Problem 2

In the preceding problem we mentioned the elementary units which pattern the visual field. Now we will investigate the nature of the visual field, the patterning of the elements of this field, and the visual attributes of these elements. In addition we will consider a general model of communication and the requirements of freehand lettering as a means of communication.

Let us start by establishing the difference between the visual world and the visual field. For this we refer to James Gibson, who suggests:

James J. Gibson, *The Perception of the Visual World* (Boston: Houghton Mifflin, 1950)

"Try making this observation for yourself. First look around the room and note that you see a perfectly stable scene of floor and walls, with an array of familiar objects at definite locations and distances. Every part of it is fixed relative to every other part. If you look out the window, there beyond is an extended environment of ground and buildings or, if you are lucky, 'scenery.' This is what we shall call the *visual world*. It is the familiar, ordinary scene of daily life, in which solid objects look solid, square objects look square, horizontal surfaces look horizontal, and the book across the room looks as big as the book lying in front of you. This is the kind of experience we are trying to account for.

"Next look at the room not as a room but, insofar as you can, as if it consisted of areas or patches of colored surface, divided up by contours. To do so, you must fixate your eyes on some prominent point and then pay attention not to that point, as is natural, but to the whole range of what you can see, keeping your eyes still fixed. The attitude you should take is that of the perspective draftsman. It may help if you close one eye. If you persist, the scene comes to approximate the appearance of a picture. You may observe that it has characteristics somewhat different from the former scene. This is what will here be called the *visual field*. It is less familiar than the visual world and it cannot be observed except with some kind of special effort. The fact that it differs from the familiar visual world is the source of a great deal of confusion and misunderstanding about vision. It is the experience on which the doctrine of visual *sensations* is based. It is strictly an introspective or analytic

"Everything that you can see in the world around you, presents itself to your eyes only as an arrangement of patches of different colours variously shaded. Some of these patches of colour have an appearance of lines or texture within them, as a piece of cloth or silk has of threads, or an animal's skin shows texture of hairs: but whether this be the case or not, the first broad aspect of the thing is that of a patch of some definite colour . . .

"The perception of solid form is entirely a matter of experience. We *see* nothing but flat colours; and it is only by a series of experiments that we find out that a stain of black or grey indicates the dark side of a solid substance, or that a faint hue indicates that the object in which it appears is far away. The whole technical power of painting depends on our recovery of what may be called the *innocence of the eye*; that is to say, of a sort of childish perception of these flat stains of colour, merely as such, without consciousness of what they signify—as a blind man would see them if suddenly gifted with sight. . . ."—John Ruskin, *The Elements of Drawing* (London: Smith, Elder, 1857)

Basic Pattern Areas

phenomenon. One gets it only by trying to see the visual world in perspective and to see its colors as a painter does.

"Both the visual world and the visual field are products of the familiar but still mysterious process known as seeing. Both depend upon light stimulation and upon a properly functioning eye. But the differences between them are so great as to suggest two kinds of seeing. Let us try to list and describe these differences. Most of them can readily be observed without special apparatus, and the reader should therefore check them for himself as we go along.

The Bounded Visual Field

"In the first place, the visual field has boundaries, whereas the visual world has none. If you keep your eyes fixed but put your attention on the periphery of the field (a trick that may require practice) you can observe that things are visible only to a limited angle out to the right and left and to an even more limited angle upwards and downwards. These boundaries, it is true, are not sharp like the margins of a picture and they are hard to notice, since all vision is unclear in such eccentric regions, but they are nevertheless present. The field is roughly oval in shape. When measured, it extends about 180 degrees laterally and 150 degrees up and down. If you close one eye you will notice that about a third of the field on that side disappears and also that the boundary is now the outline of your nose. Many an otherwise observant individual does not realize that his nose is represented in his visual field. Even if shadowy, however, it has always been there and its discovery only illustrates the unfamiliarity of this kind of seeing as compared with the familiar reality of ordinary perception.

"What Ernst Mach, analyzing his sensations, called the phenomenal ego is illustrated in [the adjacent figure]. It is a literal representation of his visual field, with his right eye closed, as he reclined in a nineteenth century chaise longue. His nose delimits the field on the right and his moustache appears below. His body and the room are drawn in detail, although he could not see them in detail without moving his eye. The margins of the field are shown as definite and clear whereas of course their actual appearance was very vague. The point of fixation cannot be shown in the drawing; actually it is the center of the field and this should be the only part shown as wholly clear.

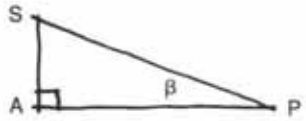
"The visual world, on the other hand, is certainly not delimited by an oval-shaped boundary. Floors, walls, and terrain are visibly continuous. As Koffka has pointed out . . ., one is ordinarily aware of a world which extends backward behind the head as well as forward in front of the eyes. The world, in other words, surrounds us for the full 360°, in contrast to the visual field which is confined to about 180°. Whether the world which includes this space behind us is a strictly visual world or not is a question of definition rather than a matter of ordinary observation. It cannot be answered by inspection for the reason that in the effort to examine the experienced world one finds oneself inspecting the visual field instead. The visual world, as we shall discover, will not bear up under much introspection and analysis without changing its character. It is at least clear that the visual world does not have boundaries. It has a panoramic character which the field does not possess."

The binocular bounded visual field may be represented in the circular format of a so-called "fish-eye" photograph, or hemispherical projection, in which the intersection of the horizontal and vertical axes at the center denotes the observer's point of fixation, and the intersection of these axes with the circumference denote points 90° off the visual axis or observer's line of sight. Here the *zenith* is that point directly above the observer; the *nadir* is that point directly below him or her; and the left and right points are those to his or her extreme left and right side respectively. Distances from the center of the circle on any radius denote the angle of any point in the visual field from the observer's fixated line of sight and vary from 0° at the center to 90° at the circumference.

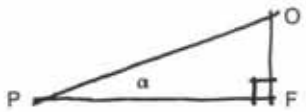
To Construct an (Equidistant) Hemispherical Projection

Given point P, a stationary point at eye level; line PF, the horizontal line of sight; and point 0, any point in the forward field of view;
to find 0', the hemispherical projection of point O, in a circle of any convenient radius H; with horizontal axis L'R', vertical axis Z'N', and center P':

1. Establish plane PSOF through point O and line PF. This intersects vertical plane LR-ZN in line PS.
2. Find β, angle APS in right triangle PAS, using true lengths of AP and AS.

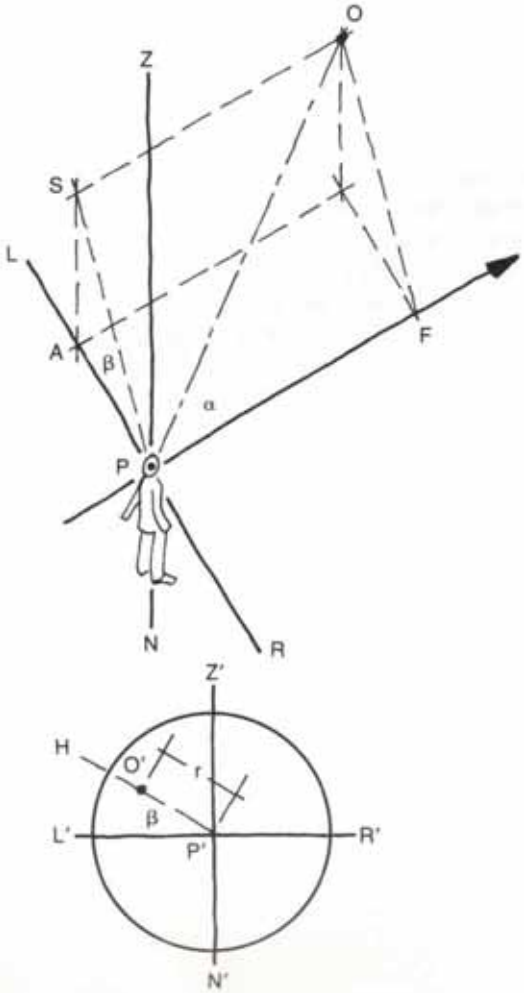


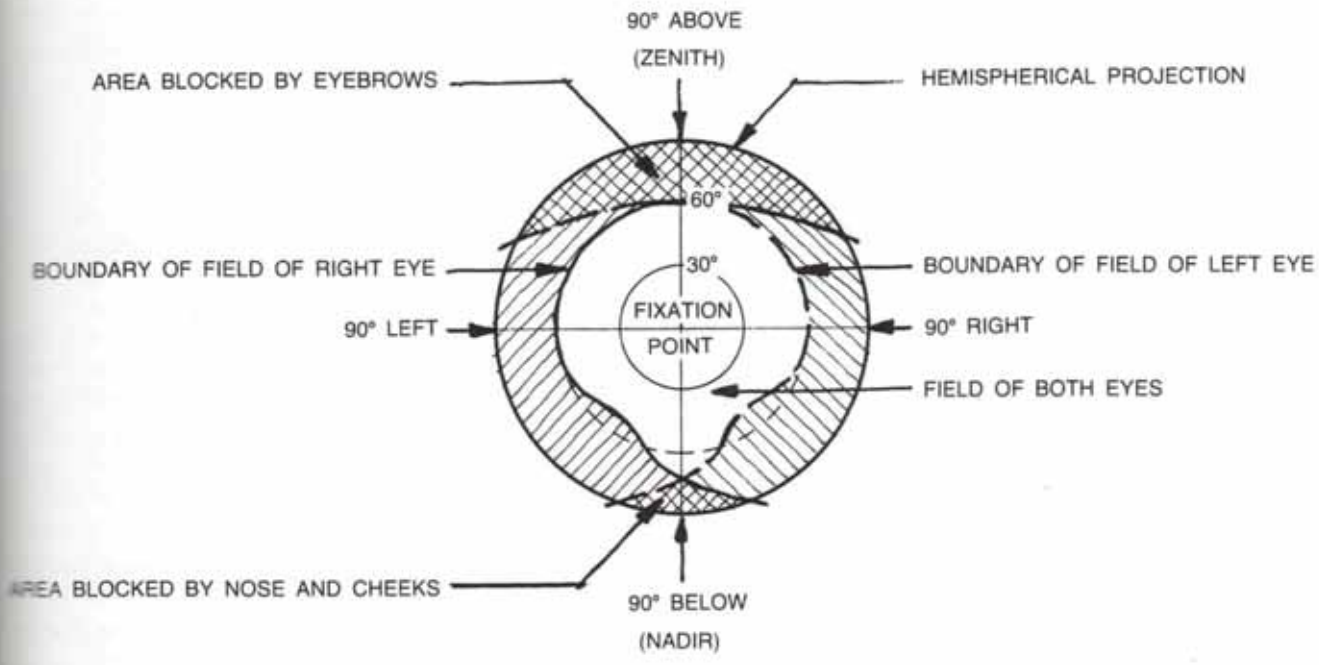
3. Find α, angle FPO in right triangle PFO, lying in plane PSOF; using true lengths of PF and FO. Note that FO = PS.



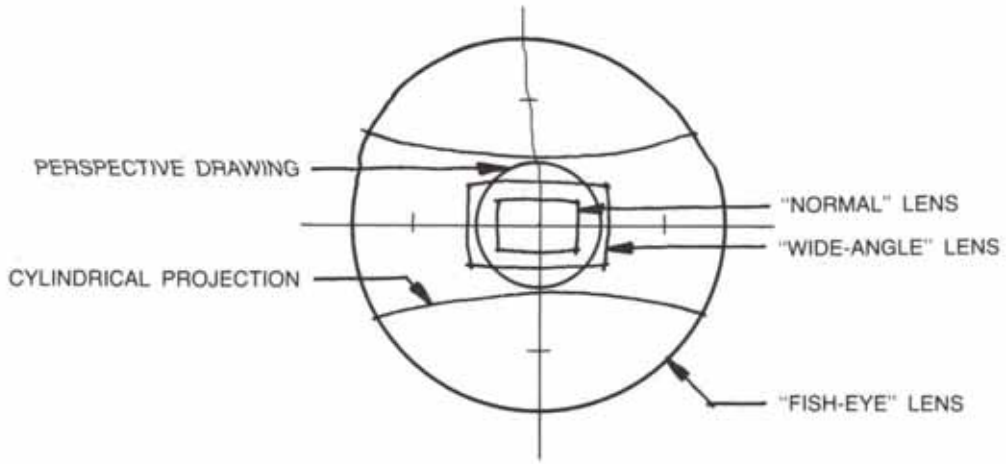
4. Draw radius H from center P' at angle β.
5. Lay out distance r from P' on H, where r = (α/90) H. This locates 0'.

Note that when α = 90°, r = H, and that when α = 0°, r = 0. Note also that lines and edges parallel to PF will lie along a radius in the hemispherical projection.





Using this representational format we can now graphically compare the visual fields of a "normal," wide-angle, and fish-eye camera lens, as well as a conventional perspective drawing and a cylindrical projection.



For more information on these several systems, see Fred Eichenberger, *Wide Angle Perspective Systems* (Raleigh, N.C.: School of Design, North Carolina State University, 1970), and Shin-Ichi Murakami, "A Study of Fish-Eye Projection," *Journal of Graphic Science of Japan*, no. 9, 1971.

Having discussed the extent of the bounded visual field we may now consider a second characteristic—the gradient of clarity in that field. Referring again to Gibson:

"A second characteristic of the visual field is that it is sharp, clear and fully detailed at the center, but progressively vaguer and less detailed toward its boundaries. For instance, the contours and patterns of the array of surfaces in your field can be observed to become gradually less determinate as you attend to those out toward the periphery. So difficult are the latter to see that the impulse to turn the eyes and fixate them may seem almost irresistible.* If you move your eyes down this page of print, for example, and fixate at random one letter of a single word, you will probably find that you can perceive that word and the words adjacent to it on the right and left and above and below, but no more. The visual field, therefore, possesses a central-to-peripheral gradient of clarity. The visual world does not. It does not even have a center, which agrees with the fact that it does not have boundaries. The world is ordinarily perceived by *scanning*, that is, by moving the eyes rapidly from point to point, and the objects and surfaces which compose it are always clear and fully detailed. If the objection be advanced that they are in fact only clear and detailed *when fixated*, the answer is that the objector gets this fact from an inspection of his visual field, not his visual world."

*"The center of clear perception corresponds, of course, to the fovea of the eye—that area of the retina best equipped anatomically for discrimination of fine detail and on which is projected an image of the object toward which the eye is pointed."

To summarize:

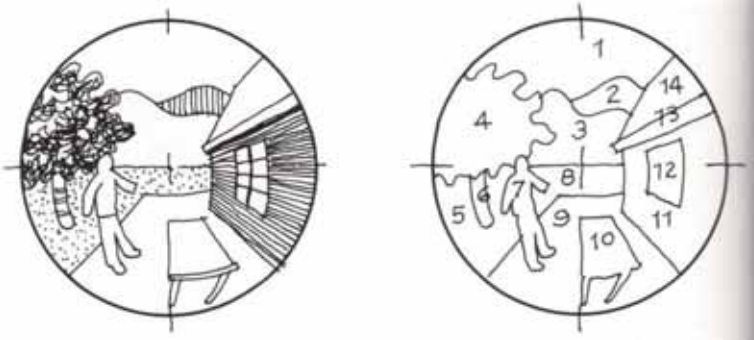
the **visual world** is unbounded and uniformly clear;

the **visual field** is bounded (extending approximately 180° horizontally, and 150° vertically), and has a center-to-periphery gradient of clarity;

the **hemispherical projection** (or fish-eye photograph) as an approximate representation of the visual field, includes a slightly larger vertical subtense (180°) and a uniformly clear field.

Let us now turn our attention to the "areas of patches of colored surface, divided up by contours" which Gibson describes as the sensory content of the visual field. We can diagram these areas in a hemispherical projection with each different portion indicating the projection of a different environmental surface, such as vegetation, floor, wall, table top, book, sky, etc., or whatever is in the visual field. The visual field consists of a number (N) of these areas or elements, and we can now give them the name of *"basic pattern areas,"* or BPAs.

Note that if there were *no* patterning of the visual field (N = 1), it would be completely uniform with "nothing" to be seen. This condition of a completely homogeneous visual field is called the *ganzfeld*. Can you think of some real-life examples?



Environmental surfaces as represented in a fish-eye photograph, and the major BPAs of this environmental scene as diagrammed in a hemispherical projection.

In what way are these basic pattern areas different?

As presented in a two-dimensional hemispherical projection, they can be described as having different shapes and sizes, as being in different positions, as having different colors and textures, as being vertical or horizontal, and as being glossy or matte. Thus we identify the primary *static* visual attributes of the basic pattern areas in the two-dimensional context of a bounded visual field in terms of:

In the four-dimensional visual *world* we must also consider duration, motion, and brightness. For a further discussion of these "attributes of the modes of appearance" see Ralph M. Evans, *An Introduction to Color* (New York: Wiley, 1948).

Number (of BPAs), both cardinal (depending on the "degree of patterning": 1, 20, 250, . . .) and ordinal (1st, 16th, 39th, . . .)

Position in the field; for example, upper left, far right, . . .

Size relative to the field; for example, large, small, . . .

Shape as determined by the contours; for example, round, oblong, square, . . .

Direction relative to the field; for example, vertical, diagonal, . . .

Texture as a visual surface pattern; for example, striped, dotted, smooth, . . .

Surface quality; for example, specular, glossy, matte, lustrous, iridescent, . . .

Color as a property of the surface; for example, red, light blue, dark green, . . .

The following problem will now provide you with an opportunity to clarify for yourself the concept of basic pattern areas and of their attributes as characteristic of the visual field, and challenge you with an opportunity to clearly communicate your understanding of these issues in a graphic presentation.

Materials

15" x 20" white illustration board

Rubber cement

Drafting gear, pencils, pens

Architect's sketch paper

Several examples of color illustrations or advertisements about 8" x 10", cut from magazines, with ten to twenty basic pattern areas varied in all attributes.

Procedure

Turn your magazine clipping sideways or upside down, so you will tend to see it as a two-dimensional visual pattern rather than as an illustration of some three-dimensional scene or object. Identify all the basic pattern areas (BPAs) by carefully and completely outlining their contours on an overlaid piece of tracing paper. Number each BPA consecutively, with a different number for each BPA.

Next, prepare an inventory of all the static visual attributes of each of these BPAs. Remember: what you are dealing with now are only the different patches that pattern the surface of the piece of paper in front of you—nothing more than that. Your problem at this point is to describe as clearly as you can the attributes (number, size, position, shape, direction, color, texture, and surface finish) of each of these patches in the context of that piece of paper.

If you divide the diagonal of your clipping overlay into ten equal parts (how?) and draw a horizontal/vertical grid through all these points, the area of your clipping will thus be divided into one hundred equal parts. Each of these "cells" of this grid will then be 1 percent of the total area, and it will be very easy to estimate the relative size of each BPA using this grid.

To minimize the merely clerical work in this problem, it is recommended

"There lived in England in the Fourteenth Century a monk named Occam, to whose philosophical mind occurred one of those bright ideas which make history: he formulated for the first time the basic principle that truth is not complicated beyond necessity; in other words, that no solution to a problem can be right if a simpler and more direct solution can be found. This principle has been known, for obvious reasons, as 'Occam's razor' and by it centuries of scientific investigation have been shorn of avoidable complexities. The art of design also requires an Occam's razor, ruthlessly wielded. . . ."—Walter Dorwin Teague, *Design This Day* (New York: Harcourt, Brace and Company, 1940)

that you select a clipping with a maximum of about twenty BPAs. This will be easier if you have available a number of illustrations to consider as alternatives. You should neglect any BPA of less than 0.5 percent of the total area, and should aggregate *adjacent* areas of nearly similar color. Where two adjacent BPAs blend together without a clear ("hard-edge") boundary, you will have to arbitrarily establish a bounding contour.

Present the original clipping, the BPA identification, and your descriptive attribute-inventory in a simple, two-dimensional layout on the illustration board, in horizontal or vertical format. In designing this presentation your objective is to achieve a clear, orderly, logical, and comprehensive arrangement, for the most effective communication of the concept to a naive viewer, unaware of BPAs.

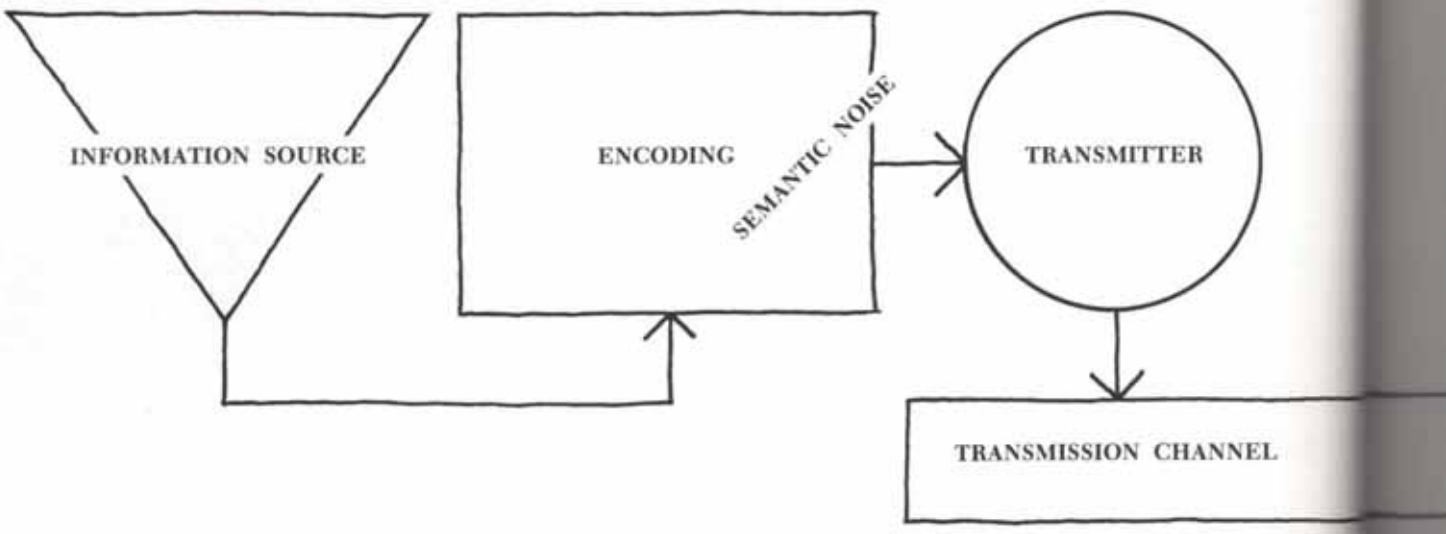
You may want to take advantage of the convention in our culture of reading from left to right and from top downwards. Also bear in mind that any graphic element that is not absolutely necessary will needlessly complicate the presentation and act as "noise" in the system. The simpler, less complicated alternative is usually to be preferred. A good rule is "When in doubt, leave it out." In addition, remember that personal graphic mannerisms communicate only information which is irrelevant to the present purpose.

Here is a diagram of the general communication model adapted from Geoffrey Broadbent, *Design in Architecture* (New York: Wiley, 1973), based on C. E. Shannon and W. Weaver, *The Mathematical Theory of Communication* (Urbana: University of Illinois Press, 1949).

"The information source (e.g. a human brain) wishes to pass a message to the information destination (e.g. another human brain) so as to modify the latter's behaviour.

"This information consists of ideas, thoughts, concepts (*signifieds*) about people, objects or things (*referents*), which have to be *codified* into words, images, symbols (*signifiers*) selected from those available in the *language*. Sometimes no precise signifier exists, i.e. one which denotes the referent directly; the message has to be codified in terms of analogies, metaphors etc. selected by the information source for their connotations. This may introduce distortions (*semantic noise*) into the coding process.

"The encoded message is then *transmitted* by some appropriate medium—speech, writing, drawing etc. according to the nature of the communications channel. The transmitter converts the message into a *signal*.

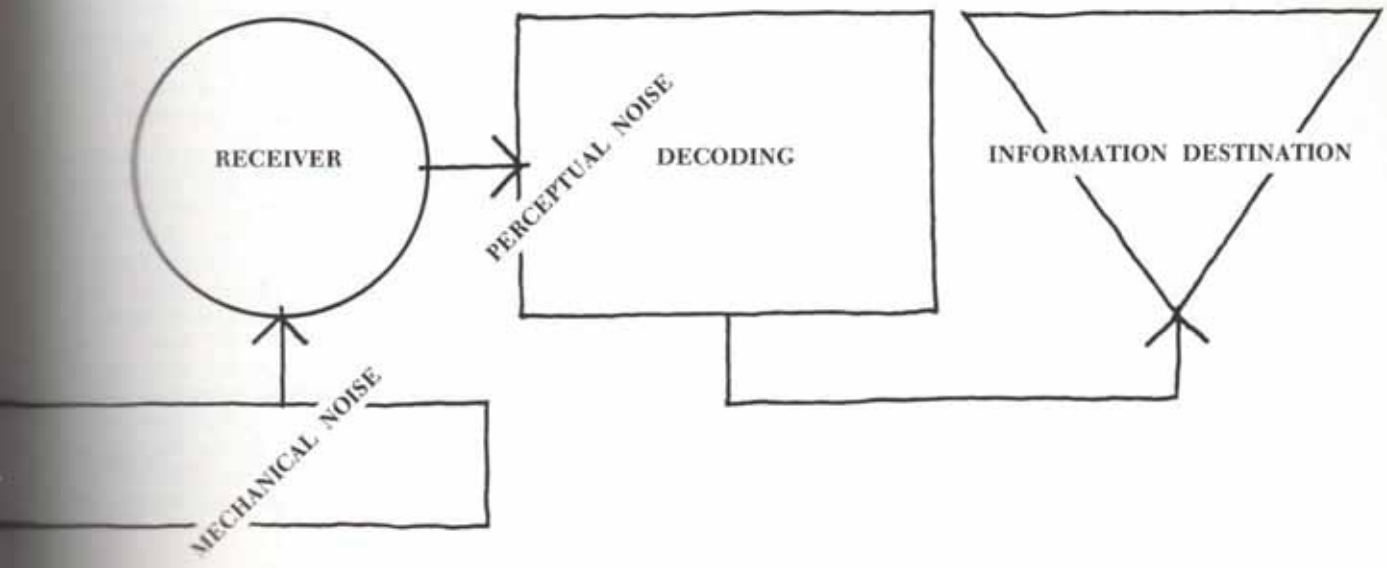


"The channel may take any form which is capable of conveying information: radio, TV, a book, a letter, a drawing etc. Strictly speaking it is the medium used in conveying the signal from transmitter to receiver; a pair of wires, coaxial cable, band of radio frequencies, beam of light, marks on surface of paper etc. Whatever channel is used, the signal may be perturbed by mechanical noise—a term which betrays the origins of information theory in telecommunications, where it refers to the clicks, bumps and hisses of a telephone channel. But it can be applied to any disturbance in any channel, smudged lettering, tea-stains on a drawing etc.

"The receiver performs a reverse function to the transmitter; it decodes the signal and reconstructs the original message from it.

"If the original signifiers carried largely denotational meanings, communication will be accurate—provided that the signal was not perturbed too much by mechanical noise as it passed through the channel. But if it contains signifiers with connotational meanings—analogies, metaphors and so on, then it is likely that the decoding will result in meanings which are rather different from those the source intended. The decoder will draw on his own experience of connotational meanings and this will introduce *perceptual* noise.

"The destination's behaviour *will* change as a result of receiving the message—if only to the extent of rejecting it. But if the change is other than that desired by the message source, the latter will have failed to communicate."



"Note that in the absence of supplementary information, or information inherent in the context, it is usually necessary to introduce some "redundancy" in the message to offset the effect of "noise." R. L. Meier, in *A Communication Theory of Urban Growth* (Cambridge, Mass.: MIT/Harvard University Press, 1962), explains:

"Redundancy, which implies an overdetermination of meaning, has value in overcoming the effects of disturbance, poor forgetfulness, typographical errors and the like. On the other hand, it uses up the time of *sender* and *receiver* alike. Too much redundancy in a channel is disinterest in a *receiver*, while too little causes confusion and an inability to specify what it was that was communicated. The proper amount is arrived at through trial and error. Speech is typically more redundant than prose, but through the influence of radio, loudspeakers, and new forms of fiction, the properties of the two sides of language are beginning to converge. Pictures contain much greater redundancy, a great deal of which can be removed by making cartoon-like drawings. It is often convenient to assign payoffs to the meaningful, or nonredundant, fraction of a message. Experience shows that in most circumstances the returns obtained from redundancy and outright repetition are vanishingly small for any given individual. However, when a single message is directed to many different persons, as in the mass media, the uncertainty about the vocabulary of the *receiver*, and the environmental interferences affecting his receiving make the use of considerable amounts of redundancy efficient for the *sender*. Thus we may assert that though the payoff resides in the meaningful fraction, the *insurance* that the meaning will be received as intended resides in the redundant fraction. If there is growth in cultural interaction, there must be expansion of the quantity of meaningful communication on a per capita basis, and this almost certainly involves a reduced need for insurance."

For an extensive discussion of the role of contexts in human culture and communication, see Edward T. Hall, *Beyond Culture* (Garden City, N.Y.: Doubleday, 1976).

All the lettering in this presentation is to be done freehand by you directly on the illustration board using only the specified letter style and conventions. You may use any medium for this lettering—pencil, crayon, felt pen, ink, etc.—and you should experiment with all of them to discover which is best for this case.

THIS IS AN EXAMPLE OF HOW LETTERING SHOULD BE USED VERTICALLY.

THIS IS AN EXAMPLE OF WHAT IS TO BE AVOIDED.

Here now are our specifications for freehand lettering:

1. Use *only* the letterforms shown herewith. These alphanumeric characters are modeled on those which have been found to have the best legibility and readability. See E. J. McCormick, *Human Factors in Engineering and Design*, 4th ed. (New York: McGraw-Hill, 1976), or Rolf F. Rehe, *Typography: How to Make It Legible* (Carmel, Ind.: Design Research International, 1974).

2. Draw *light* upper and lower guidelines for each line of lettering.

3. Take care to make all vertical elements of the letterforms truly vertical: draw *light* vertical guidelines.

4. Provide vertical spacing between lines of lettering (this is called "leading" in typography, and is pronounced "ledding."

5. Try to achieve an apparent uniform spacing of letters in words.

6. Be sure that there is more space between words than there is between letters in words.

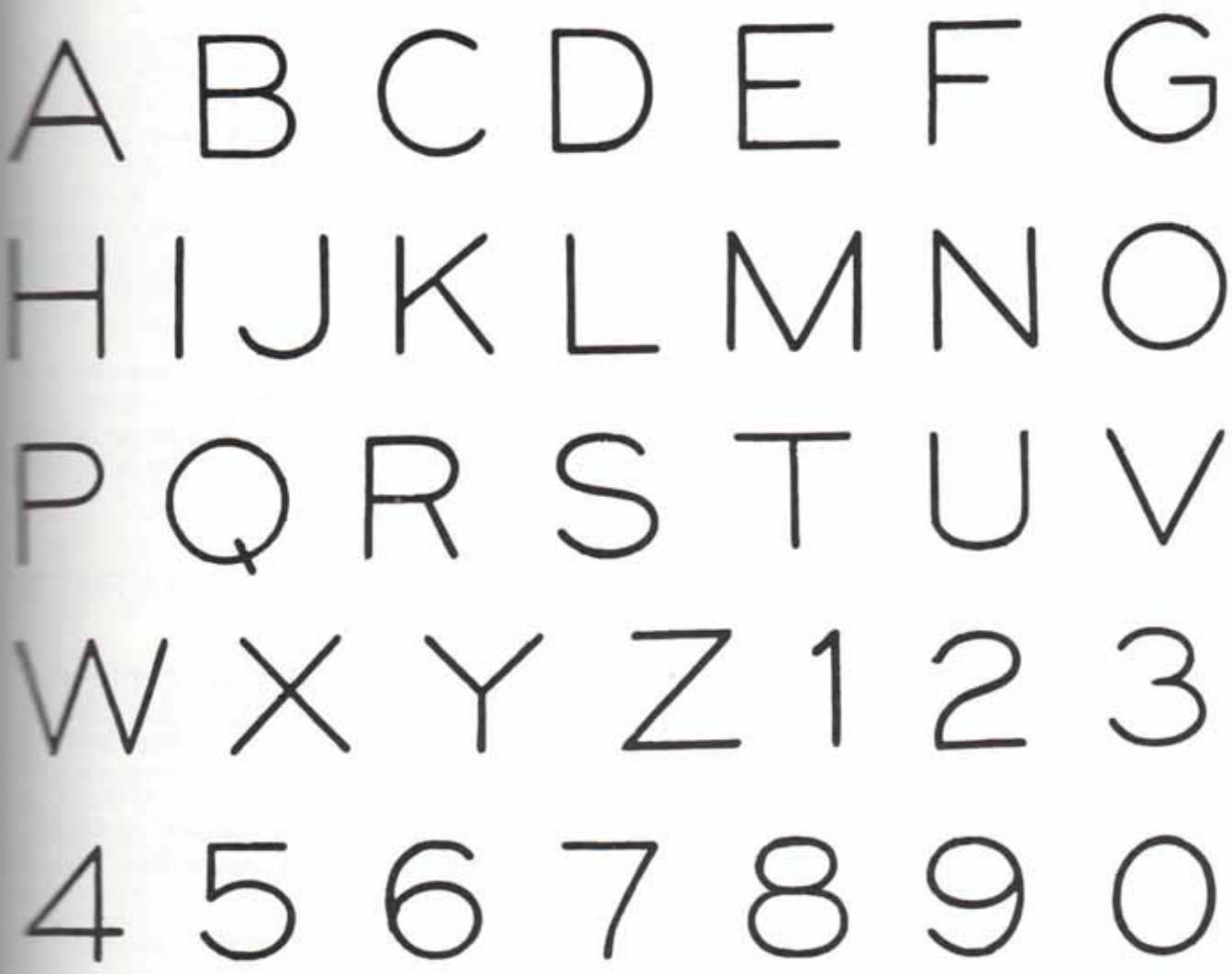
7. Arrange the lettering in horizontal lines to read from left to right and the lines to read from top to bottom. If for some reason it is necessary to arrange the lettering vertically, the convention is to turn the paper or board 90° clockwise and letter the *lines* in this format (see example).

8. Do not try to go too fast! Take time to form each letter properly and master this before you build up speed. Speed will come later—about three years later. Until then make sure your lettering is *good*.

Freehand lettering is one area in which beginning design students often experience conceptual difficulties. These problems are in addition to those related to the mastery of the necessary craft skills, and arise from certain confusions over the proper use of creativity and the question of self-expression.

In our work here we use lettering as a means of communicating information connected with the assigned problem, and not as a means for the self-expression of the designer's personality. The use of personalized letterforms and idiosyncratic lettering styles is thus irrelevant to the issues we are concerned with, and can only add "noise" to the communication process. For our present purposes, lettered communication requires the use of basic, standardized letter forms and conventionalized formats, and the designer's creativity is best employed with optimizing the use of these forms in these formats.

It has been suggested that the greatest art is to conceal art: to achieve a result so natural and inevitable in character that there is no evidence of artifice, or of the designer. Such design anonymity represents, perhaps, the ultimate possible design achievement: on a par with nature itself. But the young designer's ego is sometimes like the baby monkey's tail—always getting in the way and interfering with operations. Eventually, of course, the monkey manages to gain control of its tail and the tail is no longer a problem. How about you?


A B C D E F G
H I J K L M N O
P Q R S T U V
W X Y Z 1 2 3
4 5 6 7 8 9 0

In designing this presentation you will need to invent and simulate a large number of hypotheses and through a comparative evaluation of these alternatives arrive at an optimum solution. Two of the elements (the original clipping and the BPA tracing) are fixed in size and shape, but the third element of your composition on the board (your inventory of BPA attributes) is not, and it may be varied in size, shape, and direction. The best procedure here is to prepare three or four alternate versions, each one full size and on a separate piece of tracing paper.

Each of these alternates may then be tried out in a number of positional arrangements on the board along with the original clipping and the BPA overlay (in fact, by moving these separate items around on the board you can quickly simulate hundreds of alternatives). When you hit on a composition that seems to offer some possibilities, superimpose a sheet of white tracing paper (15" x 20") over the arrangement on the board, and carefully reproduce on it all the essential visual characteristics of that layout. These "comprehensives" should be complete representations (*not* abstract outline drawings) and should be carefully prepared *freehand* on a single sheet of paper to communicate the appearance of the future, final, finished presentation. Note that your usual pencil may not be the best tool for this job.

Tack or tape each of these alternative layouts up on the wall near your table (you should put up at least three at first, and ultimately not less than six). By comparing them as you prepare others, you will progress and serendipitously discover more and better ideas. Remember the three magic words:

COMPARE ADJACENT ALTERNATIVES!

Note that these alternatives which you put up on the wall are of the nature of "dress rehearsals" of your final production, and should provide a comprehensive representation of your final product. They should look like black-and-white photographs of your final design, which means that labeled outline diagrams are explicitly excluded. Thus you must reproduce the position, size, shape, texture, direction, number, and dark-and-light attributes of all the elements of your layout. Note that pencil alone may not be adequate for this purpose.

Note also that mechanical copies of your clipping (such as Xerox, etc.) are both unusable and inadvisable: unusable because they are not adequate representations, and inadvisable because your use of them precludes your own development of an essential graphic skill.

The preceding phase describes the process of studying your design, or developing your ideas through successive sequences of hypothesis, simulation, and evaluation. When you have satisfied yourself that you have explored *all* the possibilities open to you (keeping in mind the difference between the novice and the professional), you are then to execute your final *two*-dimensional design (using no lift-ups, overlays, or fold-outs) directly on the board. The original magazine clipping, as well as the tracing-paper BPA-identification, are to be rubber-cemented to the board; and all lettering is to be done freehand directly on the board surface. Please hand in your last comprehensive simulation, *just as it was before you started on your final presentation,* along with this final design, so we may compare them to evaluate the effectiveness of your simulation techniques.

Keep in mind that your simulations are the means by which you develop your design. There is no point in wasting what could have been useful design time in "improving" a simulation *after* you have made your final design decision and completed your presentation.

Discussion

How effective is your graphic layout in communicating the concepts that are at issue here?

1. Would a logical order of scanning be the following?

(a) original clipping

(b) BPA identification tracing

(c) BPA attribute inventory

Does your layout implement this order by following our culturally determined reading conventions? If you used a title on your presentation, is it located in a position that is effective in terms of these criteria?

2. Is there a close, logical relationship between the original clipping and your BPA identification tracing? Have you communicated this relationship by positioning them close together, in the same orientation, and in horizontal or vertical alignment? (Does any departure from these conditions aid communication, or does it add "noise"?)

3. Have you positioned the three elements (original clipping, BPA identification, BPA inventory) on the board with some regard to the "white space" as a "positive" element in itself, or have you used this white space as a sort of "packing material," in equal amounts around each of the elements so as to keep them from rattling around in the illustration board "box"?

4. Have you used any graphic material (borders, margins, boxes, arrows, horizontal and vertical division lines, decorations) in your presentation without making a visual comparison, side by side, with an alternate design *without* such material, to check to see if it is visual "noise," impeding communication?

5. Have you realized that in all probability the "surface quality" attributes of each BPA on your original clipping are identical, since the surface in question is only that of the piece of paper?

6. Is your "re-coding" of the several attributes of each BPA a clear and adequate graphic and/or verbal characterization? (Note that merely using a sample from a duplicate illustration only avoids the essential effort you must make to reformulate these attributes.)

7. Have you followed all the specifications for freehand lettering? Does your graphic craft reflect a professional level of responsibility?

Rubber cement is specified for all work with paper in this program because of its quick drying, transparent, flexible, stainless, waterproof, nonwrinkling, and noncurling properties. There are a few points you should know about using it. For most applications of a nonpermanent nature, brush on an even coat of cement over the larger surface, extending the area of application slightly beyond the boundary to be covered so as to ensure complete coverage, including the edges; then immediately join the other surface. Slight positional adjustments are possible. Then cover the surface with a clean sheet of paper and rub gently from the center outwards. Excess cement beyond the boundary may be *gently* rubbed off, when the cement is dry. This attachment will hold for a week or so and is adequate for most class work.

For a somewhat more permanent job, apply a uniform coat to *both* surfaces and let them both dry. When these surfaces so prepared are placed in contact, they cannot be shifted or separated. To permit the accurate positioning of the work, it is therefore necessary to use a "slip sheet." When the cement coatings are dry, use a clean sheet of tracing paper to cover all but a small edge of the lower surface. The upper surface may now be accurately positioned with reference to the lower one, and fixed in place at the exposed area. The slip sheet is then withdrawn bit by bit and the two surfaces are gradually brought into contact. Again cover and rub gently from the center outwards, and remove excess cement.

If your cement becomes too thick, it may be thinned with rubber cement solvent or thinner, obtainable at art supply stores. A consistency like that of a thin cream is usually most suitable.