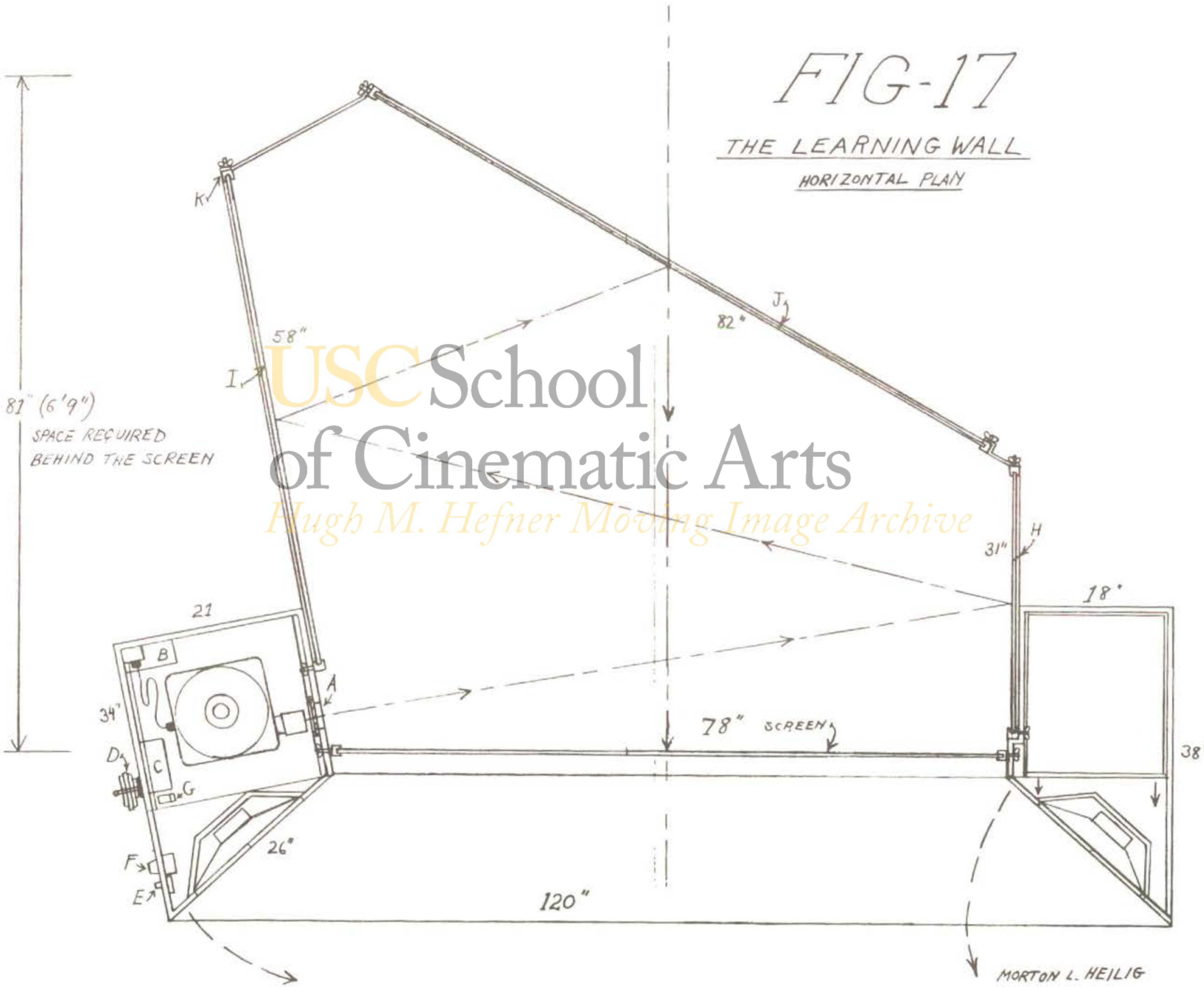
As implied earlier, even the best slide or filmstrip projectors available today emit a barrage of light beams, clanks and whirrs that are extremely distracting. This racket is more acceptable if the projector is in the rear of the room or 23 feet behind the screen. But placing it in either place would defeat another design parameter we set for ourselves, i.e., keeping the teacher in her normal position at the head of the class. This meant placing the projectors at the side of the screen and in this location the beams of stray light, the whirr of the fans and the clanking of metal parts become intolerable.

The solution was to build a light and sound proof box (21) (18-C) that would contain all the projection equipment; one tape deck (22) 2 Kodak Carousels (23) (24) one dissolve unit, and one Dukane filmstrip projector (25). Each piece of equipment rests on a platform that pulls out for easy loading. Four 3 x 3 inch windows are cut in the side of the box to allow projected light beams to emerge. (19) (18) (17-A) 1/4 inch plate glass covers these holes to contain the sound. Additional sound containment is achieved by using 3/4 inch plywood for construction and lining of the box with 1/4 inch carpeting. All this sealing unfortunately also seals in the heat. Thus two 4 inch muffin fans were installed (one at the middle of the back and one at the top of the back) (17-B) to rapidly dissipate heat. The hot air is evacuated through a baffle that successfully contains the noise while passing the warm air.

# FIG-17

## THE LEARNING WALL

HORIZONTAL PLAN

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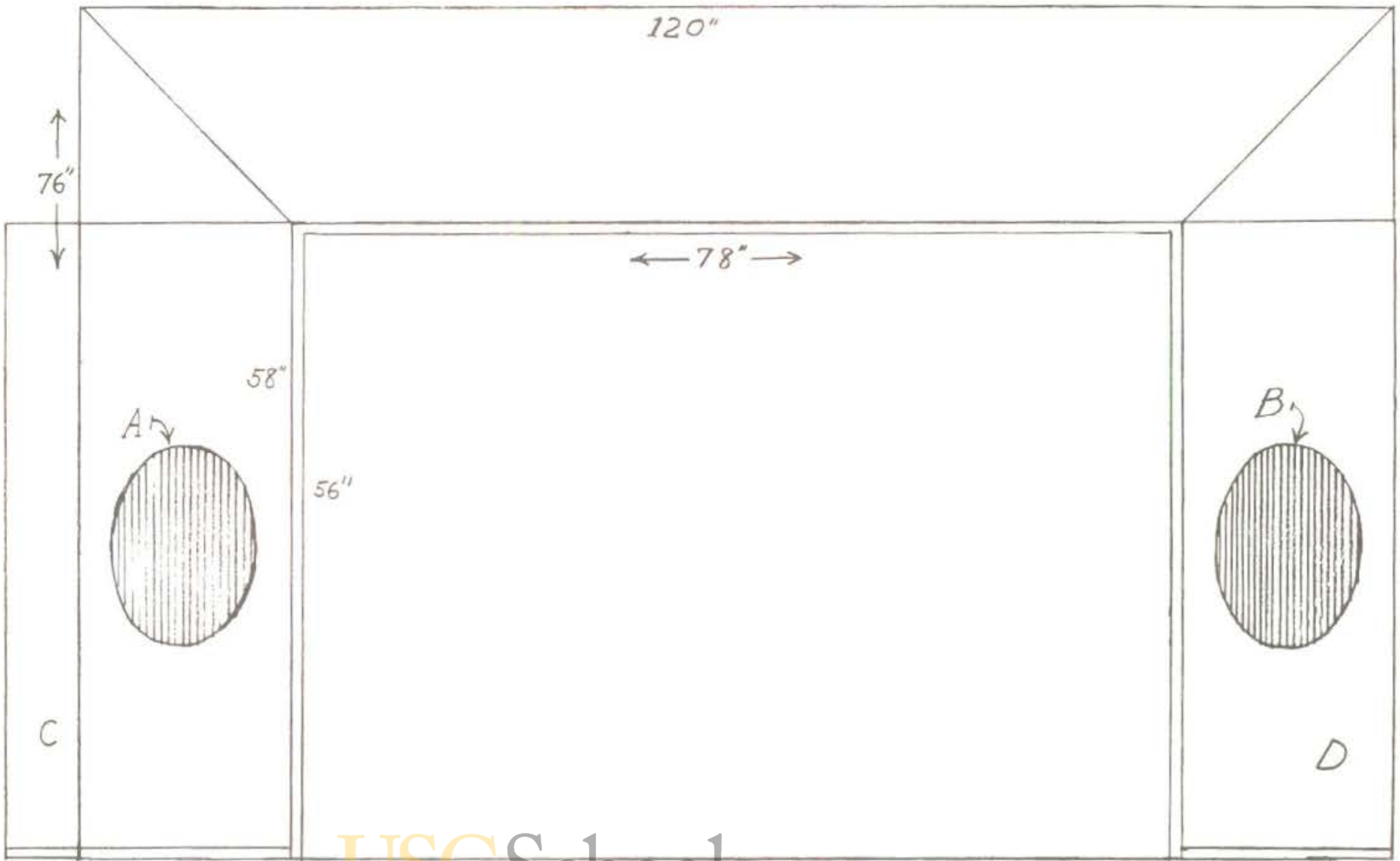


FIG-18. LEARNING WALL — VERTICAL PLAN

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Fig. 19

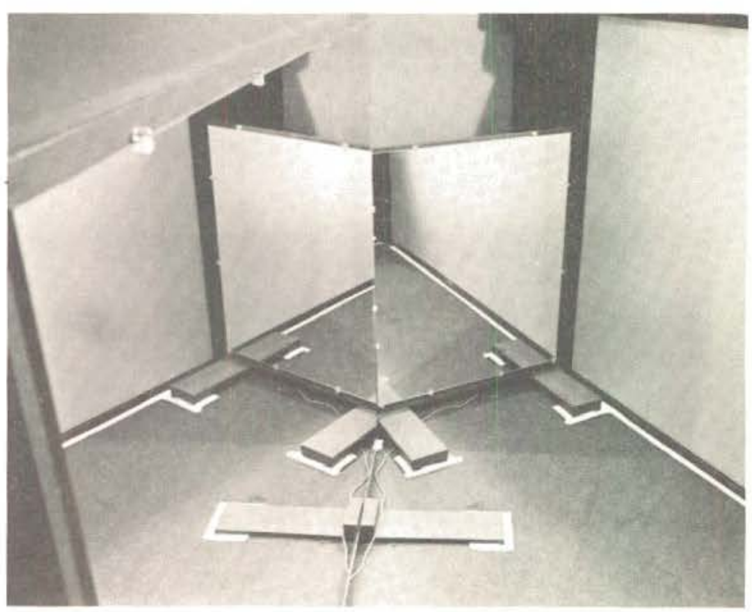


Fig. 20

Fig. 21

Fig. 22

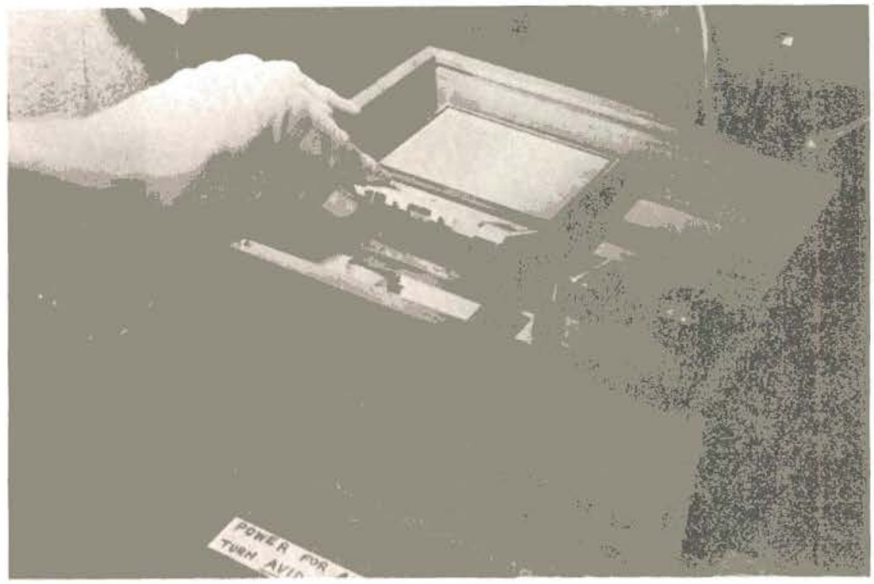



Fig. 23

Fig. 24

Fig. 25

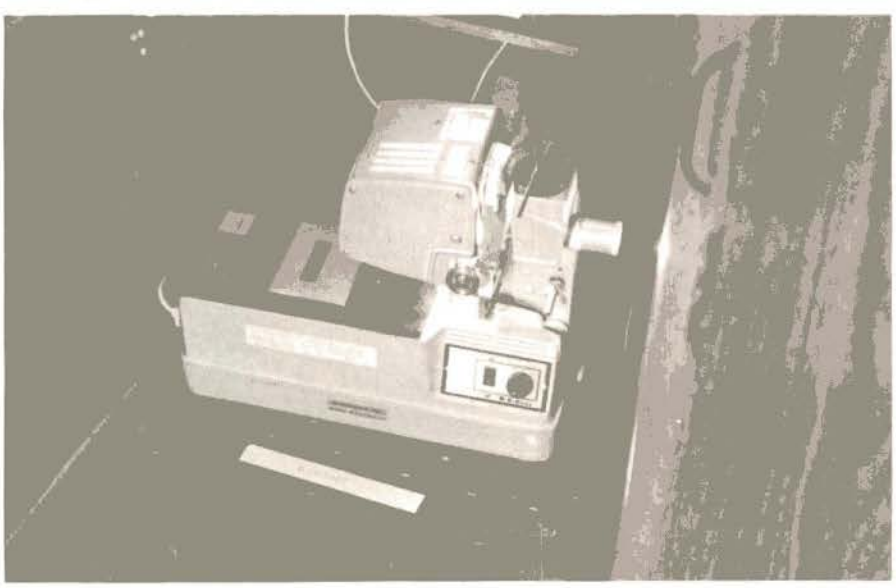
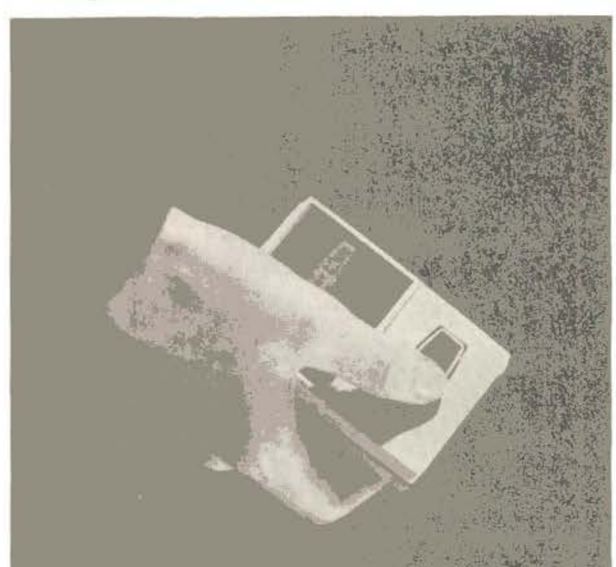


Fig. 26



The upper section of the projector box contains a radio receiver (17-C) which activates the tape recorder when triggered by a small radio sender (26) operated by the teacher.

The door contains one of the Wall's 2 speakers. (18-A)

A pilot light automatically turns on when the door is opened enabling the teacher to see well while loading, unloading, etc. even though the room is dark.

Each piece of projection equipment can be independently governed by 10 foot control cables that pass through the wall of the box and hang on hooks attached to the side of the box. (17-D) The box has one main power switch (17-E) and volume control pot on the outside (17-F) of the swinging door. Both are handy to the teacher but invisible to the students.

One main internal switch (17G) allows the teacher to switch power from the Kodak Carousels to the Dukane and to feed the control pulses eminating from the AVID tape deck to one projector or the other. The projection box thus successfully eliminates all the audio visual distractions of the projection hardware while at the same time making equipment readily accessible to the teacher in a position where she can maintain control of her class. In addition, by sparing her the fatigue of setting up and dismantling the equipment with each audio visual presentation it increases her desire to use it.



Both the projection box and the storage cabinet are covered with a handsome wood finish. The two act as a frame, with their angles guiding the eye of the student into the picture.

THE STORAGE CABINET

The storage cabinet visually balances the projection box and stands at the opposite side of the screen (18-D). A sound speaker is attached to its swinging front door (18-B). It contains 5 pull-out drawers (27-A) for storing programs, three larger drawers (27-B) for special program materials such as stick-ons, puppets, etc. One drawer (27-C) for spare parts and bulbs, and at the bottom, a large bay (27-D) for a spare projector.

CONTROL

To enable the teacher (or the student) to adjust the pace of the program to the learner's ability, a simple control system was adopted. An AVID tape player which utilizes a two track tape cassette was chosen as the audio input (22). One track carries the sound track (music, words, effects) and the other track carries the command signals. A low 150 cycle signal stops the tape and a high 1000 cycle signal sends a pulse to either the Kodak Carousels or the Dukane (depending on which system is in operation) to advance the picture. These frequencies have recently been accepted by the National Audio-Visual Association (NAVA) as the standard for educational equipment.

The teacher has either a control cable or the radio remote which restarts the tape. The child also has a foot switch, located on the floor at the center of the screen, which can advance the tape.



The sequence of commands generally operates in the following manner. The teacher presses her remote switch thus starting the tape. A 1000 cycle pulse on the tape signals the projector to advance to the next picture (which in our example is a morning breakfast scene in the kitchen). The voice on the tape asks the child to find the orange juice bottle. Then a 150 cycle signal on the tape stops the tape.

The child takes as much time as necessary to find the juice bottle. Finally he touches the screen (28). When the teacher feels he has come to his conclusion and that he is ready for feedback, she presses her remote control which re-starts the tape. A 1000 cycle signal on the tape instantly advances the projector to the next picture and then a 150 cycle signal stops the tape again. The next slide is an identical copy of the first slide except that it has a visual feedback cue (such as a black circle) around the right answer (which in our example is the orange juice bottle). The circle graphically shows the child if his hand is in the correct place. If it is, or once the child has corrected himself by placing his hand in the circle (29), the teacher presses her control and starts the tape again. The tape pulses the projector to present the next picture and the audio asks the child the next question, etc. The remote radio control has proven popular with teachers and students alike, because it affords them complete freedom of movement without the entanglement of wires. It has also an element of magic about it that truly delights the children.

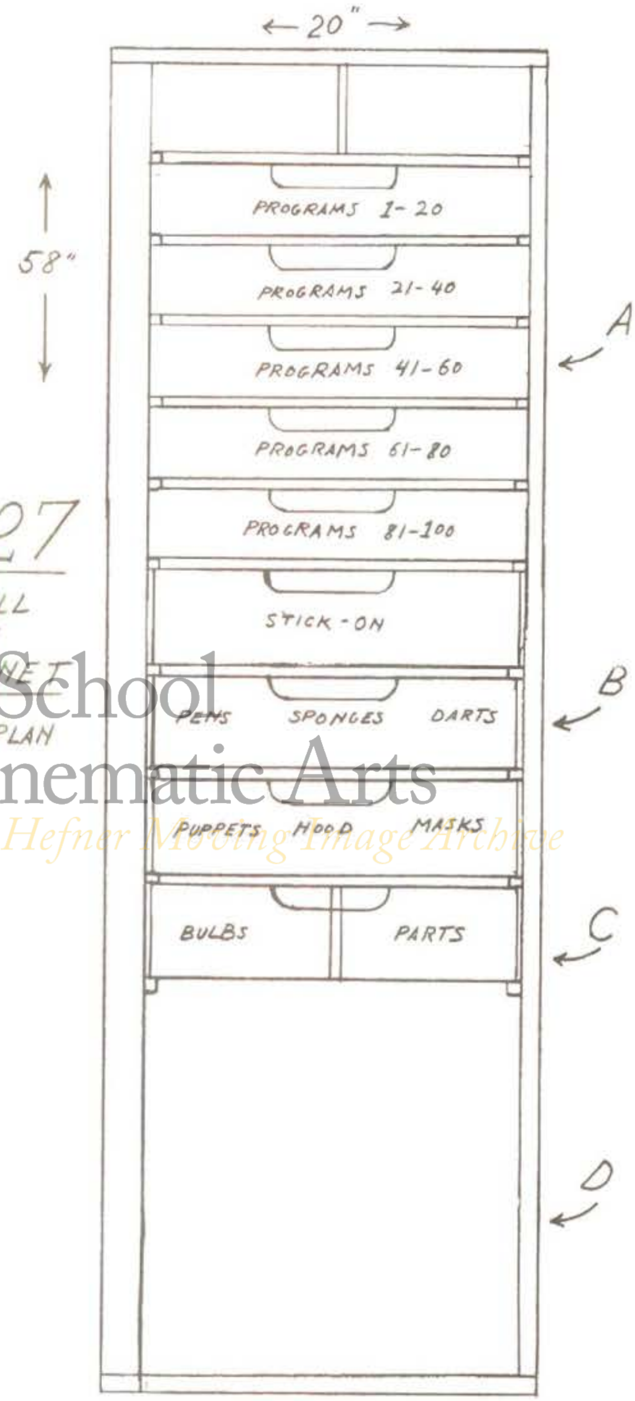



FIG-27

WALL STORAGE CABINET

VERTICAL PLAN

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Fig. 28

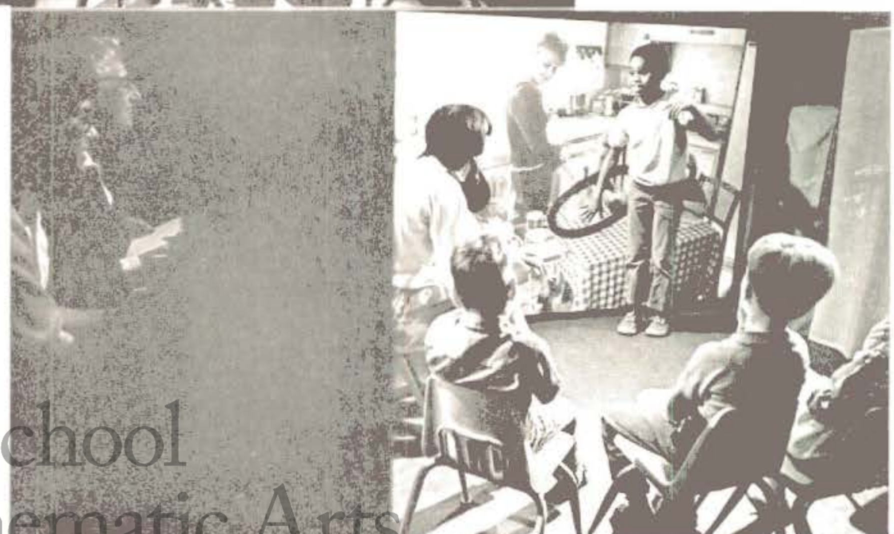


Fig. 29



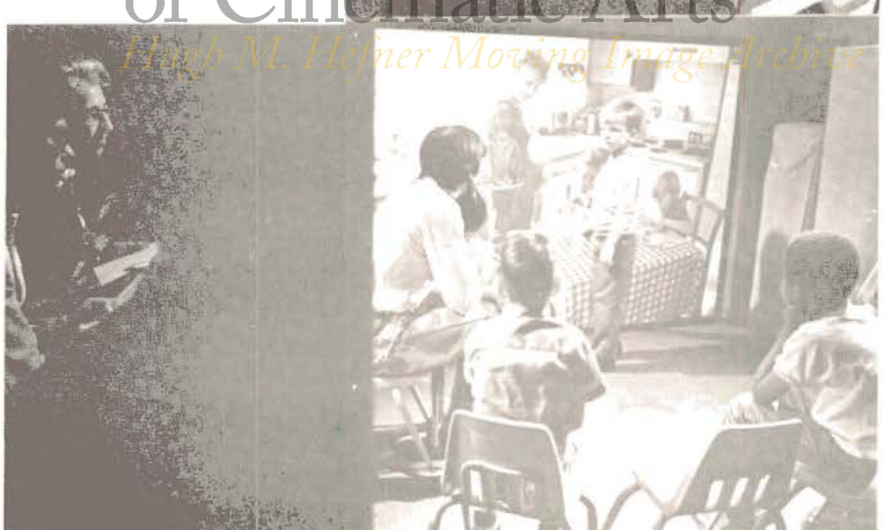


Fig. 30

Fig. 31

## THE SCREEN

Since the child is not just looking at the screen but touching it, and often banging on it, as well as (as will be illustrated later) drawing on it, pasting on it, etc., it must have characteristics not previously associated with screens. It must be:

1. strong
2. resiliant
3. safe
4. washable
5. reflective

Conventional roll-up screens don't satisfy these requirements. What does, is a sheet of 1/4 inch acrylic plastic, coated with a fine diffusion emulsion on the side away from the viewers. Keeping the emulsion side away from the students protects it from scratches, abrasions and the stickiness of their hands. The front smooth side can easily be sponged down and, can act for certain programming as an excellent mirror. Putting the shiny side in front rather than in the rear as is usual, obligates that the screen be used in a darkened environment; if not, everything in the room, including the students, will be reflected in the screen to the detriment of the image.



## MIRRORS

The mirrors used to fold the light beam behind the screen are made of 1/4 inch plate glass and rear coated. Front coated mirrors, i.e., mirrors that have their reflective coating of silver or aluminum on the front surface rather than on the rear of the glass, would give a much better optical result but they are three to four times more expensive. Rear coated mirrors have the advantages of not oxidizing (because the glass protects the coating from the air) and of being easily cleaned without scratching. The Learning Wall System uses 3 mirrors (17). Mirror #1 (17-H) is 31 inches x 54 inches, mirror #2 (17-I) is 58 inches x 54 inches, and mirror #3 (17-J) is 82 inches x 54 inches. The main difficulties with the mirrors is in keeping them flat. Since the glass is flexible, the flatness of the mirrors depends completely on the flatness of their support. Wood is not advisable because it warps. The best solution is a square tubular metal frame (17-K). To protect the back of the mirror the frame is then filled with 1/2 inch plywood.

When the projection box, the screen and the mirrors are bolted together (with hand operated wingnuts) the Learning Wall is automatically in the correct geometrical arrangement for projection.

In some installations it is advisable to cover the space between the box, screen and mirrors with a light weight cover to keep dust out.

The Wall comes apart quickly for shipment in several units.

- The projector Box is shipped as a unit (projectors and tape recorder are now shipped separately, but they could be secured and shipped in the box.)
- The Storage Cabinet is a unit.
- The Screen and Mirror One go in one case.
- Mirrors Two and Three go in another case.
- The Light Box is a unit.
- The Lights are a unit. Teacher's Chair and Student's Chairs are a unit.
- Programming accessories are a unit.



## COSTS OF THE LEARNING WALL and LEARNING WALL ROOM ACCESSORIES

BASIC LEARNING WALL:

| | | Price |
|---|---|---|
| 1 | AVID Learner cassette tape playback unit* | $226. |
| 1 | Dukane Remote Control "Classroom" Model 28A6 filmstrip projector | 169. |
| 1 | 1/4" x 54" x 75" Acrylic rear projection screen with 1" Apton Tubular Frame | 325. |
| 3 | Rear surfaced mirrors with 1" Apton Tubular Frames | 200. |
| 1 | Sound proof equipment cabinet with light, ventilation fans, electrical outlets and one 10" speaker | 190. |
| 1 | Program materials storage cabinet with light and one 10" audio speaker | 100. |
| 1 | Student's foot switch and cable | 10. |
| | Total | $1,220. |

Note *The Avid Programmer, which permits the user to create his own "pulsed" programming, sells for $325. Elco Optisonics, Inc., markets an alternate tape player, the Soundomatic IV, for $206., and an alternate programmer, the Soundomatic III, for $249. Additional models for straight playback or programming are currently being developed by other manufacturers.

OPTIONAL LEARNING WALL EQUIPMENT:

| | | |
|---|---|---|
| 2 | Kodak Ektagraphic Automatic slide projectors with Zoom lens | $428. |
| 1 | Kodak Carousel Control, Model 2-B56 | 215 |
| 1 | Wireless remote control-radio pick-up and signal generator | 60 |
| | Total | $703. |
| | Complete Learning Wall Total | 2,023. |

LEARNING WALL ROOM ACCESSORIES:

| | | |
|---|---|---|
| 1 | Teacher's mobile seat with control console | 75. |
| 5 | Students' chairs with cushioning and covers | 75. |
| 1 | Light Box for vinyl cutouts | 150 |
| 4 | Reflection lights | 56 |
| 2 | Teacher's lights | 28 |
| | Total | $384. |

COMPLETE LEARNING WALL AND ROOM ACCESSORIES $2,307.



Note: Cost of local taxes, shipping, installation, programming and programming materials (such as: stick-ons, puppets, flo pens, etc.) are not included.

Prices quoted are list prices; schools capable of obtaining GSA (General Service) prices can deduct approximately $400. from the final Total, leaving a total of $1,907.

## PROGRAMMING TECHNIQUES

There are seven different ways of using the Learning Wall and new ones are constantly being discovered. It will be noted all of these techniques, with the exception of the last, are not different ways of projecting the image, but rather different ways of responding to the image on the part of the students.

1. Conventional viewing
2. Touch Response
3. Stick-on
4. Drawing
5. Reflection
6. Light Beam Projection
7. 3-Dimensions

1. Conventional viewing - This is the use of the Wall as a screen for the conventional viewing of slides or motion pictures. It is "conventional" because like in all current slide, motion picture and television presentations, the programming proceeds at a preset pace. The child viewing it remains physically passive and is never invited to react physically or verbally.



Note: Stating that the child is physically passive, or non-interactive, does not necessarily mean that the child is not involved or that he may not be reacting in an extremely vital way internally. The important distinction is that the child is not interacting in an externally noticeable fashion- moving, pointing speaking out, etc., and that such action if it does spontaneously erupt is not solicited by the structure of the program.

2. Touch response - In programming for touch response a still or motion picture is presented to the child, then stopped while he is asked to identify a part of the picture by touching the screen with his hand or finger (30). While his hand is in position the next image informs the child if he is right or wrong by circling the correct area with a line (31) (or by having it remain light while the rest of the picture goes grey etc.)

A variant of touch response, used primarily in Body Image programs, is to have the child match his (or her) body to the life size image on the screen (32) (33) or to point to the feature on his (or her) body or face that corresponds to the parts in the projected image he is asked to identify. In response to the child's actions the appropriate body part appears or fills in with color.

Another touch response technique is to project a master image on the screen and ask a child to answer a question about the master image by pointing to one of a series of small pictures around the edge. The border "answer" pictures can be colors, numbers, letters, figures, parts of the major picture, etc., (34). An other variation of this mode is to have the screen divided into 2, 4, 8 or 12 (35) squares or circles and to ask the child to pick the right answer which then becomes encircled or brightened, etc. (35 The Response programs develop the child's capacity to listen to instructions, discriminate visually, solve problems, and move with coordination.

3. Stick-on - In this technique the slide projects a basic setting such as the ocean, the jungle, a city street, a room, etc., on the screen and the child is asked to superimpose picture cutouts such as animals, people, objects, numbers, and letters. These "stick-ons" are made of flexible vinyl which adhere to the screen electrostatically when rubbed.



The child can be asked to spontaneously create a scene of his own liking, or he can be asked to place his "stick-ons" in precise areas, either to complete partially drawn illustrations or to match objects. In addition he can be challenged to demonstrate positional relationships by placing "stick-ons" above, beneath, to side of, etc. projected images. To enable the child to choose "stick-ons" in the dark it was necessary to build a "Light Box" (9). The Light Box is 54 inches high, 50 inches wide and 8 inches deep and stands to the right and perpendicular to the screen. It contains a single flourescent tube that back illuminates a sheet of 1/4" milky white plastic.

The light is handled in such a manner that the surface is evenly illuminated notwithstanding the shallowness of the box.

A curtain covers the box when not in use to prevent the colorful stick-ons from distracting the children; and to eliminate reflections from the plastic surface (8). When operating, the child studies the assortment of stick-ons on the light box (40) makes his selection, peels off one, places it on the Wall and secures

Fig. 32



Fig. 33

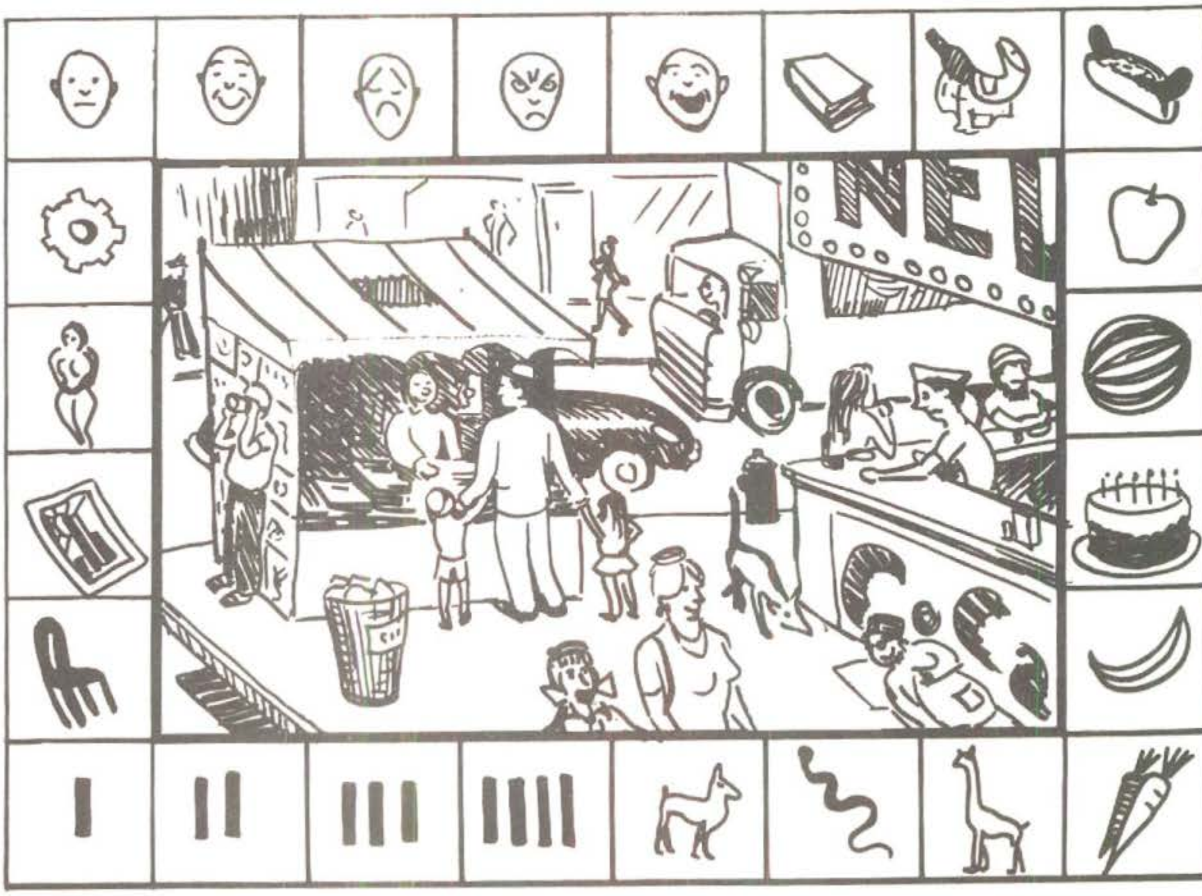


FIG-34

MLH




FIG-35 + 36

MLH

it by rubbing with his hands. (41)

We have found that excellent color quality is obtained by drawing the "stick-on" figures with flo pens (filled with plastic ink) on polished 3 to 6 mill vinyl of a doubly "soft hand".

Adhesives are not advised, as they are messy and wear off. The system will improve even further when a method is found to build a reasonably durable electrostatic charge on either the screen or the "stick-on".

The "stick-on" technique is a variation of the very popular flannel board. It has the advantages, however, of being much more exciting visually and of allowing the teacher or student to instantly pose new and complex environments by simply changing the slide or filmstrip frame. In selecting one "stick-on" from the choices on the light box, the child is already involved in a figure-ground perceptual task, and, by peeling them off and moving up, down and across the screen and pressing them on, he is going through excellent visual-motor exercises. In addition, the large size of the screen makes directional training an experience related to the child's own full scale body position in space.



A variation of the "stick-on" technique is to allow the child to attach 3-dimensional materials to the screen surface with suction cups. In one form a slide with horizontal rows of pictures is projected. For example-- a row of animals, a row of foods, a row of babies, a row of animal nests and a row of words (36)

The child is asked to find the cat, the cat's food, baby cats, the cat's house and the word cat. He places a suction dart (37) in or over each answer of his choice. When all darts are placed, the teacher advances to the answer slide which has each correct answer encircled. In one glance the child can see if his darts are in the correct circles. The suction cups provide a memory system when a multiple of answers are called for. In variations of this technique, light rubber or plastic 3 dimensional figures can be attached to the screen (38), or flexible mat with many small cups (similar to bath mats) can be attached in response to questions, to match images, or to tell stories (39).

Note: Suction cups adhere extremely well to the smooth shiny surface of the acrylic screen. They will not, however, adhere to conventional pourous screens.

4. Drawing - In addition to being used as a projection screen and a versatile flannel board, the Learning Wall can be used as a blackboard and a large easel.

In this technique, a slide is projected on the screen and the child is invited to draw directly on the screen surface with a large felt tipped pen (42). The pens are filled with water soluble inks of different colors that adhere easily to the plastic surface, dry quickly and are easily washed off the screen (or the child) with a wet sponge (43). Depending on the program, the child can be asked to trace the looping lines of a suspension bridge, draw over dotted lines depicting actions (44 & 45), to complete unfinished figures, or draw new ones into partially populated scenes, etc. The screen is large enough for 2 or 3 children to work simultaneously. The great advantage of this technique is the simplicity of set-up for large scale intermediate motor practice. The main disadvantage is impermanence, i.e., once completed, the drawing cannot be taken down and preserved.

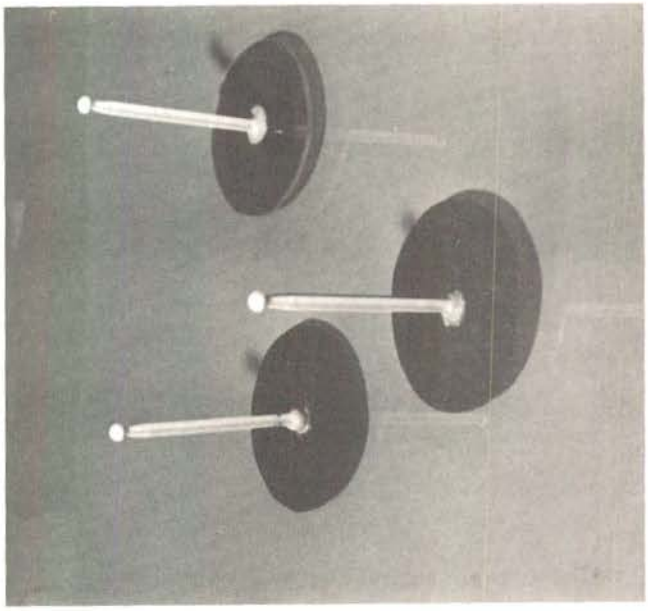


A variation of the drawing technique is to have the child draw on a large sheet of newsprint, vellum or tissue paper (46) rather than on the screen itself. The paper can be attached to the screen with masking tape, suction cups, or magnets placed against the screen's metal frame. In this way the drawing can be preserved, to be displayed at school or taken home (47).

5. Reflection- The reflection technique opens up the possibility of creating a type of programming never used in the classroom before. Fundamentally, it is a method in which the child sees a reflection of himself or an object in the picture on the screen. The rationale behind the development of this technique is two fold:

1. Instant feedback has always been recognized as a vital factor in appropriately guiding development. People cut off from feedback cannot develop normally. Classical examples are the deaf-mute whose vocal apparatus is intact but who doesn't learn to talk because he cannot hear, and the blind person who, though his facial motoric system is undamaged, never develops the normal array of facial expressions because he has never seen his own face or the face of others. Thus, if a child were

Fig. 37



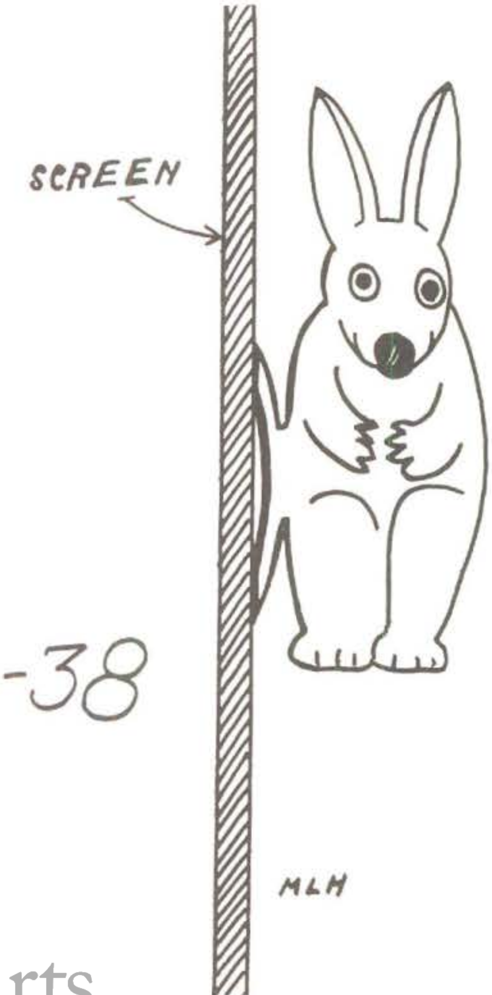



FIG-38



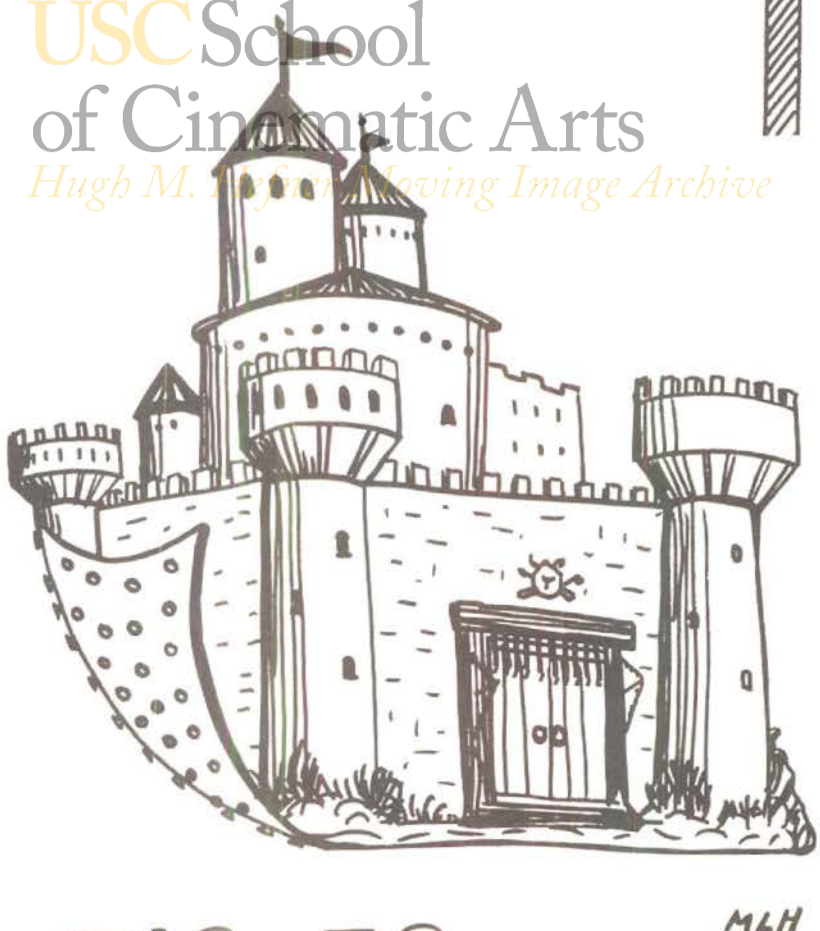



FIG-39

Fig. 40

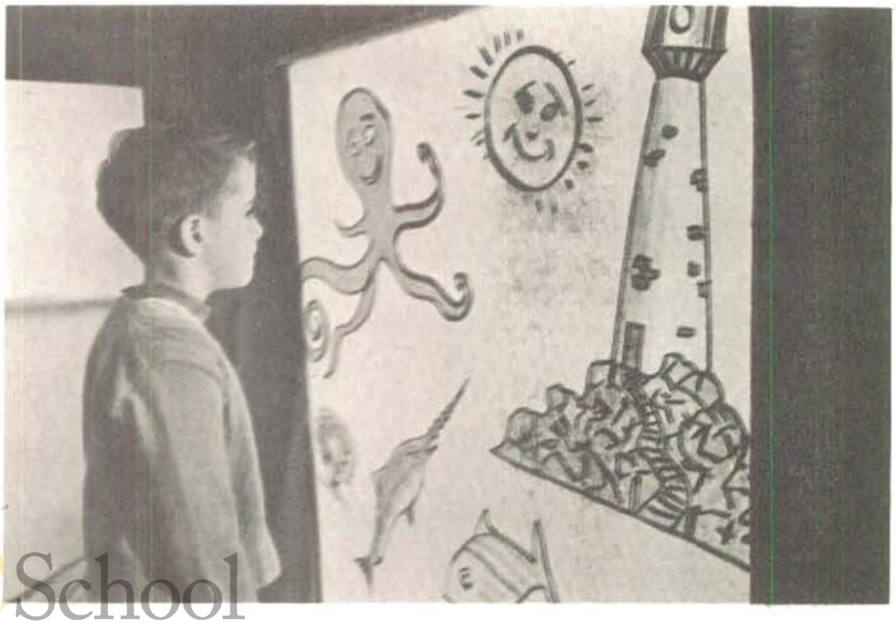




Fig. 41

Fig. 42

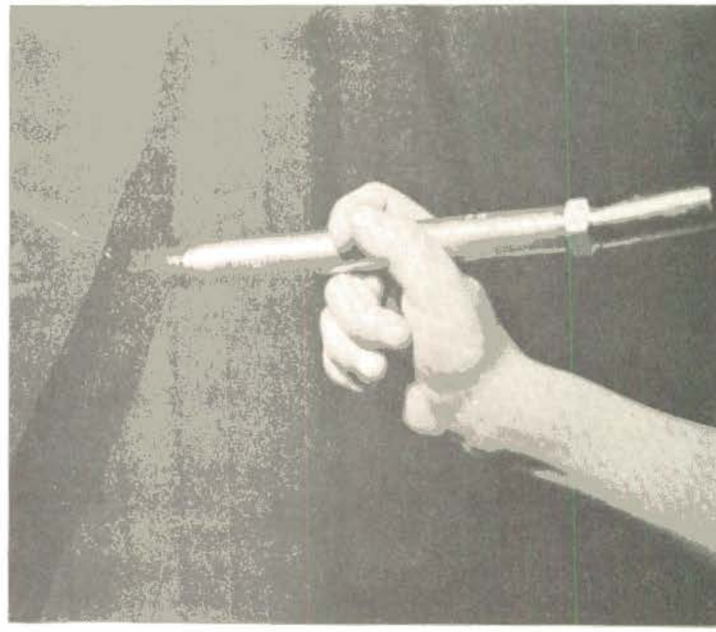


Fig. 43

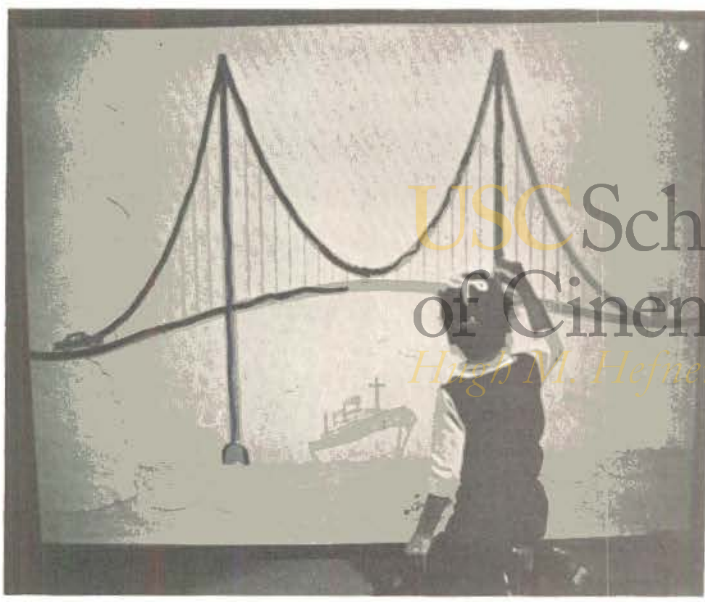


Fig. 45



Fig. 44

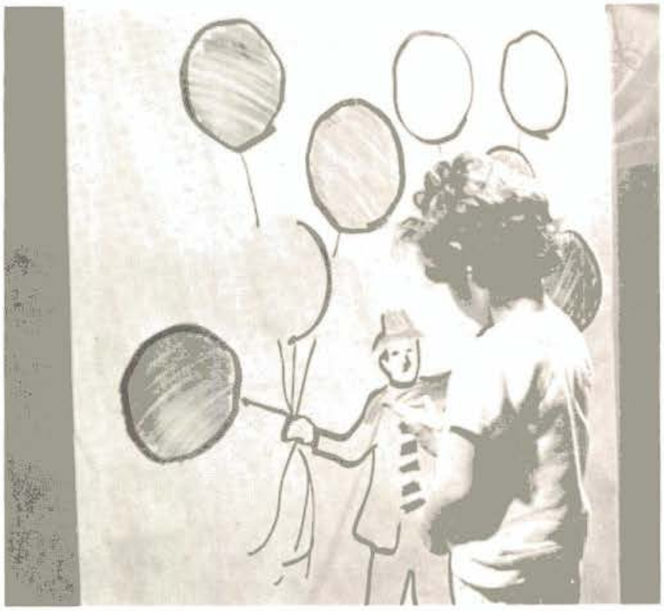


Fig. 46

Fig. 47



Fig. 48

Fig. 49

asked to assume certain physical positions or make particular movements, it is reasonable to assume that he could master these tasks rapidly if he could immediately see a feedback reflection of himself.

At this point one may ask, "Why not use a mirror?" There is nothing wrong with a mirror, but the reflection principle uses the smooth front surface of the screen as a mirror with the small advantage that it is already there (one needn't haul in a huge 54 inch mirror) and the big advantage that while being used as a mirror the Wall can simultaneously be used as a screen.

Thus, the child can see himself in the image projected on the screen, or compare the position of his body with that of the figures projected on the screen. This would be impossible with an ordinary mirror. The rationale has another element that this is an extension of the idea of dynamic interaction; the child can literally be in the picture and he can become one of the characters in the story rather than passively watch the children (or animals) in the picture having all the fun.



Our experience has taught us that the technical success of the reflection technique relies on 5 basic factors: the screen, the slide, the overhead lighting, the student (or subject) and the room background.

1. The screen must have its smooth shiny surface facing the student. If its diffusion side faces the student there will be no reflection.
2. The slide projected on the screen must have large dark areas so that the reflected image will stand out.
3. Lighting - A broad flat beam of powerful light must fill the area in front of the screen. This is created by a battery of three or four lights attached to the ceiling above the screen. (I-P) (6) The bulbs (150 Watt spotlights) are contained in specially adapted light shields (7) which direct a powerful beam of light into the student's area, but prevent any light from spilling onto the screen or the students in the rear of the class.

<u>Note:</u> If bright lights are put to the side (rather than above) they will blind and distract the child, but, due to the way the eye is set in the head, (with over-head eyebrows, bone shelf and eyelashes) bright lights above, (like the sun) are not bothersome.

4. Although students of any complexion or dress are easily visible in the screen, their reflected image is enhanced if they are wearing high key clothes, i.e., white, yellow, light blue, etc.
5. The room background should be kept dark (teacher's lights turned off). If not, the whole room is reflected in the screen and this confuses the image.

If all these conditions are met the child sees a very distinct image of himself in the screen. Once this effect is achieved it can be used in a variety of ways.

A child can be asked to stand in the light before the screen and then be instructed to assume a certain body position - such as in the game "Simple Simon" wherein Simple Simon says, "Put your hands up into the air in a "V" position".



After the child has interpreted the command (48) the teacher presses her remote control and images of 2 children in the correct position appear on either side of the child's reflection (49). By comparing his own reflection with the images of the other children, the child can easily see if his position is correct. If not, he can correct it until the stance of his reflection matches those of the projected figures.

Each slide has a star in the upper left hand corner and a circle in the upper right hand corner (48 & 49). This directionality is established early in the game.

Small cardboard stars and circles can be attached to the back of the child's hands with an adhesive backing or rubber band to reinforce the distinction.

Simple Simon refers to the "star" hand, "star" foot, "circle" hand and "circle" foot rather than saying "left" or "right" because the mirror image reverses these sides and this would lead to a great deal of confusion in all asymetrical exercises.

As the child masters each lesson, the commands become progressively more complex - i.e., "Simple Simon says, "Raise one foot off the floor, stretch your arms out to your sides with the thumb of your star hand pointed up and the thumb of your circle hand pointing down," etc.

Another way of using reflection is to project a scene with characters and have the reflection of the child become one of the characters in the picture. To enhance the drama the child could wear a mask or a costume or both and become a pirate, an astronaut, etc.

Another variation of this technique that has interesting potential is in using puppet reflections wherein instead of seeing himself, the child can control one or two hand puppets that play in the scene while his own reflection vanishes. This is conveniently arranged by having the child put on a robe and hood made of black velvet (50). The hood has holes for eyes, mouth and nose, and a cap beak to prevent the overhead lights from illuminating the features through the holes. The black velvet absorbes all the light allowing none to bounce back towards the screen to create a reflection. The hand puppets, which should be white or yellow, etc., are clearly visible in the scene and appear to float miraculously in the air (51).

Using these techniques the children can tell their own stories, play parts in pre-written stories, answer quizzes, etc. Contrary to a full scale theater or puppet theater, the children can see themselves in the scene and the story can progress rapidly from one scene to another by advancing a slide.

If motion pictures are used in place of the slides, a whole new range of reflection possibilities appear. The child (or his puppet) would be able to do gymnastics, or dance with the characters on the screen.

9. Light Beam This is a technique wherein the children could interact with the projected image by projecting light onto the screen. In its simplest form one child could have a battery or Wall powered hand projector that projects a white dot onto the screen. A Further elaboration would be to have each

Fig. 50

Fig. 51

Fig. 53

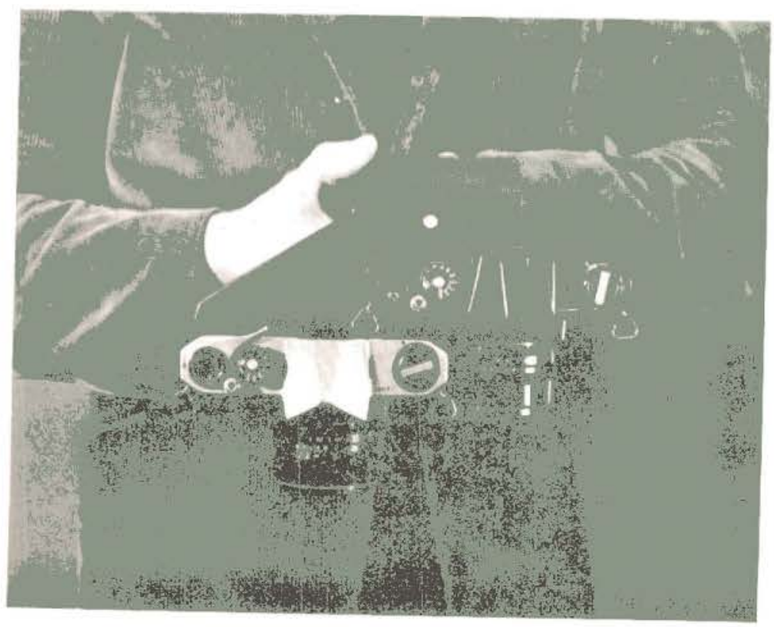


Fig. 52

child identified by either his own color or his own shape - square, circle, triangle (or both color and shape). He then could locate, trace, chase, dance with his light image.

The most interesting potential may be offered by having either the teacher, student or both project cartoon like characters onto a projected setting on the screen. By moving the handle and talking into a throat microphone connected to the Wall speakers the characters can become fully animated and appear to talk from the screen.

10. 3-D The last of the techniques so far devised is 3-Dimensional pictures. This is the one technique that does involve a different projection technique as well as a different type of student response. 3-D per se is not new, but creating it in rear projection is rarely, if ever done. Standard 3-D technique is to take 2 photographs with a horizontal separation of 2 1/2 inches and to front project these two slides (or movies) from two projectors, the lenses of which are covered by polarizing filters whose crystalline structures are set at right angles to each other. The polarized images are carefully projected on top of each other on an aluminized screen (so that the polarity of the light is conserved). The spectators view the images through polaroid glasses whose crystalline orientation for each eye corresponds to the crystalline orientation of the filters on the projectors. Left eye matching left picture projector; right eye, right projector.



By having each eye see only its corresponding image, the brain receives two slightly different perspectives of the same scene, and as it does in real life, fuses these two different images into one 3-Dimensional image. Everyone has always assumed that rear projection with light passing through a light diffusing screen would sufficiently destroy the polarity of the light to allow each eye to see both images thus destroying the psychophysical requirement for the brain's creation of depth. Practical experimentation has proved this not to be the case. If right and left eyes pictures are projected through polarizing filters and viewed through matching polaroid glasses, an excellent 3-Dimensional illusion is created. The illusion works from any angle and almost any distance from the screen. It becomes strained and falls apart, however, very close to the screen, i.e., under 18 inches. It works best when photographs with good structural planes are taken. i.e., leaves in the foreground, children in the middle plane and mountains in the background, and when the children use a long light-weight aluminum pointer to probe into the depths of things rather than useing their hands.

3-D is very meaningful for training depth perception and for lessons in sculpture, mechanics, etc., which depth is important.

Anyone can construct a 3-Dimensional still photo camera by mounting two identical cameras on a common wood base so that the center of the lenses are 2 1/2 inches apart and pointing straight ahead. Since 35mm cameras are too broad to permit this spacing (side by side their lenses are 6 inches apart) it can be achieved by placing one camera just ahead of the other (52). The slight difference of range from the subject makes no difference in the final result. Once the cameras are set- lenses, shutter speeds and F stops must be identical. Most important, both cameras must be fired at the same time, either manually or through a cable release (53).



This, then, is a description of the Learning Wall Room, the Learning Wall and the Learning Wall Programming techniques. Together they form a system which combines into one facility the attributes of a projection screen, a flannel board, a blackboard, an art easel and a mirror, often extending the potential and sensory excitement of each.

A Learning Wall can be installed in any classroom. All of its programs (except suction cup) would work on smaller more economical models, i.e., 4 x 5 1/2 foot flexible screen stretched across a wooden frame with uncovered projectors located directly behind the screen. This version would cost as little as $467 (Screen $88, AVID Learner $210 and Dukane Projector $169)

However, to obtain the fullest benefit from the Learning Wall and the concept of interactive programming, we recommend that schools set aside a small room, (or if the school is still in the planning stages design a small room adjacent to the classroom) as a special Learning Wall Room, similar to the one we have at the Dubnoff School. The idea of having a room set aside in the school for a special function is not a new one. Schools have gymnasiums, auditoriums, art rooms, science rooms, wood working shops, etc. and since audio -visual techniques are becoming increasingly important in education it seems only logical to have a specialized facility for them so they can reach their fullest potential. The expense of a special media room is very small when amortized over the number of students who will use it in a year and the number of years the school will be in use.

Though a bit skeptical at first, the teachers at the Dubnoff School have become very positive about using the Learning Wall Room. Even if they could duplicate all of its effects (which they could not) in their own classrooms, it saves them the time and fatigue of setting up equipment, pulling shades, raising screens, plugging in wires, arranging chairs and then putting everything away afterwards.

In sum, audio -visual media are here to stay. When used interactively on the Learning Wall they are a potent extension of the teachers art. As such, they deserve a home of their own.



For further information about constructing a Learning Wall Room, or obtaining a commercially available portable Learning Wall and sound filmstrip programs contact:

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