VISUAL COMMUNICATION EXHIBITION SYSTEM

By

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Thesis Committee

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INTRODUCTION

The purpose of this thesis is to research, design and fabricate a graphically oriented three-dimensional exhibition system. Final design would allow the system to be mass produced, keeping functional and aesthetical qualities in mind. The design would provide for storage, site adaptation, fabrication economics, maintenance and storage of this system.

Through the exploration of structural materials, production processes, fabrication techniques, graphic imagery and form, this system will provide for the exhibition of two-dimensional and three-dimensional graphic and communication representation.

The completed thesis will consist of a full scale finished three-dimensional exhibit system prototype with graphic representation.
TERMINOLOGY

Since I am involved with the research, design and fabrication of a visual communications exhibition system, that will be modular in design concept, I feel these terms should be defined.

System
A system is an arrangement of parts so related or connected as to form a unity.

Module
A modular system has a standard or unit of measure.

Visual Communication
Visual communication is a means of communicating information such as messages, texts and visual graphic images through the sense of sight.
RESEARCH

Historical

Throughout history, visual devices have been employed to help man communicate with himself and his fellow man.

For prehistoric trodolyte man, the natural or man-made cave dwellings provided surfaces for visual materials to be presented and permanently recorded.

Indeed, throughout time, man's fascination with and ingenuity of exhibiting his art and visual communications has been restricted by his own lack of technological advancements. Ironically, civilized man has developed different means of presenting his visual images. Because of an impersonal mobile society, permanent communications structures are becoming less feasible and practical, due to our changing environments.

Contemporary man now has the responsibility of exploring and creating new and ingenious ways of presenting visual communication images.

In spite of historical and contemporary knowledge, modern man has been woefully blind to the real potential of providing structures for graphically oriented exhibition systems. Such structures should provide for temporary visual communications exhibitions; and be functional in concept as well as be aesthetically pleasing in form.
Correspondence

My correspondence provided me with a wide variety of information regarding structures that could be adapted to exhibition systems.

I was provided with informational brochures, regarding existing exhibition systems for temporary and permanent use, such as the Abstracta System, Design 8 System, System 70, and the Rapid Frame System. I found these to be intriguing from a structural point of view, but for the most part, these systems provided only for the exhibition of three-dimensional objects, and not for two-dimensional visual communications, in which I was primarily interested.
DESIGN PARAMETERS

Structure

The structure of a graphic oriented exhibition system should be simple in concept and fabrication. Simplicity of design, a minimum number of components and manifold possibilities of application and arrangement are all advantages of such a visual communications exhibition system.

The flexibility of the connecting members in a single system enables a multitude of plan designs and spatial sub-divisions to be adopted, which create ever-new optical images.

Site Adaptation

The exhibition system is to be initially displayed in the Bevier Gallery located at the Rochester Institute of Technology, Rochester, New York.

This system will be adaptable to other exhibition sites, making use of the available space and lighting, and will provide for a flexibility of modular visual communications arrangements for each site situation.
Mass Production

An exhibition system should be designed with the capability of being mass produced in today's technology. In the final production of any exhibition system, being innovative in concept, cost and production techniques is very important. It has been established that the final structure could be mass produced for a cost not to exceed $100.00 per modular unit. This cost does not include the final graphic or visual images, but would be the cost of the modular structures.

By mass producing an exhibition system, or certain parts of that system, tremendous cost reductions can be achieved. Simplicity of parts, and a minimum number of components would allow a mass produced system to be economically manufactured. The system should have a standardization of parts, thus allowing for a reduction in total fabrication dies and tooling costs, making the final product more economical to manufacture. This would offer a lower cost per structural unit to the buyer. In essence, the total volume of the mass produced units could be high, while the cost per unit would be kept at a minimum.
Panel Sizes

The visual graphic and text panels of the system should be fabricated to a standardized size. The standardization of panel sizes would allow for the enlargement or reduction of artwork formats to be used.

This standardization is important in providing original and finished artwork to be used for photo-silkscreening, photostat enlargements, super-graphics, and text panels. These visual communication images can then be incorporated within the structural framework.

The system should be fabricated to accommodate standardized panel surfaces.

The accompanying illustrations demonstrate the cones of human vision and viewing angles, and also show the plan of visual field and degrees of neck rotation.

Lighting

Because the exhibition system is to be used primarily where there is adequate natural and incandescent lighting, it was determined that there be no special illumination of the system.

Using a flexible metal arm, lighting needs could be adapted wherever necessary. Because of the system's variety-of arrangements,
there will always be access to lighting the visual and text areas of the exhibit.

Maintenance

I found that whatever form the design would take, minimum maintenance and care is essential for any successful exhibition system. This is necessary because most of the time, the system will be assembled and disassembled by a lay person.

With simplicity of design, and with the least number of components to the system, the maintenance could be kept minimal, ranging from one-eighth inch to five-eighths inch in thickness. Commonly-used exhibition and display panel materials such as plexiglas, plywood, homosote, styrene, masonite and foamcore may be obtained in standardized sizes and thicknesses.

Assembly and Disassembly

Being modular in design concept, the exhibition system should be designed for quick, practical and versatile assembly and disassembly, possibly without the use of tools.

Considering the majority of assembly and disassembly will probably be done by a lay person, simplicity of structure, arrangement and installation would be of great benefit. The system, being
practical in concept, should allow for the assembly and disassembly by one individual if the occasion arises.

Storage

When dealing with a temporary exhibition system, the storage of that system is of vital concern to the user. A properly designed system allows for storage for any duration time. When in storage, that system should occupy a minimum amount of space. It should also provide for storage of a partial or complete modular unit. Thus, it would be practical to design a system that when disassembled, would allow for the complete storage of that system until further usage becomes necessary.

Shipping

In designing an exhibition system that would be used in a variety of site locations, the shipping of that system becomes a major factor in the final concept of the structure.

It would be advantageous to the system if no special packaging and shipping container was required. Perhaps, the components of the exhibition system could be stacked, thus eliminating secondary shipping cartons and keeping costs at a minimum.
HUMAN FACTORS

In the design of a graphic exhibit system dealing with visual communications at a human scale, there must be a concern for the viewer in relation to the visual panels, text or any visual materials within such a system.

The eye level or vertical distance from the floor to the inner corner of the eye, with the subject standing erect, looking straight ahead, should be 64.7 inches for the "average" or (50th percentile) man. A range from 60.8 inches (5th percentile) to 68.6 inches (95th percentile) will accommodate the middle 90 per cent. A range from 59.2 inches (1st percentile) to 70.3 inches (99th percentile) will accommodate the middle 98 per cent. For women, a subtraction of 4.5 inches from the male figures would give the required percentiles.

If the head is not restricted the field of vision is large because slight movements of the head can appreciably widen the field of view. Apart from head movements and various limits of vision, the eyes themselves are capable of movement. The rotation of the eyes adds to our ability to scan objects and the subtleties of their reflective surfaces.
Diagram to illustrate lines of sight and elevation of visual field.

"S is the standard line of sight and is 5 degrees below the horizontal.

N1 is the normal line of sight when standing with the gaze undirected. 15 degrees below horizontal.

N2 shows a further drop of the line of sight when sitting with the gaze undirected. 20 degrees below the horizontal.

We are a glancing-down animal by the construction of our eyes, which point below the horizontal. So that any horizontal scanning or looking up requires flexion of the neck and the use of muscles. VC is the visual cone 15 degrees each side of the standard line of sight.

Limit. Marks an area 50 degrees above the horizontal and 70 degrees below which can be viewed by eye movement alone."
"45 degrees is the degree of natural head movement.

60 degrees is the degree of head movement achieved by conscious force.

VC visual cone, 15 degrees each side of medial plane, is the area of vision which can be scanned by normal eye movement.

Limit marks an area 30 degrees each side of the medial plane, which can still be scanned by eye movement alone.

The maximum viewing angle can therefore be something like a sweep of 180 degrees when eye and head movement are used together. That is 60 degrees and 30 degrees either side of the medial plane.

+90 indicates an 'out of the corner of the eye vision,' achieved by eye movement alone."
DESIGN CONCEPTS

Concept

In all phases of my design concept work, I strived for a simple, creative and innovative approach to the design of a visual communications exhibit system. In my concepts, I was aware of the inner spaces, the positive and negative spaces and their relationship to the entire structure.

Although I was concerned about the aesthetic form of the structure, the function of the system as a whole was of primary importance. I was concerned with providing solutions within the design parameters that had been established. Finally, in my exploration for a final visual communications exhibition system, I felt that the designs should be a total systems design approach and not as an entity in itself.

Design

My initial design concepts explored a wide variety of exhibition structures, materials, forms and graphic presentations, utilizing my research and the physical parameters.

I also investigated structural materials of various shapes and thicknesses, including several soft and hard woods, metal sheeting, metal tubing, extruded metal shapes, acrylic plastic sheeting and stretch fabrics.
My main objective was to provide a temporary exhibit design that would allow structural flexibility, yet be modular in concept.

Based on my experience as an industrial designer, I arrived at several design concepts that I thought met the basic requirements of my research and design parameters. Upon meeting with my thesis committee for my initial design review, it was suggested that I continue my conceptual designs. I then found that many innovative forms and structures could be provided through the use of metal tubing of various lengths and thicknesses. I also found that with the use of metal tubing, different modular arrangements could be achieved. As I explored the potential of metal tubing even further, I discovered that tubing of certain lengths and wall thicknesses could be bent with the use of metal tube bending "jigs." This experimentation resulted in many intriguing forms that could be applied to my search for the design of a graphic oriented exhibition system.

At this time, I again met with my graduate committee and presented several design concepts using formed metal tubing. Final approval was made to go ahead with an exhibition system, using formed metal tubing as primary structural supports.

A support fastener to hold graphic and visual panels within the structure was needed. In order to make the system more flexible, I developed a support fastener that could be installed without the use of tools, yet allows for a variety of panel thicknesses to be used within the system. Upon approval of the fastener concept, I went directly ahead with the final production of a full-scale, three-dimensional graphic exhibition structure.
PROTOTYPE FABRICATION

Materials

It was determined that two modular units of the exhibition prototype structure would be fabricated. These two units would be sufficient in providing the necessary flexibility and arrangements, and also provide for adequate panel areas for visual graphics and text.

In order to fabricate a full-scale three-dimensional prototype of a visual exhibition system, the following materials and tools were purchased for the fabrication.

Eight (8) pieces of aluminum metal (Type AD) tubing, five-eighths inch in diameter and seven feet in length.

Eight (8) pieces of aluminum metal (Type AD) tubing, five-eighths inch in diameter and four feet in length.

Sixteen (16) pieces of aluminum metal (Type AD) tubing, five-eighths inch in diameter and fourteen inches in length.

One (1) piece of aluminum solid bar (Type AD) stock, one-half inch in diameter and twenty inches in length.

One (1) piece of aluminum solid bar (Type AD) stock, 1 inch square and forty inches in length.

One (1) piece of aluminum solid bar (Type AD) stock, 1 inch in diameter and twenty inches in length.
Eighteen (18) steel set screws, one-quarter inch in diameter and three-sixteenths inch in length.

One (1) metal drill, one-quarter inch in diameter.

One (1) metal thread tap, one-quarter inch in diameter.

Five (5) pieces of styrene plastic, one-eighth inch in thickness, thirty inches in width and forty inches in length.

Structure Fabrication

Once the required materials and tools that I needed were purchased, I was ready to begin the full-scale prototype fabrication.

My initial step was to simulate the appearance and finish of the system's components as though the parts had been mass produced in a manufacturing facility. I chose to use the metal shop facilities of the Industrial Design Department, Rochester Institute of Technology, because of the access to the metal fabrication machinery that would be needed.

I started the prototype on a power bandsaw by cutting eight pieces of aluminum tubing, five-eighths inch in diameter to a length of seven feet. I next cut on the power bandsaw the eight pieces of aluminum tubing, five-eighths inch in diameter to a length of two feet. Once these sixteen pieces of aluminum tubing were cut to size,
I then used a vertical mill to provide a finished cut on opposite ends of the tubes. The power bandsaw did not provide this even cut. I then cut the sixteen pieces of aluminum tubing to equal lengths of fourteen inches.

I was now ready to form the corner elbow pieces of the structure. Prior to this, I had constructed a wooden jig with a two inch inside diameter. The jig consisted of two pieces of wood; a male and female curve with a five-eighths groove routed through the center. By placing a fourteen inch piece of aluminum tubing into the wooden jig, and applying even pressure, a ninety degree corner bend could be formed. I repeated this process sixteen times. After all sixteen corner pieces were formed, I then cut off the excess aluminum tubing from the ends that I did not need. To do this, I used the vertical mill, and cut the sixteen pieces to lengths of six inches.

My next step was to provide aluminum connector plugs for the sixteen formed aluminum corner elbow pieces. To do this, I used an aluminum rod, one-half inch in diameter. I cut the aluminum rod into sixteen one-inch pieces. The one-inch pieces were then epoxy glued into the ends of the sixteen formed elbow pieces. These plugs would now be force fitted into the ends of the formed elbow pieces. These would be used to connect the vertical and horizontal aluminum tube members. This completed the forming and fabrication of the aluminum tubing pieces. The finished pieces were then anodized natural gray in color.
The next step was to fabricate the panel fastenings for the exhibition structure. Using the solid aluminum bar stock, one inch square, I then cut eighteen pieces two inches in length, using the power bandsaw. I again used the vertical mill to provide finishing cuts on the ends of the pieces. After this was finished, I milled a slot one inch by five-eighths inch into each of the eighteen pieces on one end of each piece. Using one half inch centers, I then drilled and tapped a single one-quarter inch threaded hole. This procedure for drilling and tapping of a one-quarter inch hole was repeated on either side of the fastener. After that, final sanding with wet and dry finishing paper was needed for the removal of burrs and scratches. The fasteners were anodized matte black in color. I then manually sanded the two opposite sides, which left them a natural aluminum color. This was a design detail to accent the fastener itself.

My final step was to fabricate thumbwheels used for the support of visual panel materials, ranging from one-eighth inch to five-eighths in thickness. To accomplish this, I used a metal lathe to fabricate eighteen thumbwheels one inch in diameter. After this was completed, I then put a one-sixteenth inch chamfer on the two outside edges of the thumbwheels. After completion, a fine satin buffing on each thumbwheel was added. The thumbwheels were left a natural aluminum color. This completed the fabrication of the aluminum support fasteners.
Panel Materials

I chose styrene plastic sheets for the panel material on which the text, logotype and directional arrows were silkscreened. The five styrene panels were previously cut to an identical size of one-eighth inch in thickness by thirty inches in width by forty inches in length. These dimensions were used because of the standardization in panel sizes that I wanted to maintain within the system.

Although the panels come in a variety of colors, I chose four opaque white panels, and one opaque black panel. The combination of black and white panels, along with the black, white, gray and red silkscreening inks, gave a bold and simplified visual communication exhibition system.

The styrene panels are light in weight and very flexible, both in the fabrication and final assemblage. The matte finish of the panels provided a very smooth and attractive surface for the silkscreening of the visual graphics. Also, when used either in a horizontal or vertical position, the styrene panels gave no offensive light glare or reflections within the system.
Visual Graphics

I chose to use silkscreening for my method of applying the visual communications to the panels because of the simplicity of application that this process gives. It also allows for a professional presentation of the visual graphics, and the opportunity to use vivid, opaque color for visual impact.

For the final visual text, I chose Avant Garde medium type in twenty-two pica size. After setting the text type photographically, I enlarged by positive photostats the text to a length of twenty-four inches. I then made the positive films to be used for the final photo silkscreening of the text. Next, I completed the silkscreening of the text on the panels. Sherwin Williams black enamel silkscreen ink was used for the text application.

The word "GRAPHICA" is used as a logotype for the final exhibition structure. Avant Garde medium type was also used for the logotype. The same silkscreen procedure was used for the preparation and application of the logotype to the panels. Sherwin Williams black, white and grey silkscreening enamels were used for the logo application.

The directional arrows were designed to be used as a graphic communication device to visually attract and interest a person. The arrows serve the purpose of providing a visual balance for the text on the panels. The directional arrows also maintain the curved character of the structure. Following the necessary steps, the arrows were applied to the panels through the use of photo silkscreening. Sherwin Williams red enamel silkscreening ink was used in the application.
Cost

The total cost of the prototype exhibition system amounted to two hundred and forty-five dollars ($245.00). This total included the cost of materials, the cost of camera artwork for silkscreening, the cost of anodizing the aluminum structure members and the support fasteners, and assorted minor supplies.

<table>
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<th>Item</th>
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<tr>
<td>Aluminum tubing and bar stock</td>
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<tr>
<td>Photo art work for silkscreening</td>
<td>55.00</td>
</tr>
<tr>
<td>Aluminum anodizing of structure parts</td>
<td>50.00</td>
</tr>
<tr>
<td>Drill and tap</td>
<td>3.50</td>
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<tr>
<td>Styrene plastic panels</td>
<td>55.00</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>6.50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$245.00</strong></td>
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</tbody>
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If the system were mass produced, then undoubtedly the cost per system could be substantially reduced.
MODULE
A standard or unit of measurement. The length of a given part, used to determine the proportions of a structure

SYSTEM
A set or arrangement of things or parts so related or connected as to form a unity or organic whole
The completed prototype was assembled and presented for review as two connecting modular units. Because the prototype system is flexible in design and structure, other arrangements and structures for visual communications exhibition may be achieved. This may be accomplished by the rotation of the elbows in combination with predetermined modular lengths of aluminum tubing.

Because the panel fastener is adjustable, a variety of panel materials and thickness may be supported either horizontally or vertically. By placing the panel fastener on a horizontal axis, shelving and seating arrangements are also possible.
CONCLUSION

After the complete assembly of the prototype exhibition structure, I found the components to be as flexible and functional as I had anticipated. The assembled system provided for the connection of two modular units, eight feet in height and thirty-two inches in width. Although I assembled the system myself, I recommend that two people would facilitate the assembly and disassembly of the exhibition system.

The experience that I have gained through the research and design of this visual communication exhibition system is invaluable to me, both educationally and professionally. Although I have just worked in a small area of exhibition design, I feel that I have pursued that which I did with success.

2. Croney, p. 156.


