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ROCHESTER INSTITUTE OF TECHNOLOGY

A Thesis Submitted to the Faculty of
The College of Fine and Applied Arts
in Candidacy for the Degree of

MASTER OF FINE ARTS

COLOR THEORY AS APPLIED TO TYPOGRAPHIC LETTERFORMS

By

Mark E. Lewis

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I. Choice of Color and Typography as Thesis Subject

Throughout my educational and professional career both color and typography have been of great interest to me. I have used both in my work, although most often separately. For example, I have done a great deal of print work on brochures and the like, although mostly in black and white. This emphasis continued through my first year of graduate school, in which most assignments were black and white.

In my second year I decided to explore these issues in more detail. During the summer semester, I did considerable research in the area of color and discovered a great deal of theoretical information that I had never before explored. Most of the color theory work, however, appeared to address color issues through the use of uniform colored shapes, usually squares, rather than colored letters.

Accordingly, I decided to do a research project that was wholly devoted to illustration of color principles and phenomena through the use of typographic letterforms.

After I decided to use color, I had to make a determination of what an appropriate medium would be. In order for the project to have a practical application, I decided to use colors that matched the Pantone Color System, because it is widely used and recognized within the graphic design community. The Pantone system is used by printers as well as graphic designers and it provides a method to match colors accurately, through mixture, if

necessary. The colors can be matched in printing ink, markers, paint, colored paper, and silkscreen inks. These multiple applications make the Pantone system and, therefore, this thesis useful to artists and designers who may work in various media.

The final preliminary decision to be made was whether to address optical, subjective or objective color issues. Optical color study is most closely allied to science. One studies and measures the properties of color including how much of particular pigments must be combined to achieve a particular color, the wavelengths of light that produce various colors, and other similar kinds of investigations.

Subjective color investigations are studies of the use of colors individually and in combination to create certain emotional or psychological effects.

Objective color investigations are those that reach the issues of how colors interact with each other when used together. Particularly, this area addresses the visual effects that are produced.

Optical color is outside my sphere of interest and expertise. Although subjective color questions are extremely interesting, I believe that they are best studied through reviews of how groups of individuals react to colors in various settings and contexts. This area blends into that of psychology and would seem to require group testing and other human evaluations.

Objective color is the area that I believe relates most directly to the work of the graphic designer. In addition, it was the area that I felt I was most qualified to address. Accordingly, I chose it for my thesis work.

II. Statement of Thesis

The purpose of this thesis is to investigate color theories through the use of typography while using the Pantone Color System as a guide. The examples used are not, nor were they intended to be, the best or only definition of a particular color theory. Rather, they represent one solution to a given problem. In this thesis I intended to illustrate color effects, (by combining color and typography,) that cannot be achieved through the use of colored shapes alone.

III. Format

The first thesis format that I proposed was to apply each of the seven color relationships to a series of posters being developed for the Bevier Gallery. I intended to develop a 3 x 7 grid matrix, with three posters, each of which would appear with identical text and imagery in all seven color relationships.

With this approach, I intended to illustrate how the same poster would be perceived differently in the various color relationships. Also, it would illustrate how three different posters, in the same color relationship would differ because of their content and imagery.

Sketches were proposed and submitted to my committee chairman. A new direction was proposed because the posters had already been displayed and it was felt that to use them as a thesis subject would be redundant. Also, the posters had imagery as well as typography and, therefore, the content of the posters might distract from the main typographical focus of the thesis.

I then returned to a concept that developed as an offshoot of my theoretical research during the summer. At that time, I had begun experimenting with a single line of five letters in various colors to illustrate the seven color relationships. That linear format was expanded into a 5 x 5 grid that became the final thesis format (See Ill. 1). This format allowed the use of more colors and also provided the opportunity to explore multiple colors next to each other.

In addition to these panels, I conceived two more series of seven illustrations each, one for each color relationship. The second series consisted of succinct definitions of each color relationship so that the series of letter panels would be comprehensible to the observer. Each of these definition panels also contained a single five-letter line that illustrated the color relationship defined by the text. This created a sense of visual unity among the panels. The final series was to consist of examples of the use of each of the color relationships drawn from existing sources such as posters, brochure covers, and similar graphic materials. This final series has not been executed because these actual practical examples tend to combine various color relationships and do not, therefore, illustrate particular relationships as the remainder of this theoretical project does. Another problem reason is due to copyright issues; copyrighted materials can only be used by permission of the owner.

IV. Typography

The primary typeface I chose was Helvetica and the type weight is Bold (See Ill. 2). This combination is simple, legible, and easy to reproduce. Helvetica is a san-serif typeface composed of clean straight lines with well-defined borders. I chose the bold typeweight because it provides good volume and is easy to read in this individual character format.

The characters chosen for all panels were "H", "N", and "Z". These three are easy to reproduce and when placed next to each other the character borders touch in some places, while producing interesting figure-ground relationships in others. All three characters are of the same size although they fill differing portions of their volume space.

Throughout the generations of the thesis, the characters used to illustrate any particular relationship changed. This occurred because I visualized the project as a series at all times, rather than as a group of individual panels. Therefore, the characters changed as the order of the illustrations changed. The color and tonal values of each illustration in relation to the ones on either side determined the order of the panels and, therefore, their character composition.

All characters were twelve picas in height. This size is large enough to be clearly legible in an exhibit format. The substrate size is 17" (102 picas) x 17". This size was arrived at by taking a standard 8 1/2" (51 picas) x 11" (66 picas) sheet

of paper and experimenting with it. The square format of the color section dictated a square substrate. Therefore I doubled the 8 1/2" inch side and developed a square. The same methodology using the 11" measurement resulted in a substrate that was too large in relation to the color area.

V. Color

The colors used to illustrate each relationship were chosen for either one of two reasons. In some cases the relationship itself dictated those colors, as in hue and cool-warm contrast. In others I chose colors because I wanted to use as many colors (primary, secondary and tertiary) in the series as possible, for visual interest.

The particular Pantone colors chosen were based on research and evaluation of each color in relation to existing colors of that hue. (See Ill. 3,4) In other words, when choosing a color such as orange, I chose a Pantone color that the observer would clearly perceive as orange.

The color figures in each relationship are situated to create the greatest contrast available based on weight, intensity, and color so as to create a striking visual effect insofar as is consistent with the color relationship.

The multiple color ground creates complex visual effects that would not exist with a solid color ground, whether it were white, black or another color. In the panels other than simultaneity and extension, if there were five colors in the figures, I chose three middle tones for the ground. This choice created a more subdued color interaction between figure and ground than that which existed among the figures themselves. In effect this choice created a secondary level of visual activity in each panel.

In the case of simultaneity, all of the figures were one color and the ground was the second color. The principal and only level of visual activity in this example was the figure-ground relationship itself.

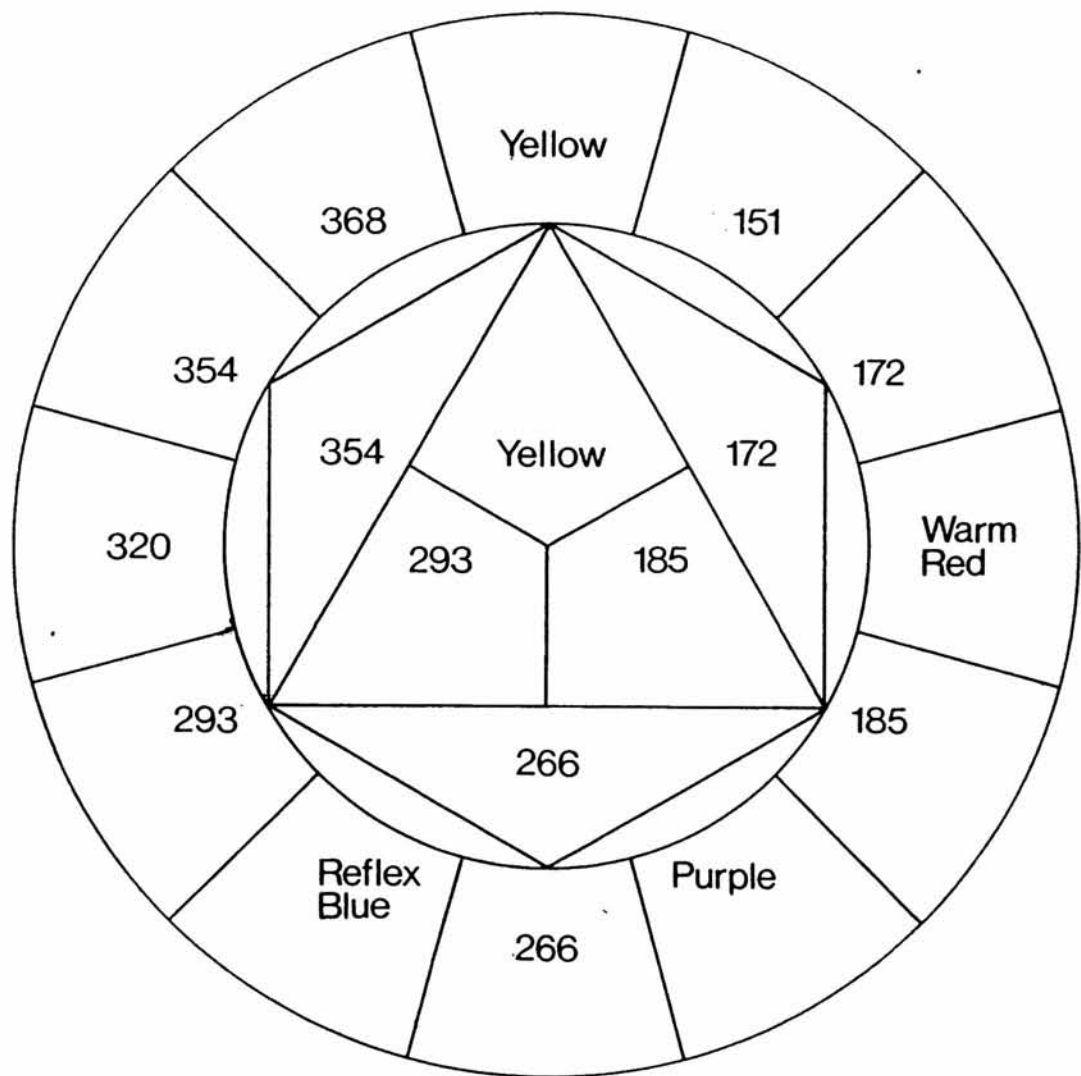
In order to illustrate contrast of extension, the all-grey ground that I chose helped the viewer to perceive the weight and intensity of the color figures. Had there been a multiple color ground, the viewer would have been distracted from the primary, and only, effect present in the panel.

In my early investigation of each relationship, I used various colored borders on each panel. After review of the format, it was determined that the colored borders interacted too strongly with, and detracted from, the central color area and all panels were finalized with white borders.

HELVETICA BOLD

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





VI. The Seven Color Relationships



Contrast of Hue

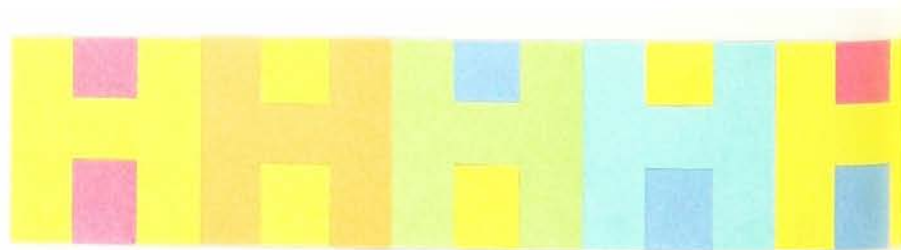
even those of the primary colors, contain impurities. As colors are combined these impurities multiply, dulling the contrast.

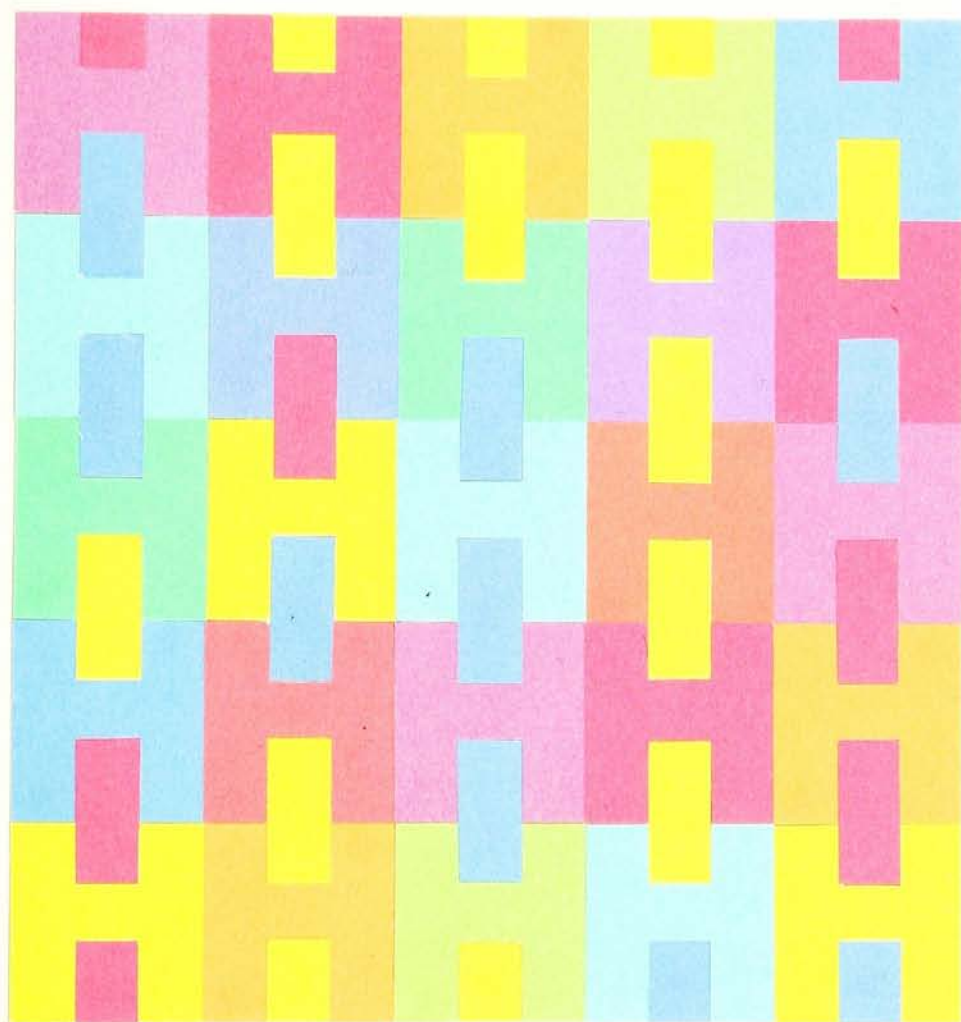
Adding white or black to a pure hue creates tints and shades of that hue. Although these additions reduce the contrast, tints and shades can be used to illustrate a hue relationship. Careful manipulation of the luminosity of the colors used is required when using white or black in this way to express a contrast of hue.

Contrast of hue occurs when two or more hues are used together.

This contrast exhibits its strongest character when composed of two or more of the primary colors: red, yellow, and blue. Strength of the effect diminishes when other hues are used because of the inherent impurities of reflective colors. All pigments,

Although this contrast can occur between any two or more colors, care must be taken to minimize other color relationships or the intended hue relationship may be overshadowed, particularly by complementary, cool-warm or value contrasts.



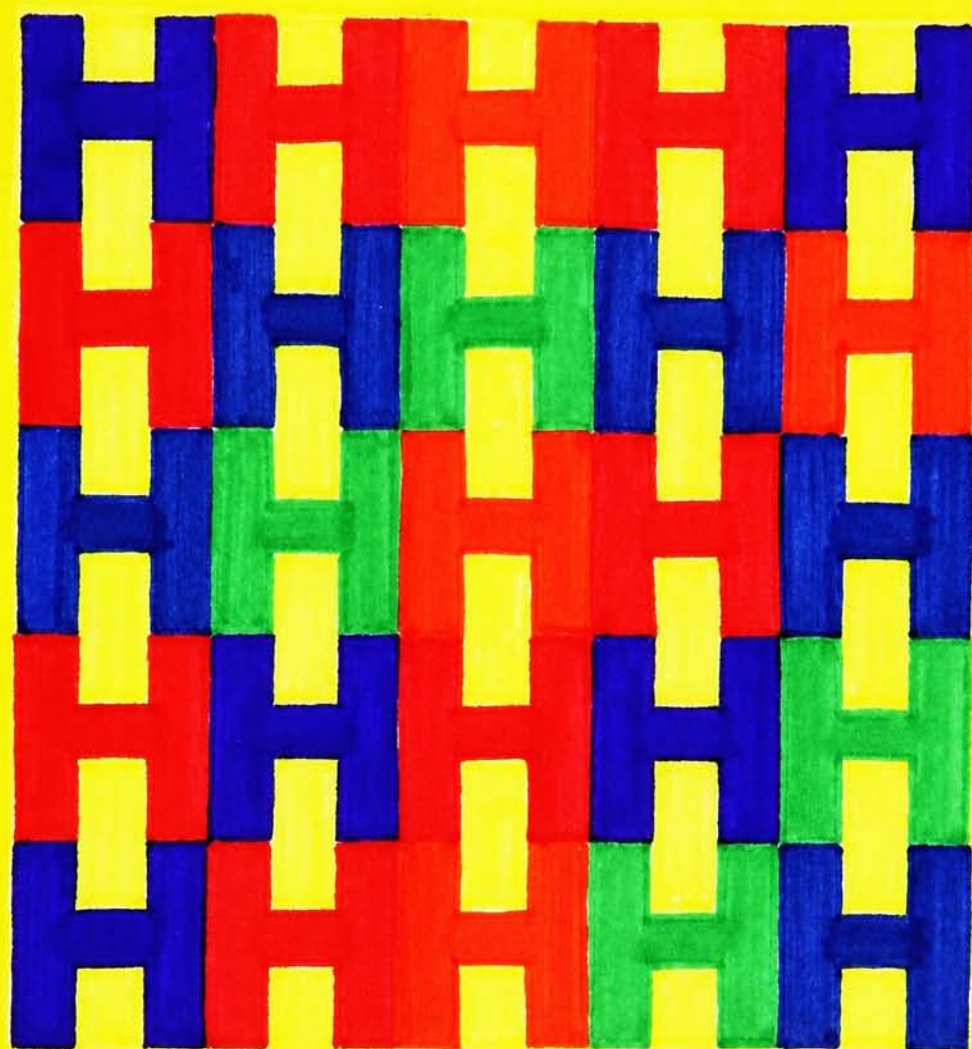


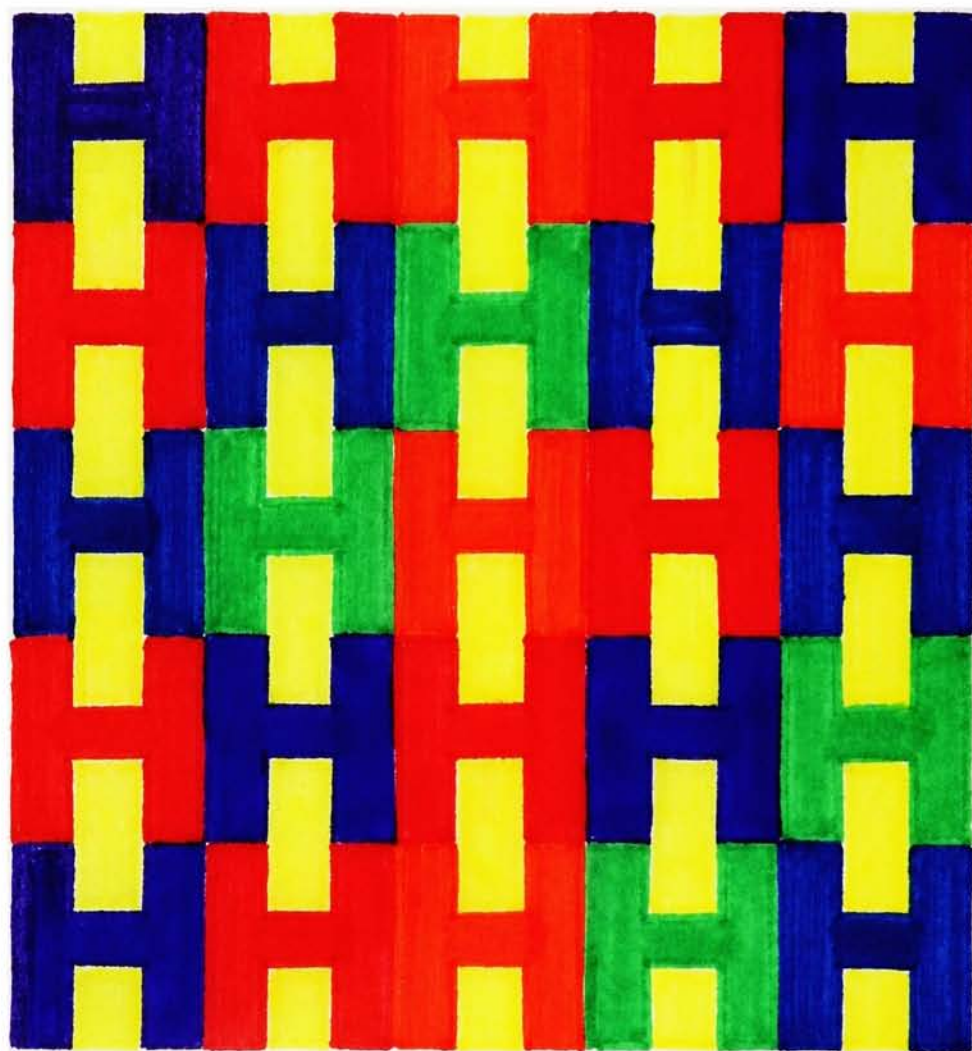
Contrast of hue was from the outset illustrated solely by "H"s. This use of letters dictated a vertical format, as that impression naturally emerges from an all "H" panel. The original version of this panel utilized red, blue, green, violet, orange, and yellow. The letters were blue, red, green, violet, and orange, while the ground was yellow. I worked on three versions of this initial phase, one with a yellow border, one with a white border, and one with a black border. See Exhibits H-1, H-2, and H-3.

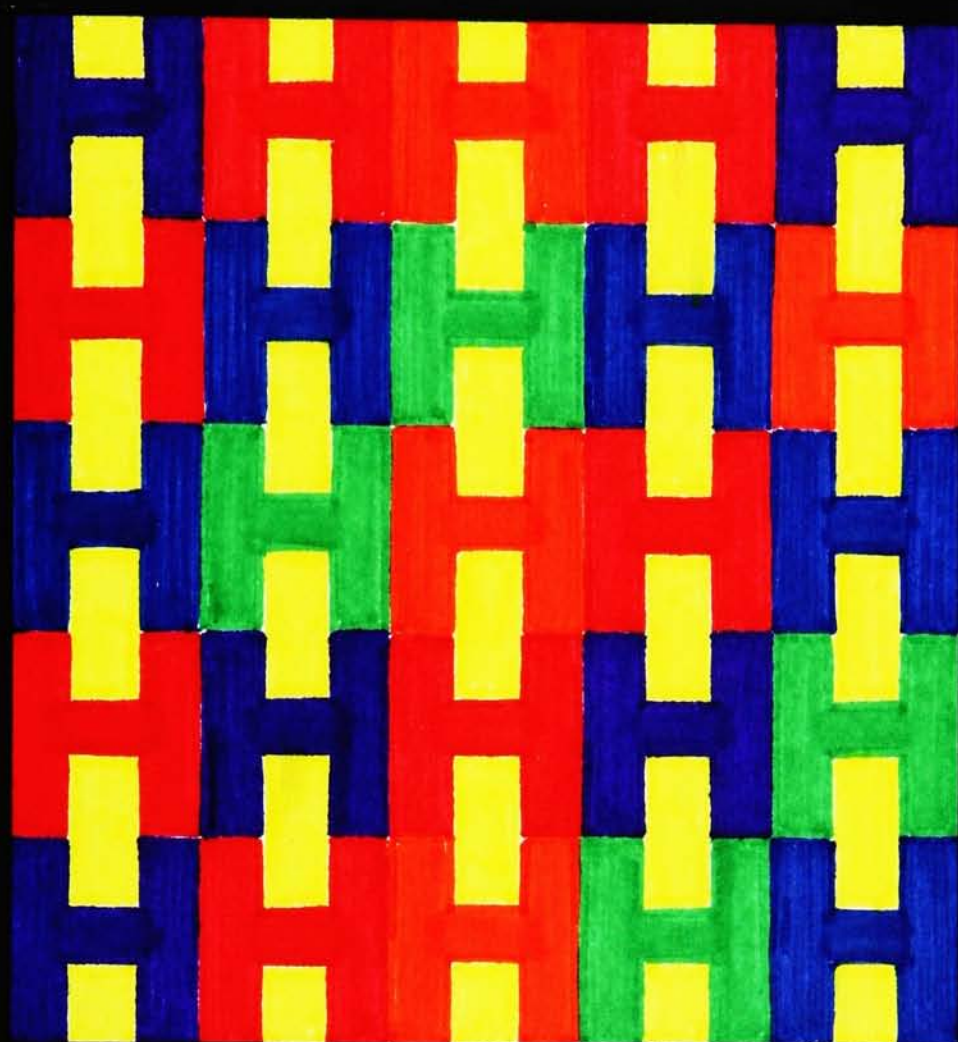
These various colored borders introduced and explored the interaction of the central color area with a colored border. White proved the best border because it enhanced the image, making it seem to spring off the substrate, without interfering with the color relationship itself. Black detracted from the effect and yellow tended to flatten into the central area.

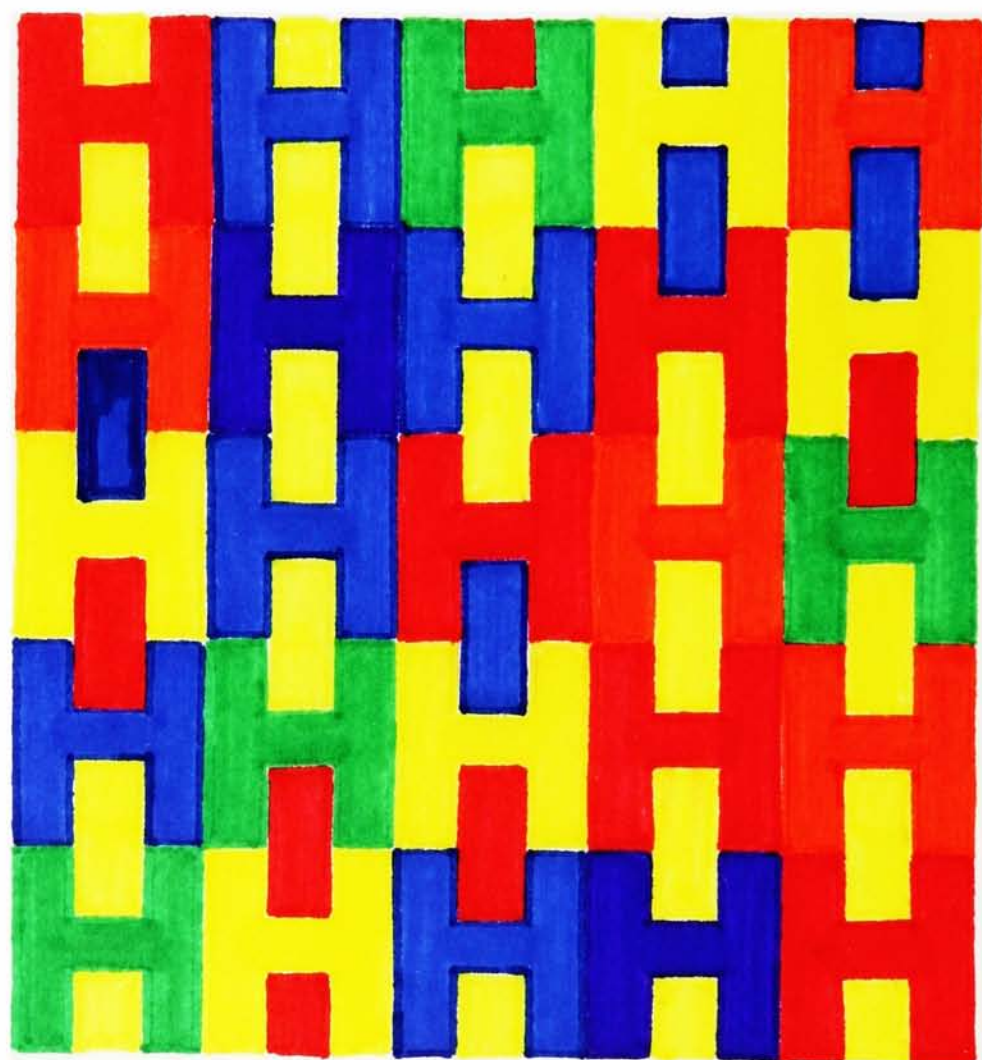
After white was chosen as the border, as it ultimately was in each and every panel, I investigated multiple color grounds to replace the all-yellow ground. For the ground I chose one light, one dark, and one middle tone color: yellow, blue, and red. See Exhibit H-4. I then decided to use all twelve colors of the color wheel in the panel in order to maximize color interaction, although I kept only three background colors. See Exhibit H-5. This composition was essentially the final version except for a change in value.

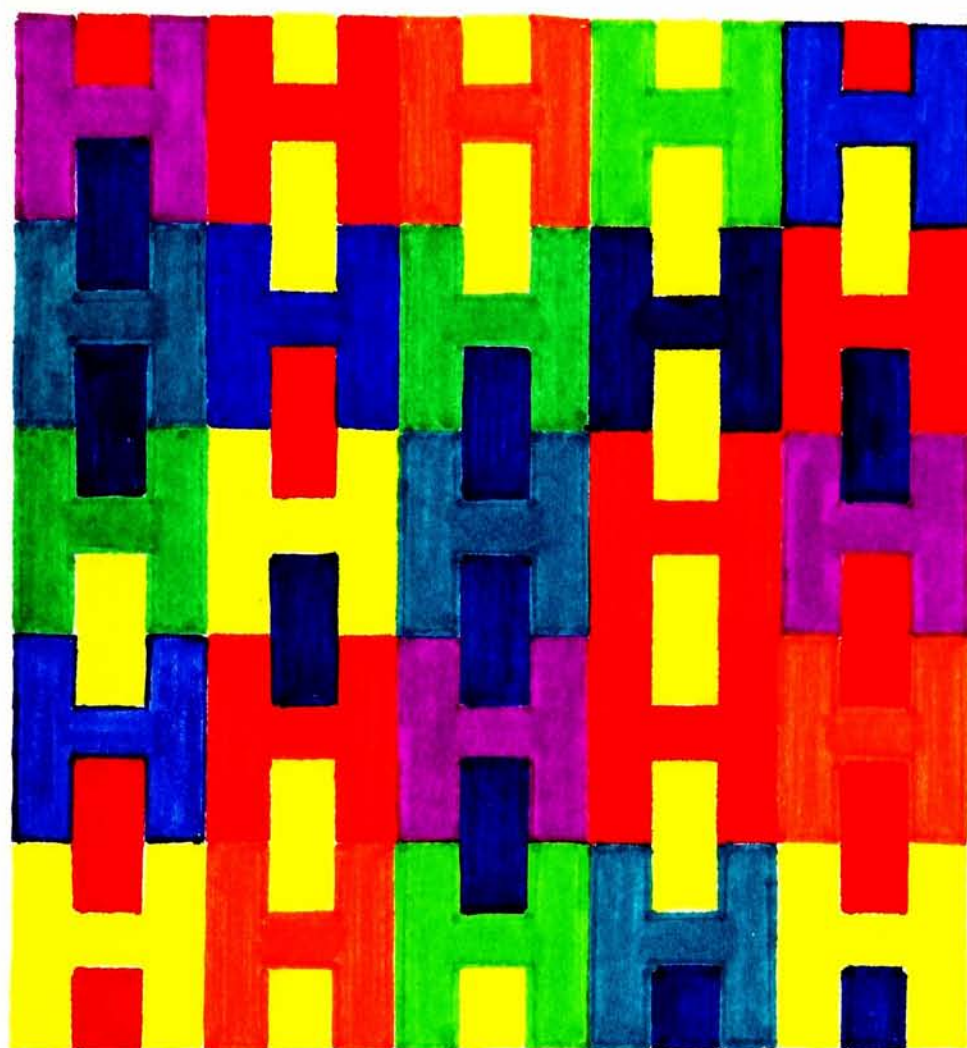
All prior versions had used pure saturated hues, but the light-dark contrast that occurs naturally between yellow and violet in the pure saturated state competed with the hue effect. Accordingly, I lightened each color to the lightest Pantone color in the final version. See Exhibit H-6. This change in value subdued the light-dark contrast without detracting from the contrast of hue.













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Complementary Color

color is that color which appears opposite on the color wheel. When any pair of complementary colors are mixed, neutral gray-black is formed.

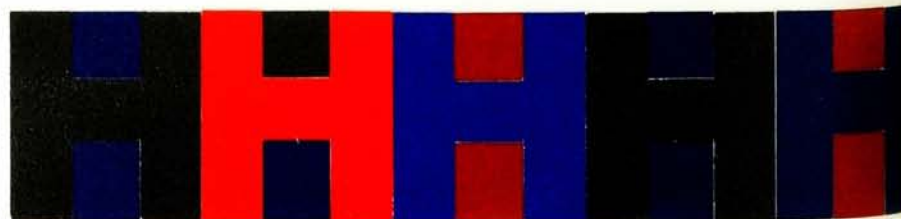
Particular pairs of complements exhibit distinctive characteristics. Yellow and violet are the extremes of light and dark colors. Red-orange and blue-green form a complementary pair composed of the polar extremes of cool and warm colors. Red and green constitute a complementary pair in which the two colors are equal in brilliance as pure hues.

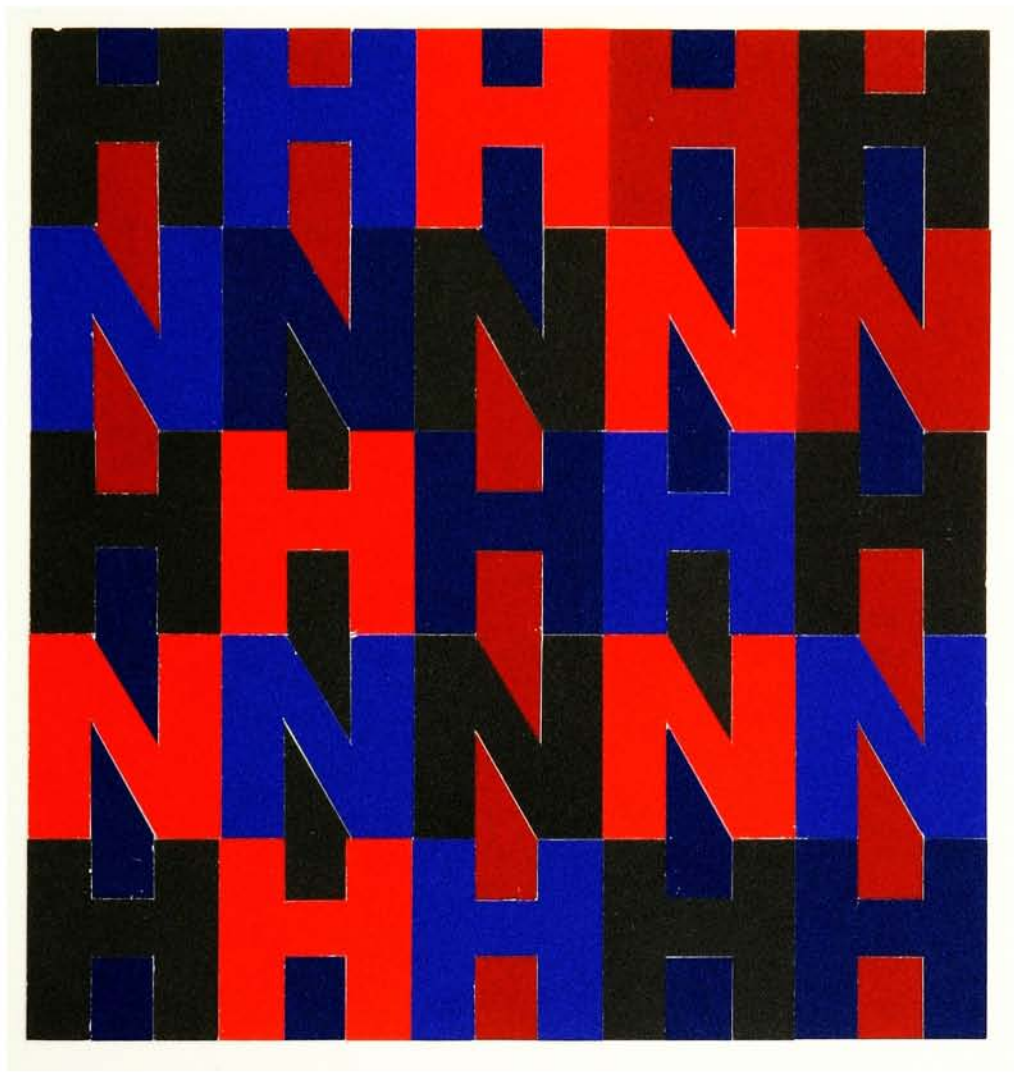
Complementary colors incite each other to a vividness when contiguous, that is totally lost as they are mixed. Ultimately, equal mixtures yield gray-black.

When complements are placed adjacent, but in very different volumes, a remarkable vividness is produced. This vividness is lost as the volumes approach equality.

In the case of colored light (direct color) the complement of a color is that color which results from the mixture of all the other colors of the visible light spectrum.

When all of the hues of reflected colors are mixed, a neutral gray-black will be the result. The complement of a reflected





My line of study centered around red and green with "H" and "Z" in a vertical reading format. I reviewed red and green with a red border, red and green with a white border, and red and green with a black border. See Exhibits C-1, C-2, and C-3.

After review of all of these variations on the two basic solutions, I concluded that the vertical format that I had been using was too distracting. To address this problem, I adopted an all "N" horizontal format in red and green with a white border. This format proved easier to read.

The five figure colors are red, green, neutral gray, gray-green, and gray-red with ground colors of red, green, and neutral gray. See C-4, and C-5. It is with Exhibit C-5 that I turned to an "N" and "Z" format.

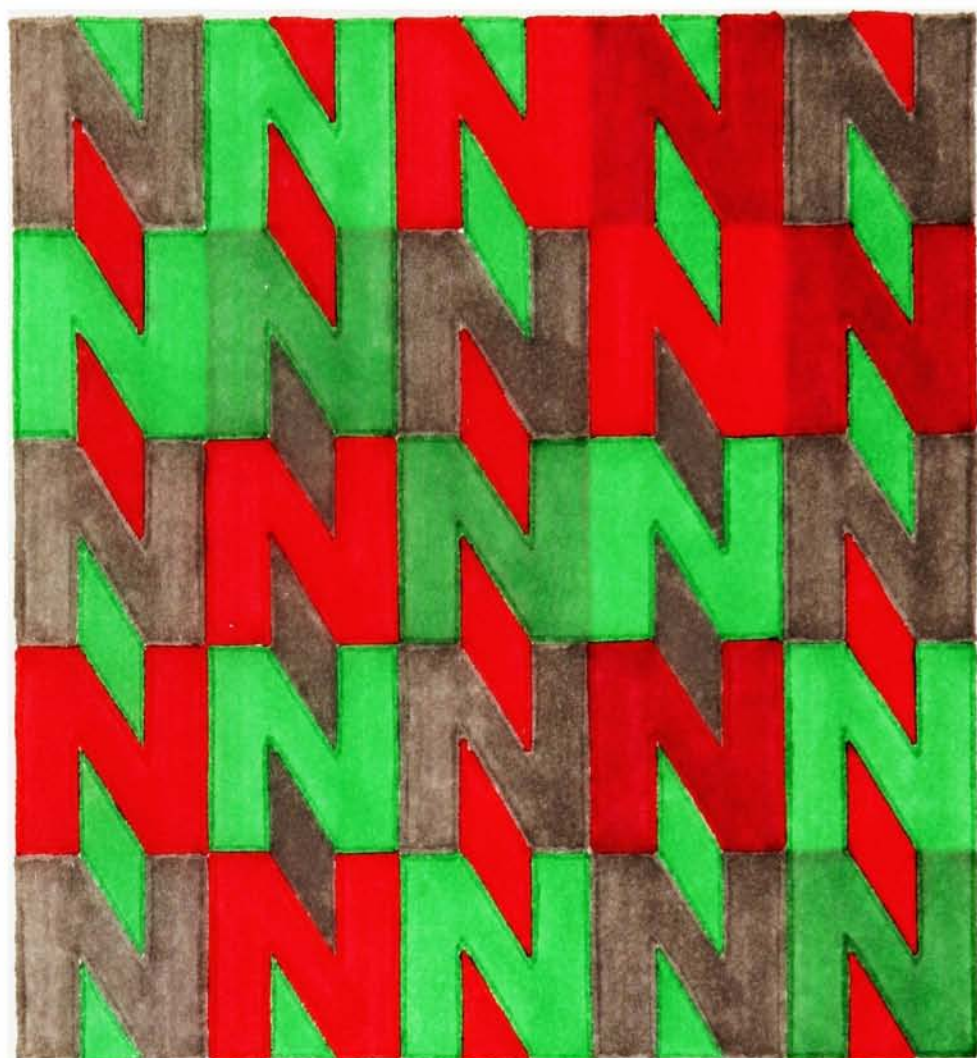
At this point, I determined that red and green was provided to be too common of a solution to the complementary color issue, so I replaced them with blue, orange and gray while retaining the scheme of color placement. See Exhibit C-6.

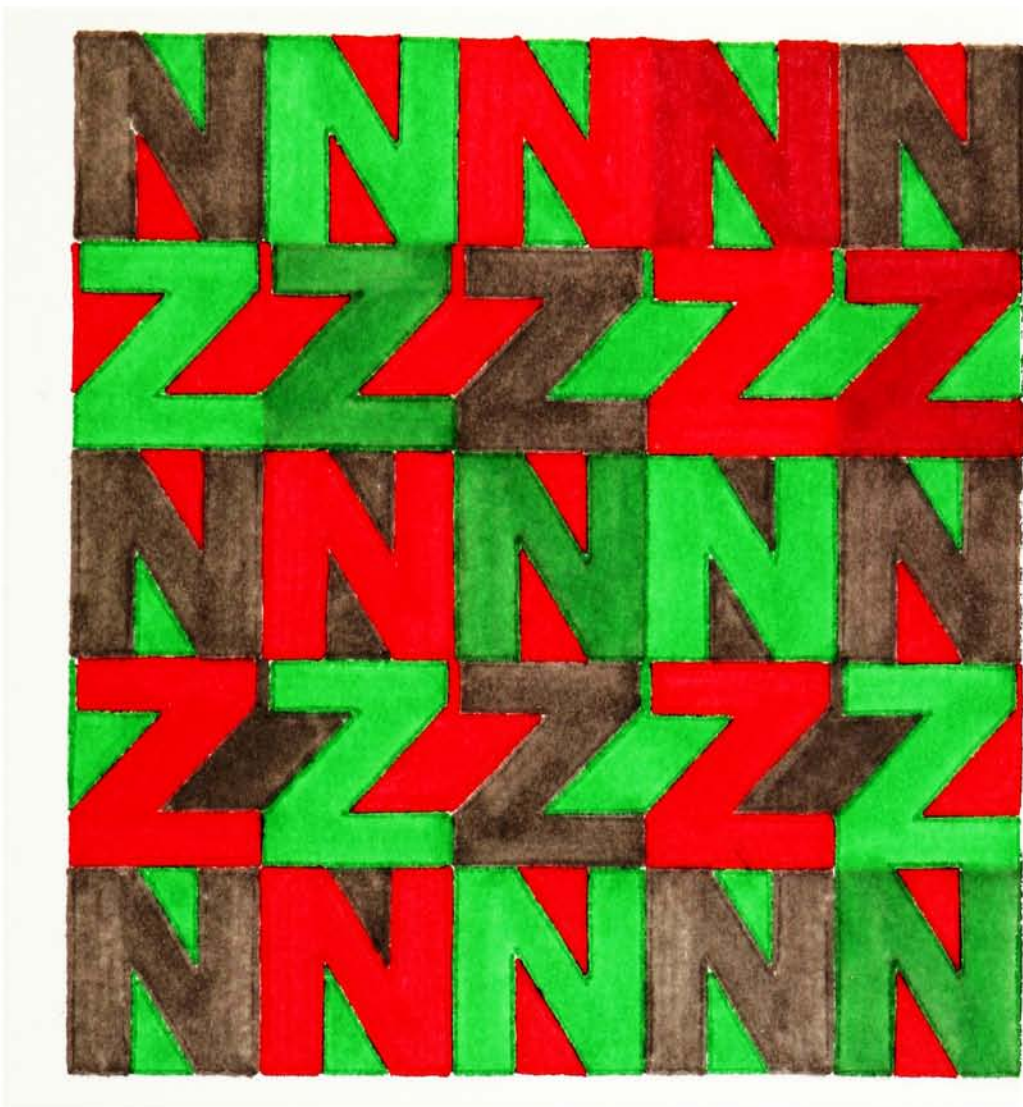
The final version of this panel is blue, orange, and gray in an "H" and "N" horizontal reading format. See Exhibit C-6.

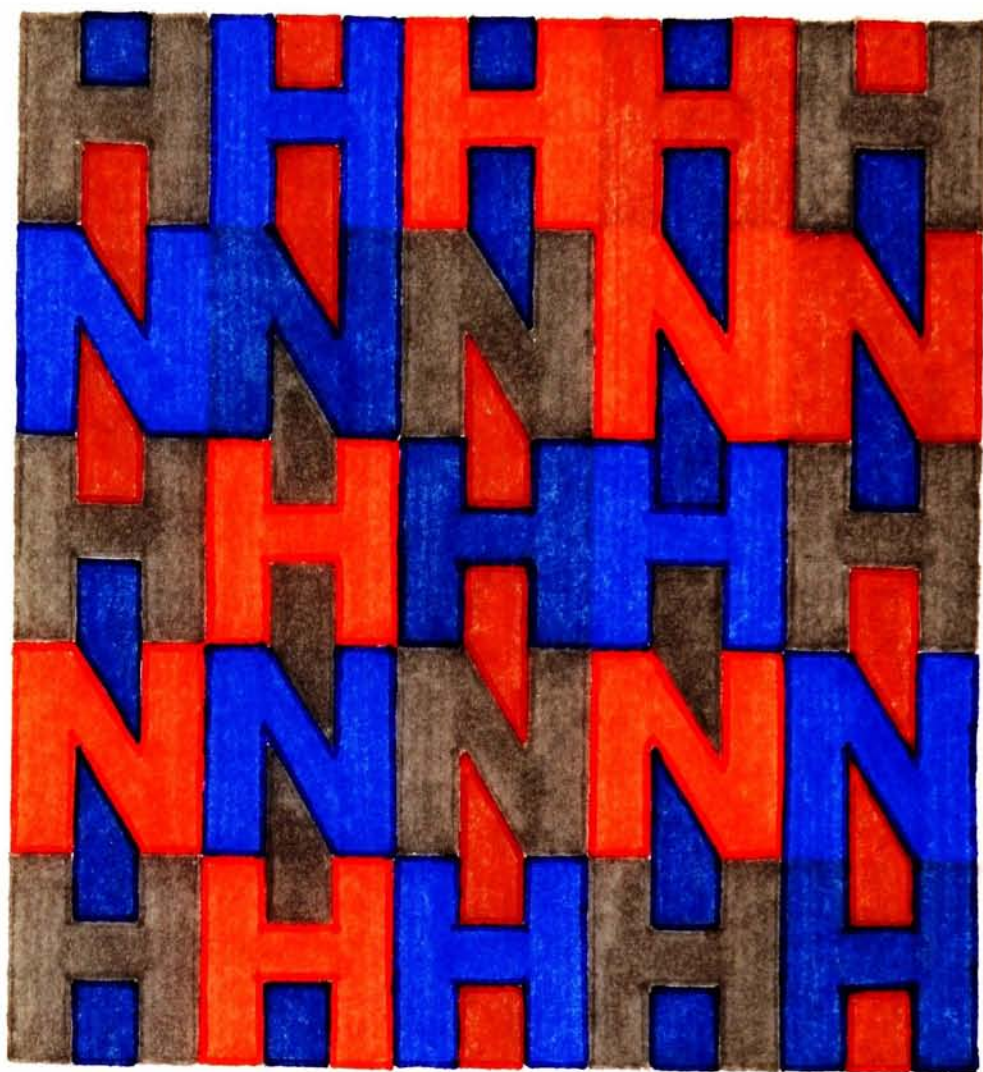


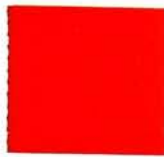




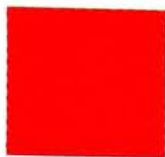








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Cool-Warm Contrast

The two poles of the cool-warm relationship are found in a pair of tertiary hues — blue-green and red-orange.

Unlike all other hues, these two are always respectively cool and warm. Although the colors yellow through red to red-violet are generally referred to as warm, and the colors yellow-green through blue to violet are generally referred to as cool, these descriptions can be misleading. All of these colors can be either cool or warm depending on whether they are paired with cooler or warmer colors.

To ensure a strong cool-warm relationship, color brilliance must be regulated. If both poles (blue-green and red-orange) are to be included in a

study, the chromatic scale should be formed through violet because the colors in this part of the color wheel are closest in brilliance. Should the chromatic scale run through yellow, then all color brilliances should be equal to that of yellow or the strongest effect will be a light-dark relationship because these colors are more distant in their relative brilliances.

Cool-warm contrast is a relative color relationship. Colors appear more or less cool or warm depending on whether they are set against a cooler or warmer background.





Throughout the various studies of the cool-warm relationship, the palette of colors I used remained the same. It consisted of warm red, red, red-violet, violet, blue-violet, blue, and blue-green. The first typographical solution I developed consisted of all "N"s. I produced and reviewed versions using violet as both ground and as a border (See Exhibit C/W-1), violet as ground and white as border (See Exhibit C/W-2), and violet as ground and black as border (See Exhibit C/W-3).

Regardless of the border color, the violet was too dark in value.

Because of issues regarding placement of this relationship within the series, I moved to a horizontal "H" and "N" format.

I substituted red-violet, blue-violet, and blue-green as ground colors. See Exhibit C/W-4. The blue-green and red-violet portions of the ground interacted well with the figures, but the blue-violet did not. The blue-violet was still too dark for this solution, and the blue-violet portions of the ground appeared receded far beyond the rest of the panel.

Keeping the same colors as in the prior panel, I then used an all "N" format because of issues regarding placement within the series. See Exhibit C/W-5. The same problem with the blue-violet remained, as it was not in any way affected by the letter change.

Up through this point, cool and warm figures had been integrated throughout the panel. I then decided to do a version

that contained a cool and a warm pole within the panel. The figures in the top two rows were blue, blue-green, and red-violet. The bottom two rows contained red, red-violet, and red-orange. The center row contained in sequence, from left to right, blue, blue-green, red-violet, red-orange, and red. In the top section, the ground was predominantly cool, containing blue, blue-green, and red-violet. In the bottom section, the ground was predominantly warm, containing red, red-violet, and red-orange. See Exhibit C/W-6

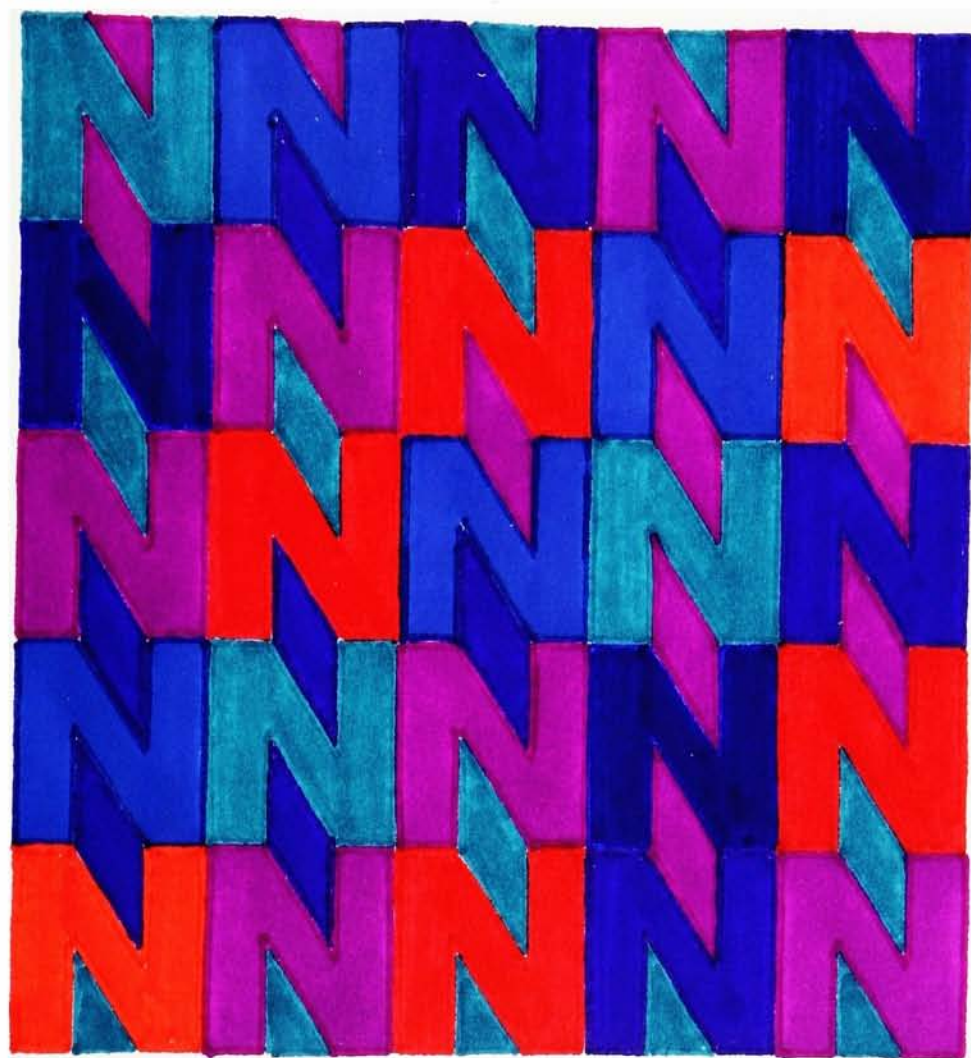
The particularly noteworthy aspect of this panel is that the red-violet which appears throughout, looks either cool or warm depending upon the context within which it is placed. The final version presents a pleasing visual effect in part also because of the segregation of the cool and warm sections.



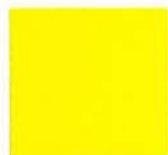












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Saturation

There are four ways in which to dilute pure hues, each of which yields a different result. Adding white to a color creates a tint. A shade is achieved by adding black to the hue. Addition of gray neutralizes a color, removing its characteristic traits. As a complementary color is added to the original, a

grayish value emerges, which intensifies as the amounts of the colors approach equality, at which point the mixture is gray-black.

Any mixture containing all three primary colors lacks brilliance. Proportions can be controlled to cause it to appear to lean more toward one of the primaries, more toward a neutral gray-black or more toward black.

Degree of saturation is not absolute. It appears to vary depending on the brightness of the backgrounds against which it is set.

Contrast of saturation is the relationship between a fully saturated hue and its less saturated variants.





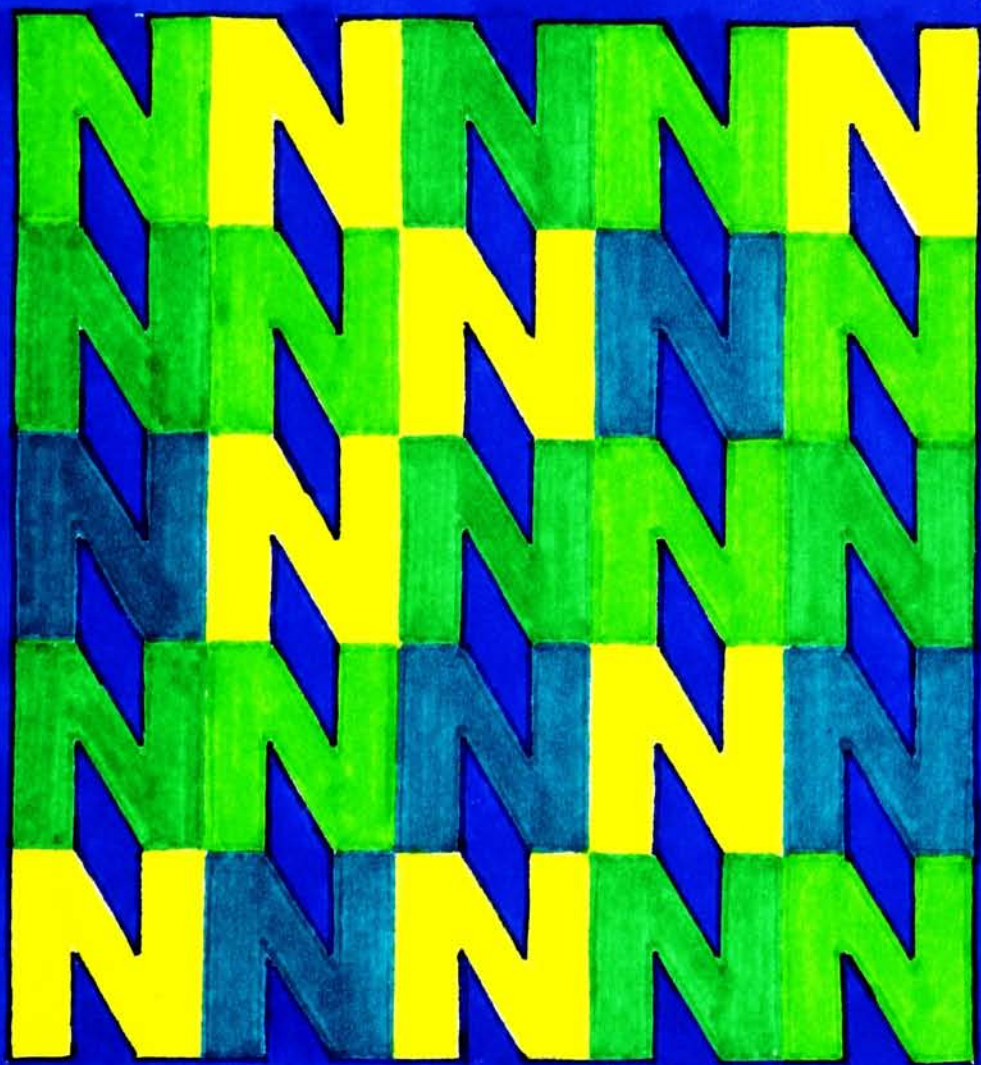
The saturation panel had two distinct generations, the first of which was based on a misunderstanding of the saturation relationship. The first three panels had a blue ground and blue-green, green, yellow-green, and yellow figures. I executed one with a blue, one with a white, and one with a black border. See Exhibits S-1, S-2, and S-3. All of these were in an "N" format. These were rejected because of the lack of blue letters, which I had omitted because of the difficulty engendered by using blue letters and blue ground. In the next panel, I used a white border, added blue as a figure color and used a yellow, blue, and green ground. See Exhibit S-4. This multiple color ground was more visually interesting and the blue letters added visual depth to the panel.

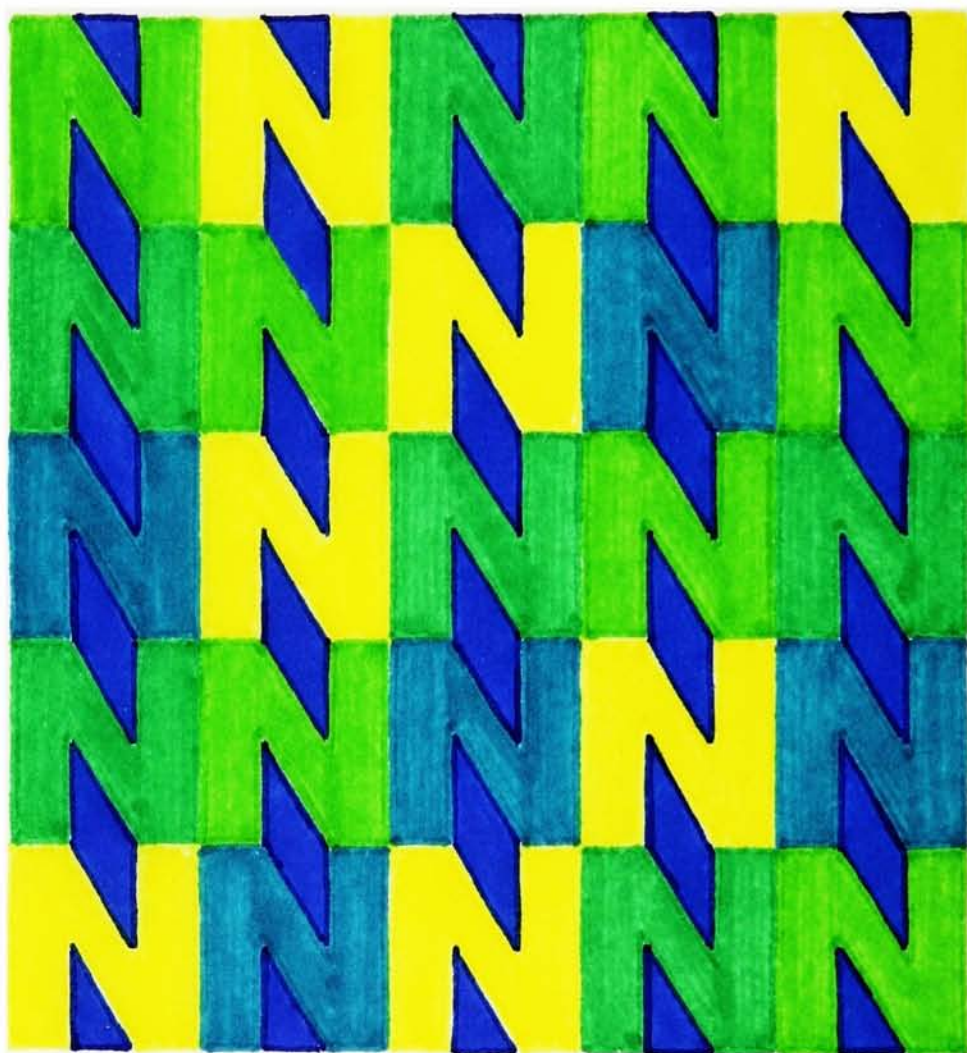
The next version represents the only one of this generation of the saturation panel, as it used a "Z" and "H" format but with the same figure and ground colors. See Exhibit S-5. At this point I realized that I had misunderstood the saturation relationship. The previous panels exhibited a stronger light-dark relationship than a saturation relationship. Further, I realized that in order to illustrate the saturation relationship, I must use neutral gray as an additive color.

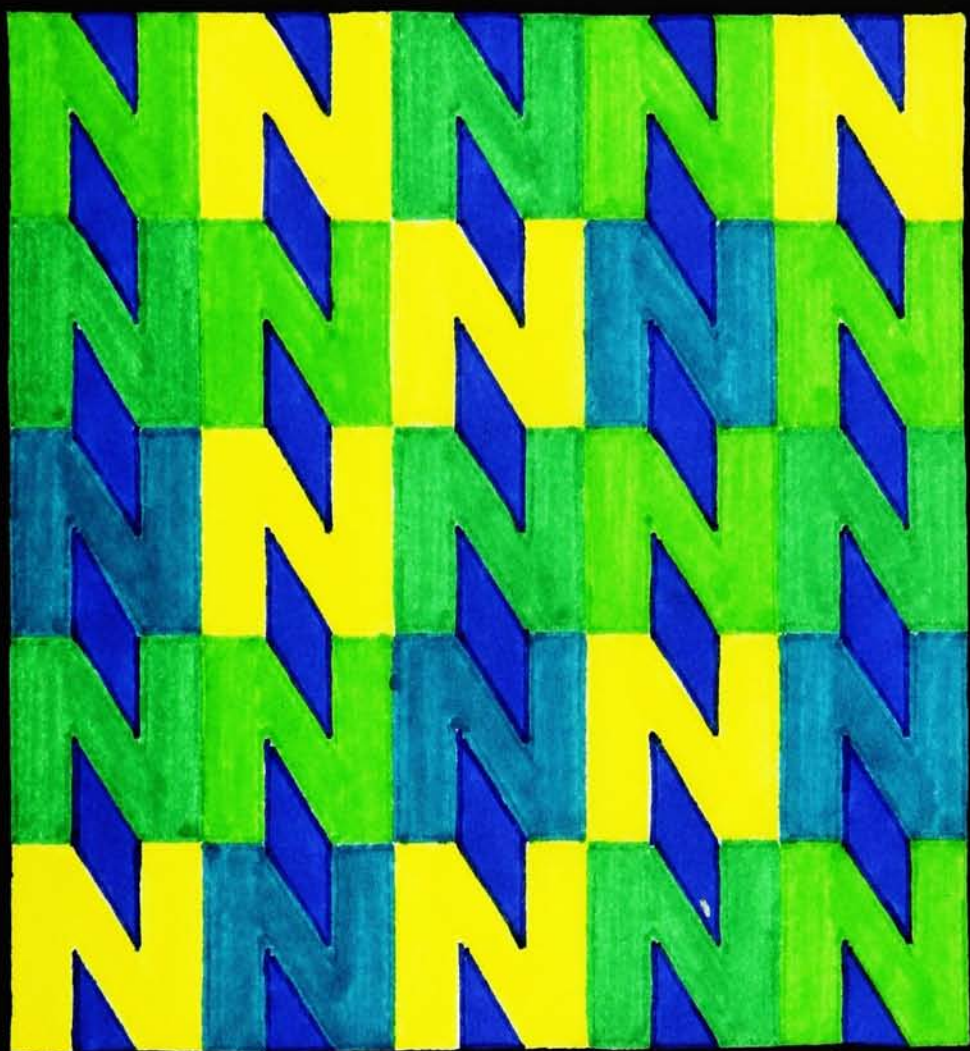
Responding to my perception of this problem, I adopted a wholly new approach using yellow as the predominant color. I assigned each of the colors that had appeared previously a number

based on its color value. Each of those numbers was then assigned to a value of yellow and gray.

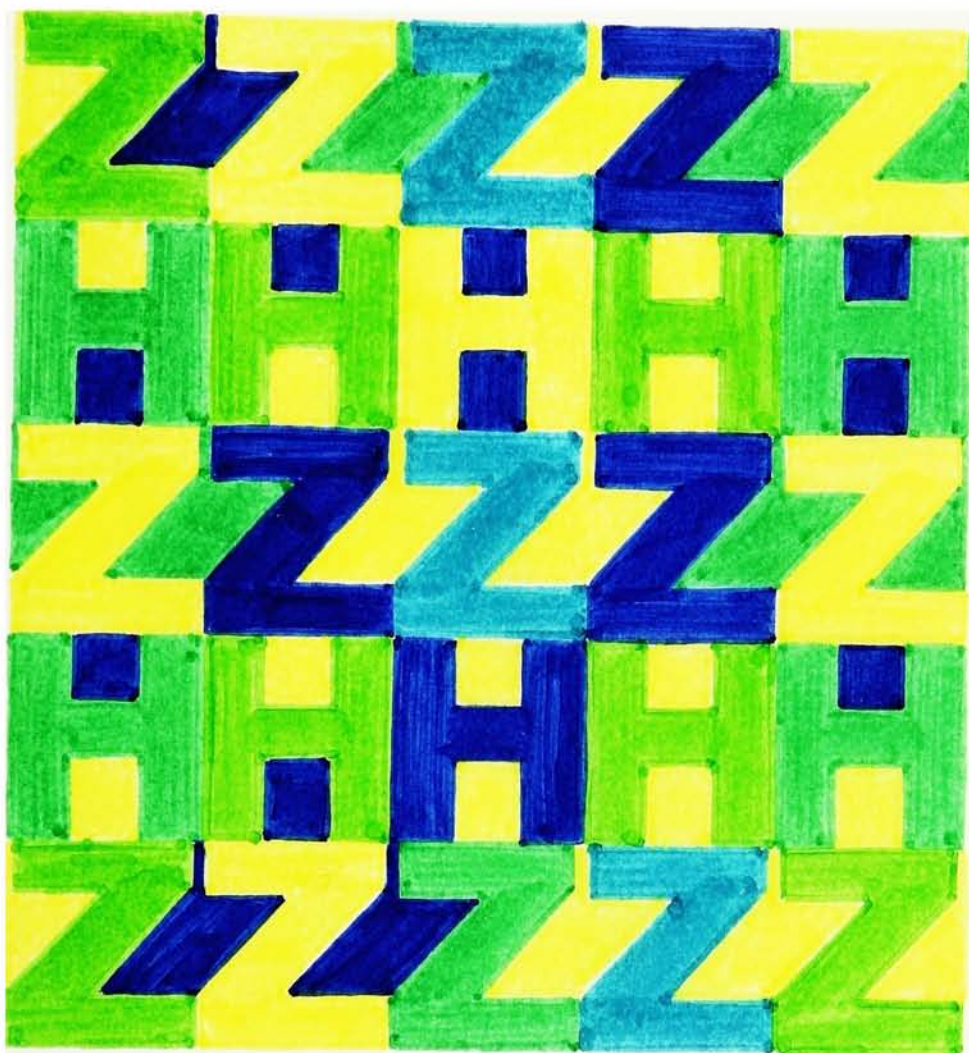
Because of placement issues I transferred the same colors and values into an "N" and "Z" format. See Exhibit S-6. In the final version, the three ground colors, are the three yellow-gray admixtures in the series that are closest to gray. There were still areas of high contrast, but the overall effect was more subdued and illustrated saturation better, without the intrusion of light-dark contrast.

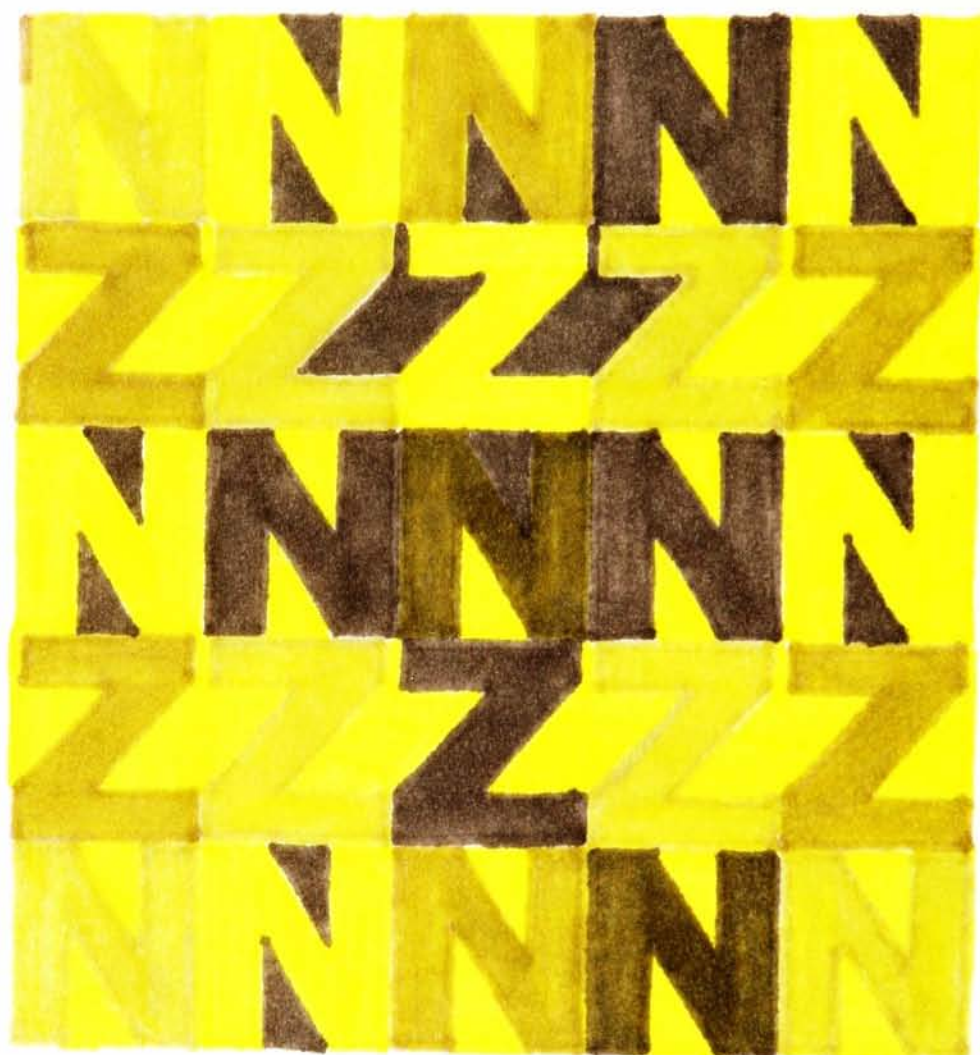
















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Simultaneity

Simultaneity is the effect created when the eye spontaneously generates an absent color while viewing another color.

This phenomenon occurs in many color relationships although it is most strongly stimulated by a pure hue. When a chromatic and achromatic color of equal brilliance touch, this effect makes the achromatic color look like it contains the complement of the chromatic color. Each of two abutting chromatic colors that are nearly complementary will appear to be the exact complement of the other. Complements that border appear to oscillate because of this effect.

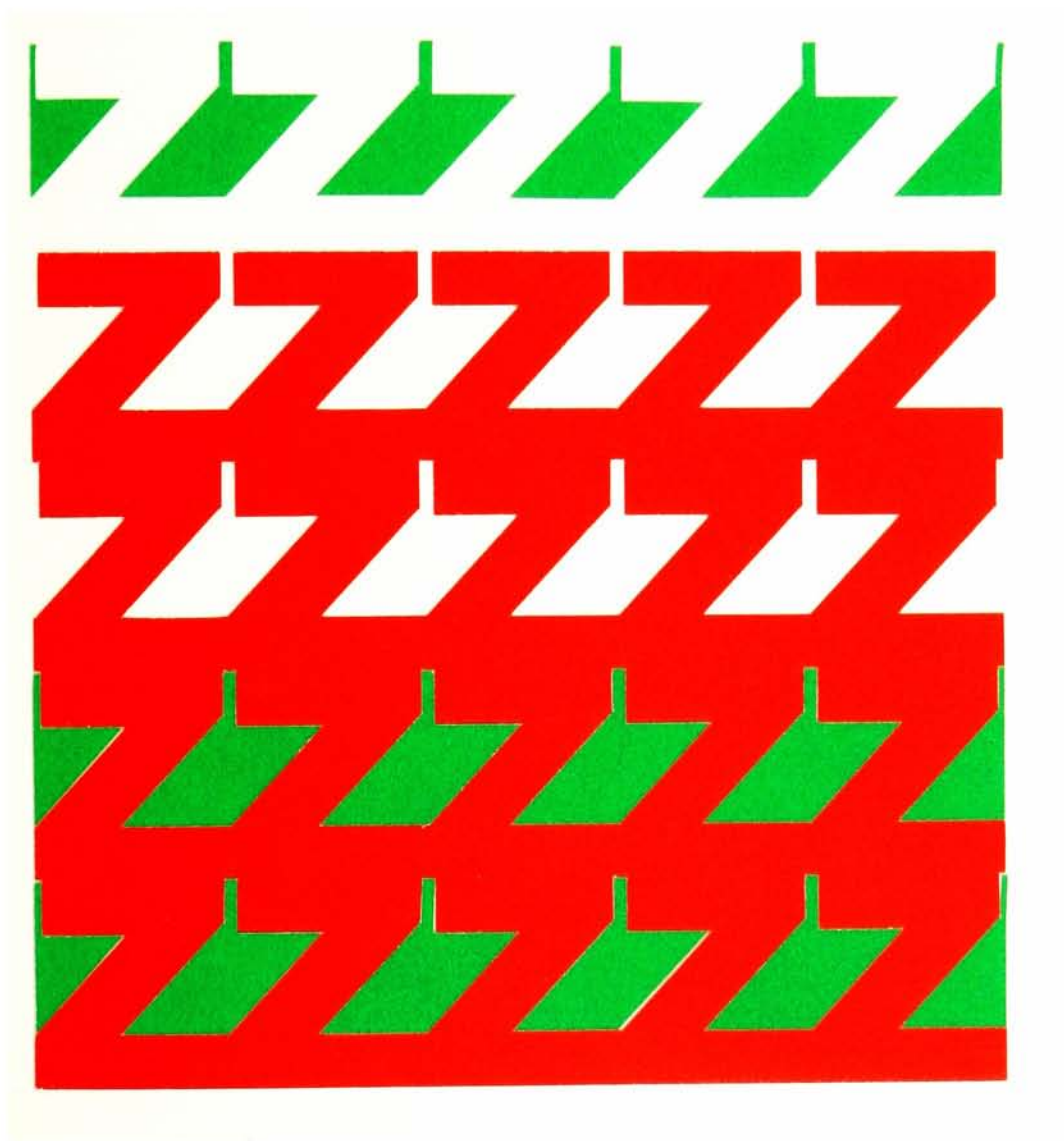
The absent color generated is not always the complement of the existing color. There are two other color relationships in which entirely different phenomena occur. When a light-to-dark sequence within a color is positioned side to side, the border of each segment appears to vibrate as each color attempts to influence the other toward itself. This effect is called successive contrast.

A colored figure with a white ground creates still another illusion. Instead of seeing the complement as the figure on a white ground as the after-image, the figure becomes white and the ground becomes the color. This is called contrast reversal.

Each of the colors in these relationships attempts to influence the other. As this occurs, the original color appears to lose its character while the sensation of the simultaneous hue appears to strengthen. This effect explains why, after staring at a color for a prolonged period and then looking at a white ground, the eye sees a resulting transparent after-image.

The perceived effect of simultaneity is characterized by visual activity of continually changing intensity that causes the colors to oscillate. This vibration is caused subjectively by the eye, not objectively by the colors themselves.





The Simultaneity panel began with a vertical "H", "Z", and "N" format using light gray letters and an all-yellow ground. The yellow and the gray used were equal in value. I investigated one version with a yellow border, one with a white border, and one with a black border. See Exhibits SC-1, SC-2, SC-3.

After further research I determined that by using two colors that are inexact complements, I would achieve a more striking illustration of this relationship. In addition, the original color combination was very similar to that of the saturation panel.

The placement of this panel within the series ultimately required a solution using only "Z"s, and I investigated a number of versions using one color as figure and one color as ground. The first of this group was yellow and light gray, using the same colors that I had employed in the "H", "Z", and "N" version. See Exhibit SC-4. This solution provided very little contrast.

The next two colors with which I worked were blue and yellow-orange. See Exhibits SC-5. These colors were acceptable, and provided an interesting textural effect because of the all-"Z" format.

Interestingly, however, because of the simultaneity effect, when using one of the colors as the figure and one as the ground, they appeared to be perfect complements. Although this was obviously a successful demonstration of the relationship, it

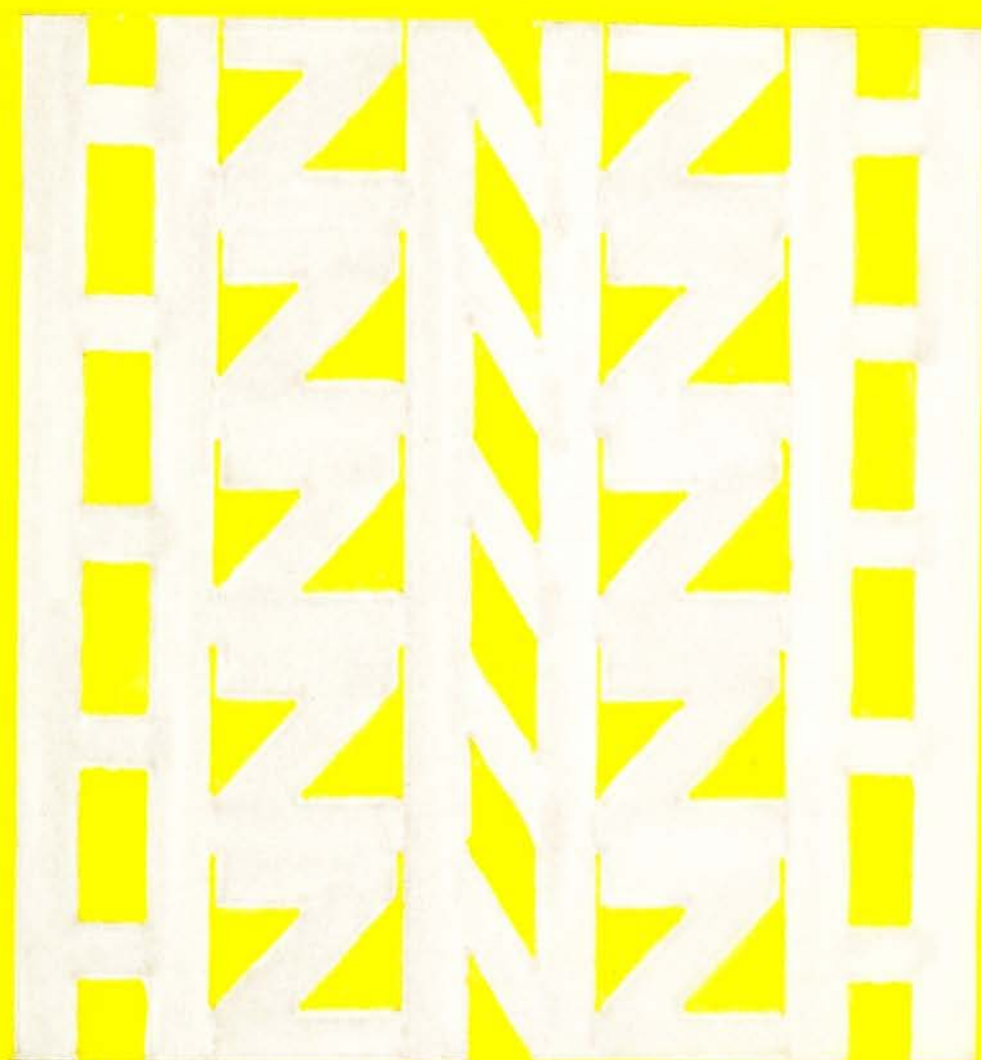
would not be apparent to the viewer who would simply see two colors that appeared to be complements.

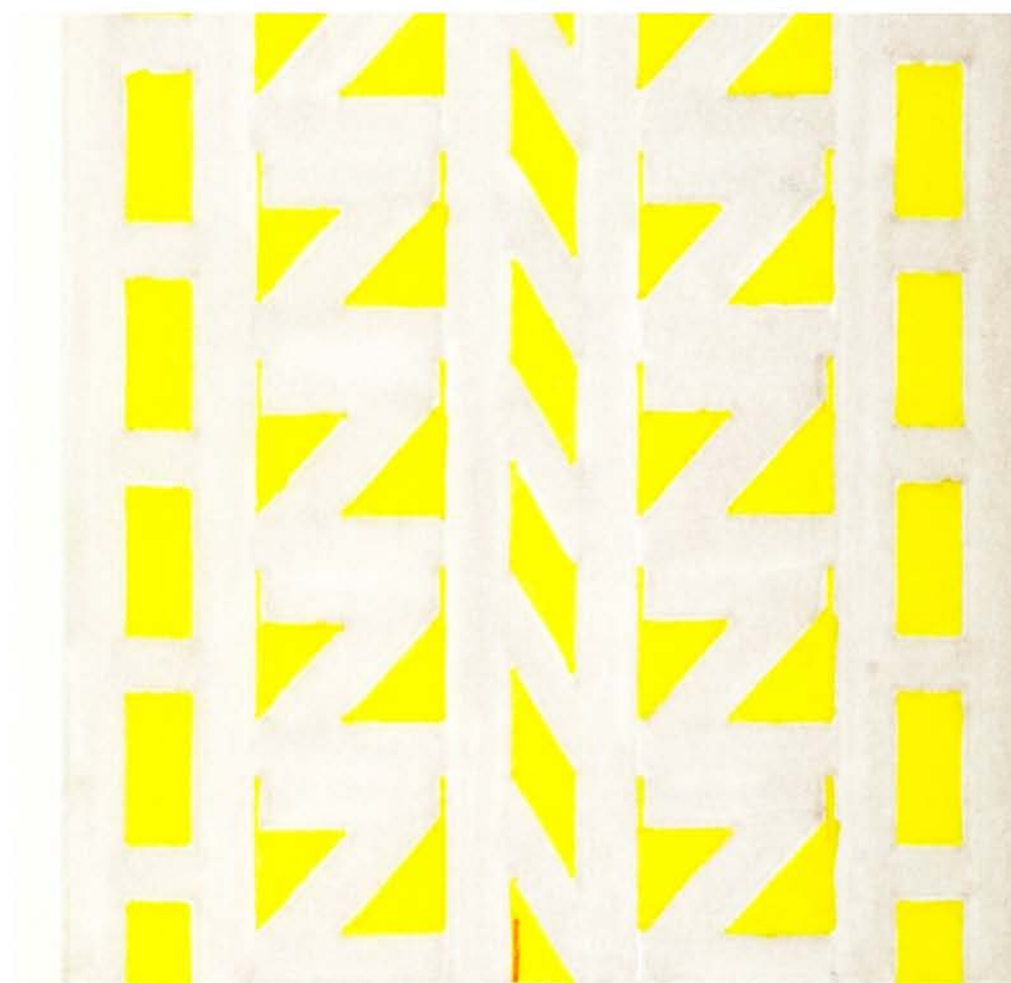
My solution to this problem was to isolate the two colors. Each would appear on a white ground and, in the center only, next to each other, so the viewer would be able to see the operation of the simultaneity effect. See Exhibit SC-5. This first version of the segregated format was essentially vertical.

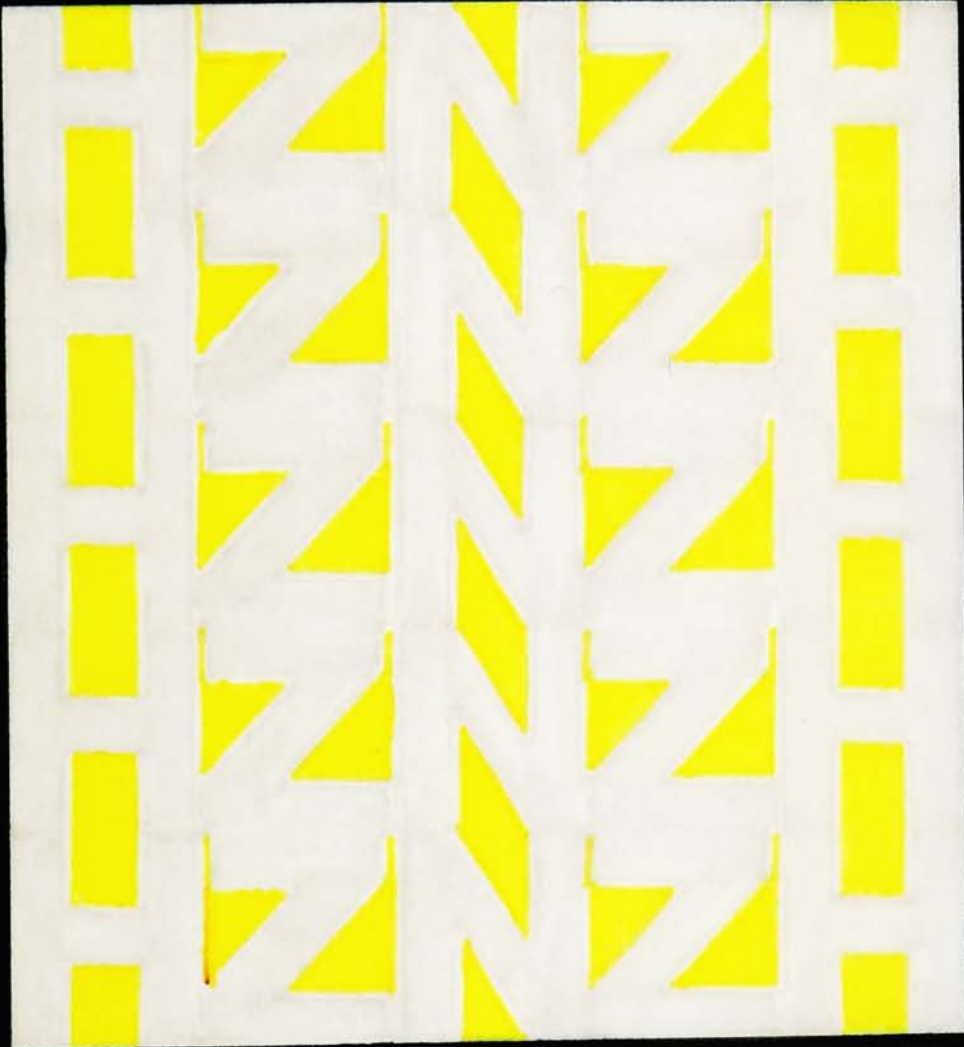
I moved away from these colors while retaining the new format for two reasons. First, and most important, the entire seven panel series was too dark and the blue in this panel contributed to the problem. Second, the blue was so much darker than the yellow-orange that a light-dark relationship began to intrude into the panel, detracting from the simultaneity relationship.

As red and green had been removed from the complementary panel, I experimented with red-orange (warm red) and green. I did several versions in which these colors were isolated. In the first one, I found the pattern to be too dominant. See Exhibit SC-7.

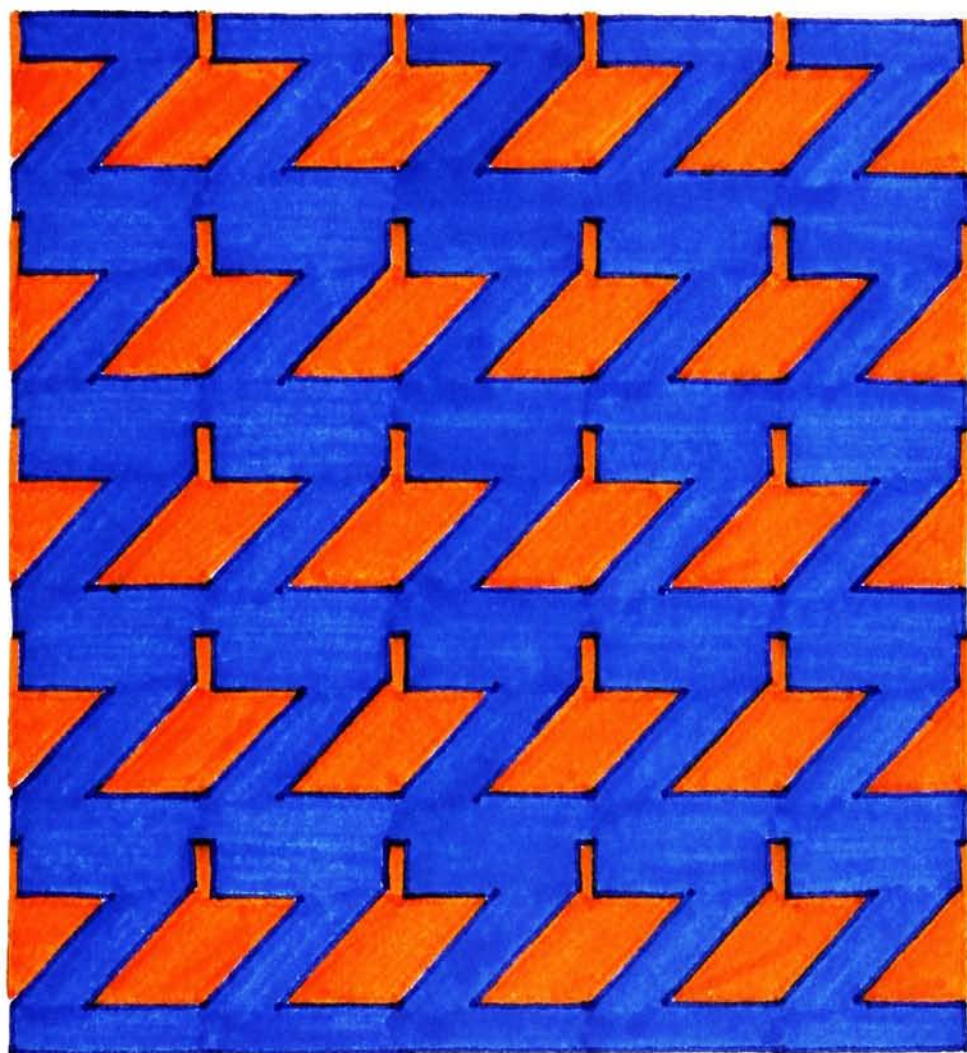
This combination was properly balanced and in the final version I simply reversed the positions of the green and the red-orange for what I felt was a more attractive solution. See Exhibit SC-8. Within the overall series, this solution also had a better relationship to the Cool/Warm panel.

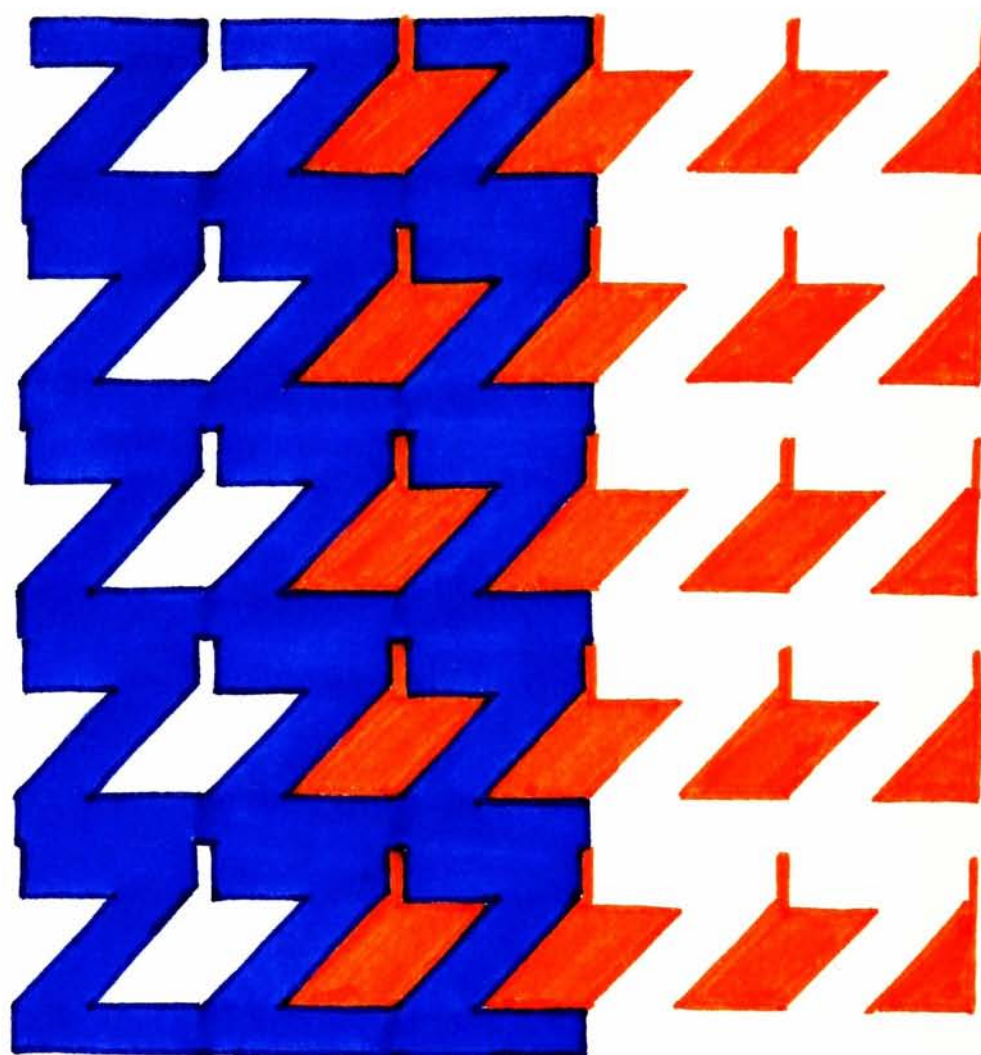


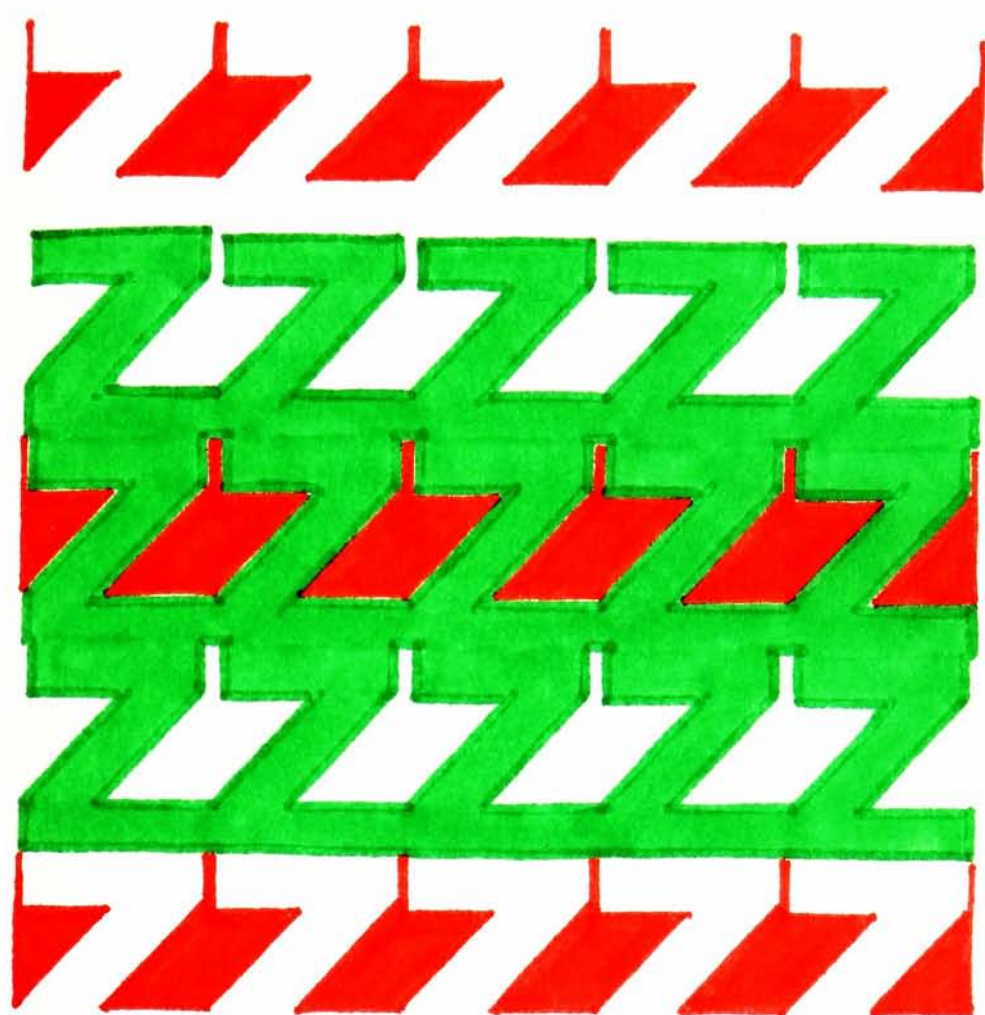


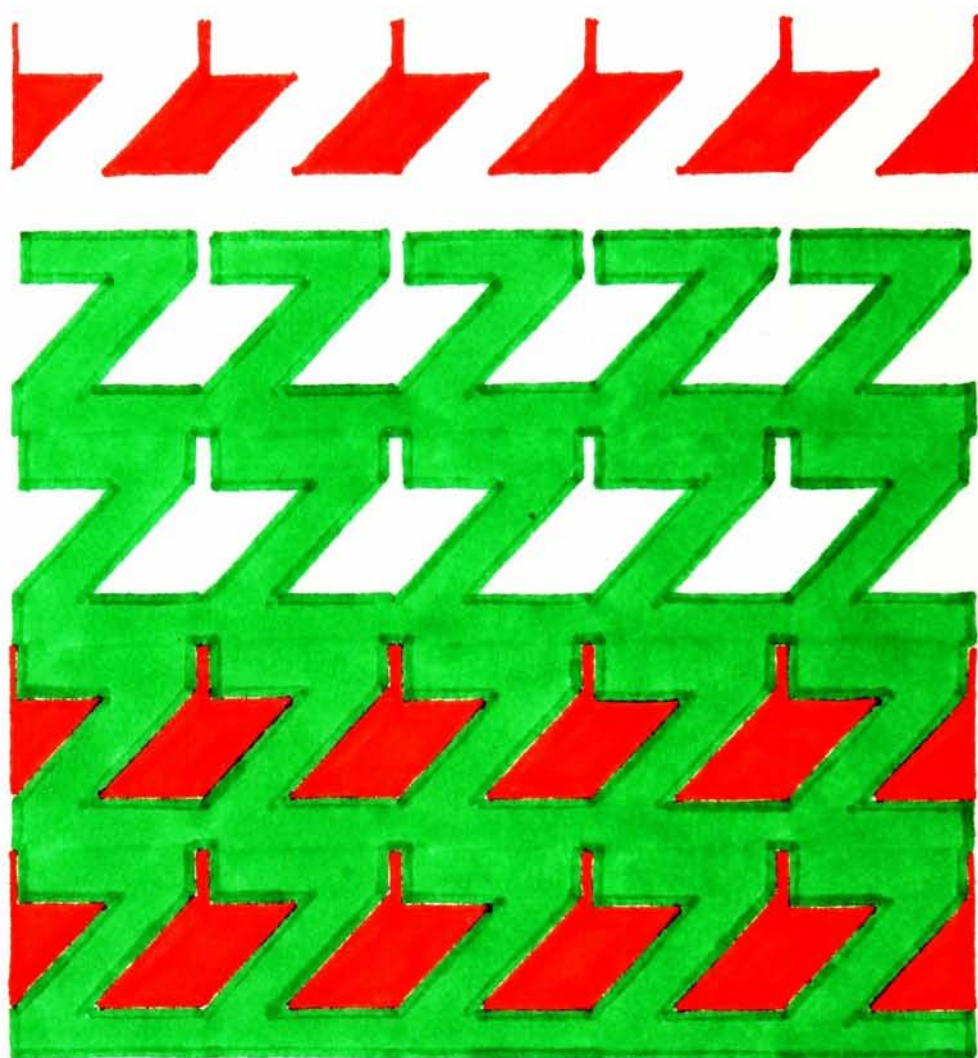






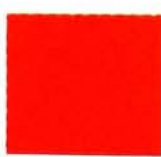








PANTONE®
Yellow U



PANTONE®
Warm Red U



PANTONE®
266U



PANTONE®
320U



PANTONE®
151U



PANTONE®
185U



PANTONE®
Reflex Blue U



PANTONE®
354U



PANTONE®
172U



PANTONE®
Purple U



PANTONE®
293 U



PANTONE®
368U



PANTONE®
403U

Color Proportion

Color proportion, also known as contrast of extension, concerns itself with the volumetric relationship between two or more color areas.

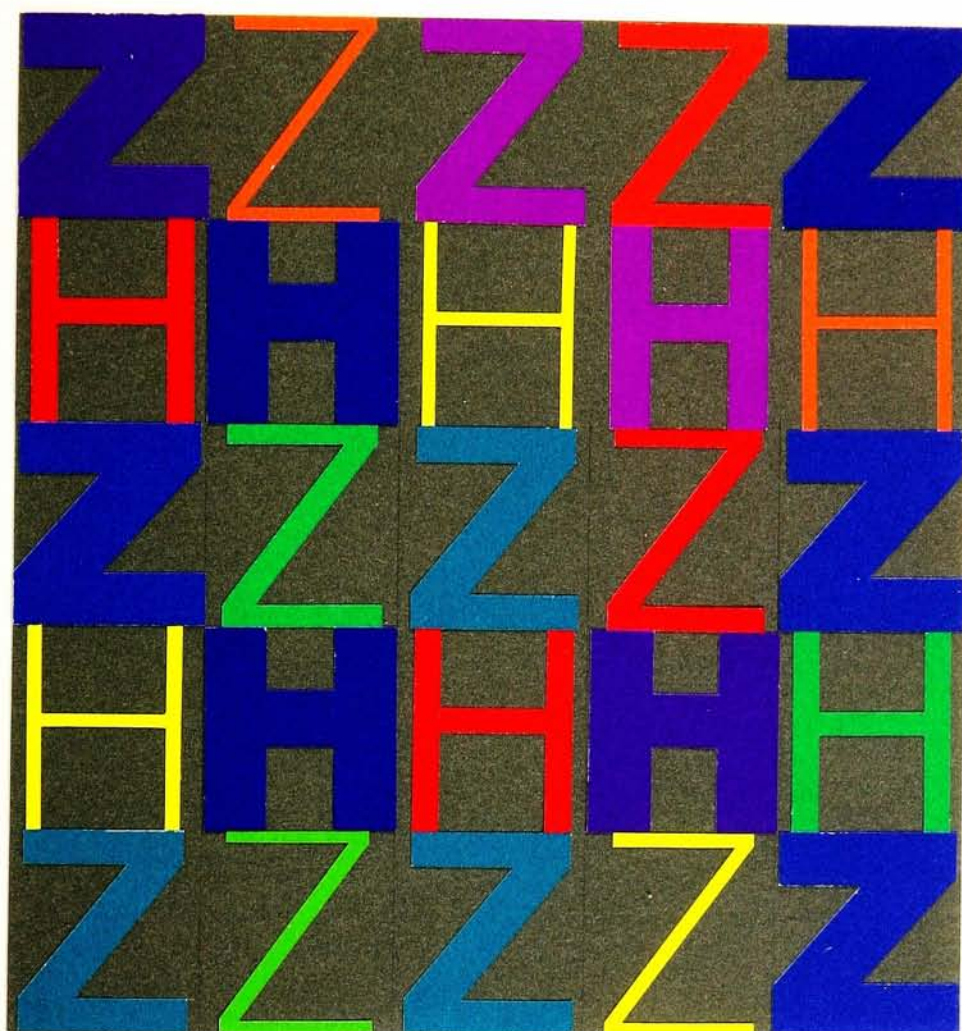
Value of the colors used and volume both interact with the background, as in the example used. Although colors naturally can be applied in areas of any size, there exists a

quantitative relationship between brilliance and volume that allows multiple colors to be used in areas of varying sizes without one color dominating. For two colors of varying brilliance to appear equal in intensity, the volume of each must be inversely related to its brilliance.

The proportional brilliance of one color to another can be expressed through numerical ratios. Under this analysis, each color receives a numerical value. For example, yellow is 9, orange is 8, red and green are both 6, blue is 4, and violet is 3. Yellow is three times as brilliant as violet, orange has twice the brilliance of blue, and red and green are equal. Utilization of the volumetric ratios among colors creates a balance that compensates for differences in brilliances.

When colors are related proportionally, the effect is balanced and sedate. Imbalance in these proportions creates an effect that is lively but somewhat more disturbing.





The Extension panel was the only one in which I worked with a non-repetitive typographic design. Initially, the panel illustrated the inverse relationship between brightness and volume. The figures were yellow and the ground was red, showing that in order to achieve a balanced effect, one needed a smaller volume of yellow to balance the red. I use a vertical "N", "Z", and "H" typographic format with a red, a white, and a black border. See Exhibits E-1, E-2, and E-3. The red border had too much red in relation to yellow and thereby destroyed the balance of the panel, and the black border had a darkening influence on the ground color.

I then experimented with a new format that contained regular, medium, and bold letterforms, See Exhibit E-4. The red-violet in this version was still too dark and I decided to change the layout to conform more closely to the others in the overall series, i.e. a more regular pattern was developed.

I reversed figure and ground, using black as the figure and various colors as the ground to see what influence black would have on similar shapes in different colors. See Exhibit E-5. Although the textural pattern was interesting, the black letters overshadowed the rest of the panel. More importantly, this version did not provide an illustration of contrast of extension.

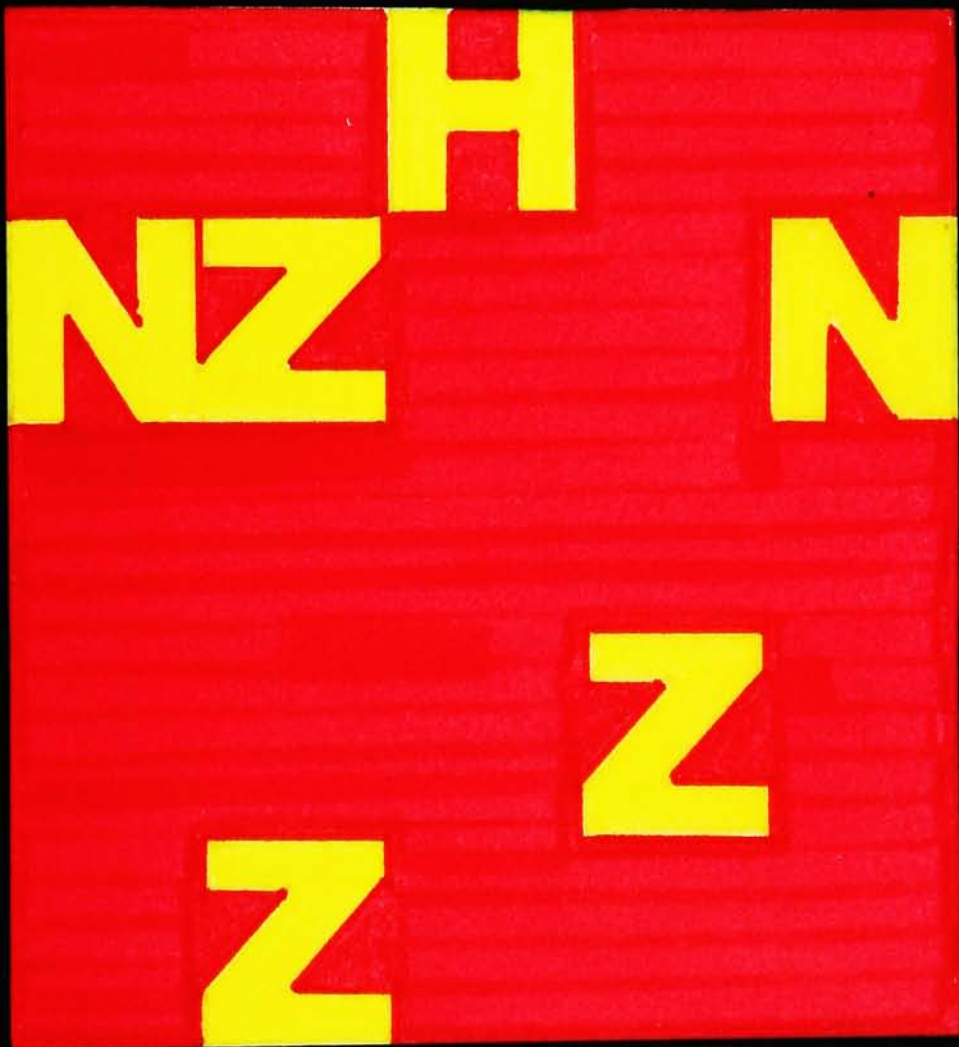
Returning black to the ground, I assigned each color a numerical value from 1-4, based upon its brilliance. This four-value scheme is analogous to the four typeweights. Hence, a

color designated as a "1" would have the lightest (thinnest) typeweight and a "4" would have the heaviest typeweight to compensate for its lack of brilliance. See Exhibit E-6.

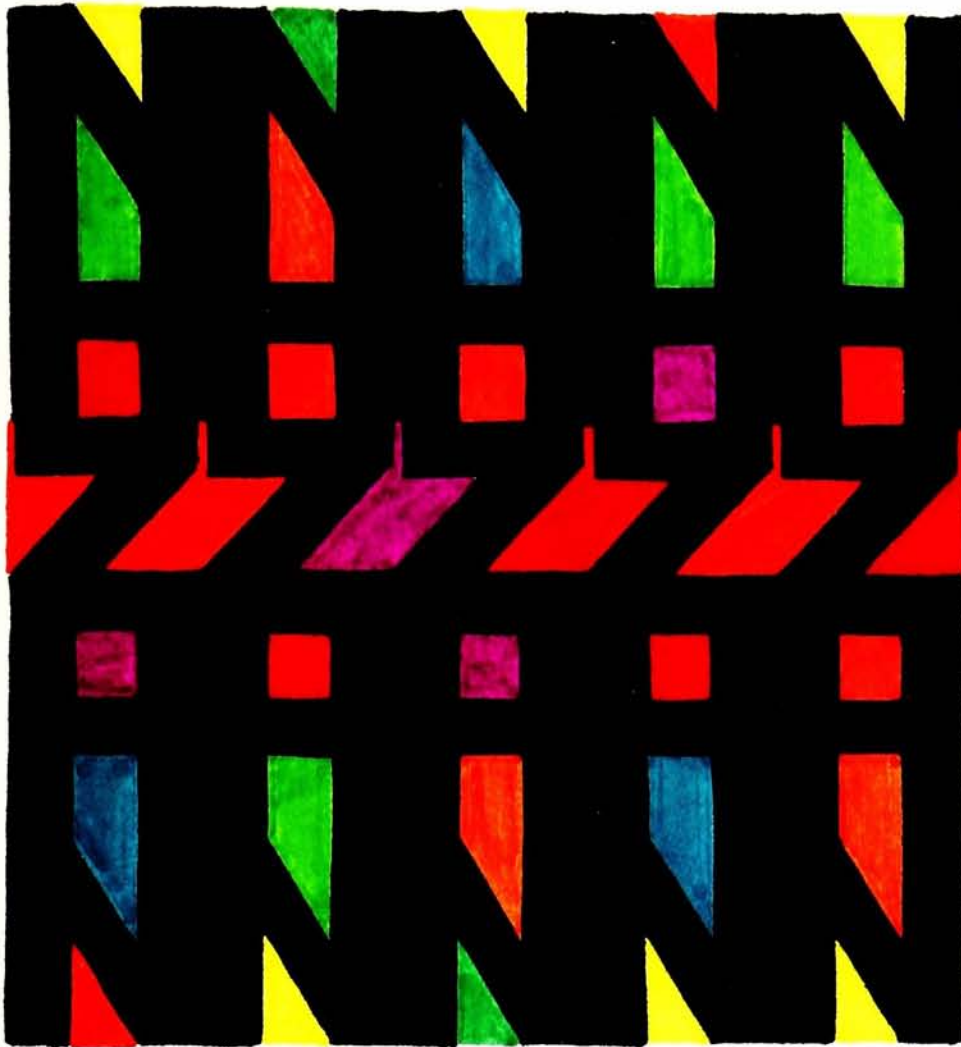
Upon further review of my research I realized I had taken a false path using black as a ground. Using black as a ground lessens the brilliance of dark colors and heightens the brilliance of bright colors. A mid neutral-gray should have been used because it does not influence the brilliance of colors.

NZ^H N
z z

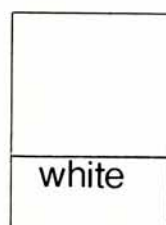












white



PANTONE®
290U



PANTONE®
291U



PANTONE®
292U



PANTONE®
293U



PANTONE®
294U



PANTONE®
295U



PANTONE®
296U



PANTONE®
Black U

Light-dark Contrast

Light-dark contrast is most dramatic when white and black, the achromatic poles, are used to illustrate it.

Of the chromatic colors, the complementary pair of yellow and violet exhibit the most striking light-dark relationship.

Compositions that show this contrast can be created with many color combinations. These include: white, black, and grays; white, black or gray with chromatic colors; tints and shades of a particular hue; and pure hues such as yellow and violet.

A complication arises when using pure hues to illustrate this contrast because a hue's value varies with the intensity of external illumination. Red, orange, and yellow appear darker in reduced light, while blue and green look lighter.

When several colors are used together, an illusion of depth can be achieved. Grouping of colors similar in lightness or darkness causes different planes to emerge. For example, a grouping of light colors appears to be on a

higher plane than the remainder of the composition. If tones are not segregated by lightness, then a flat overall effect is achieved.

Although gradations in brilliance among achromatic colors are easily distinguished, as are those within tints and shades of one chromatic hue, when different hues are compared, perceptual problems arise. Careful observation is necessary to identify colors of equal brilliance so that desired effects are not distorted.

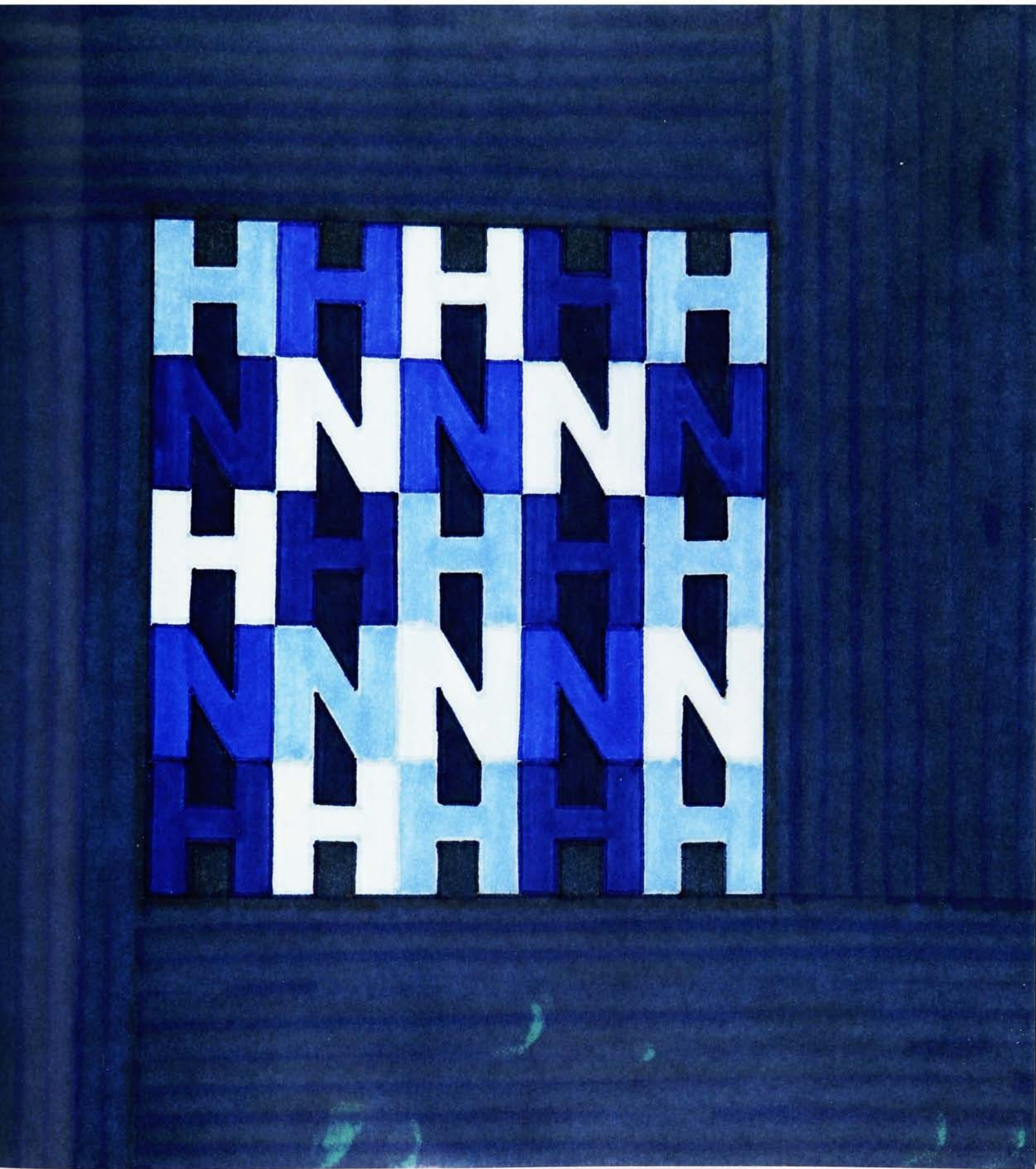




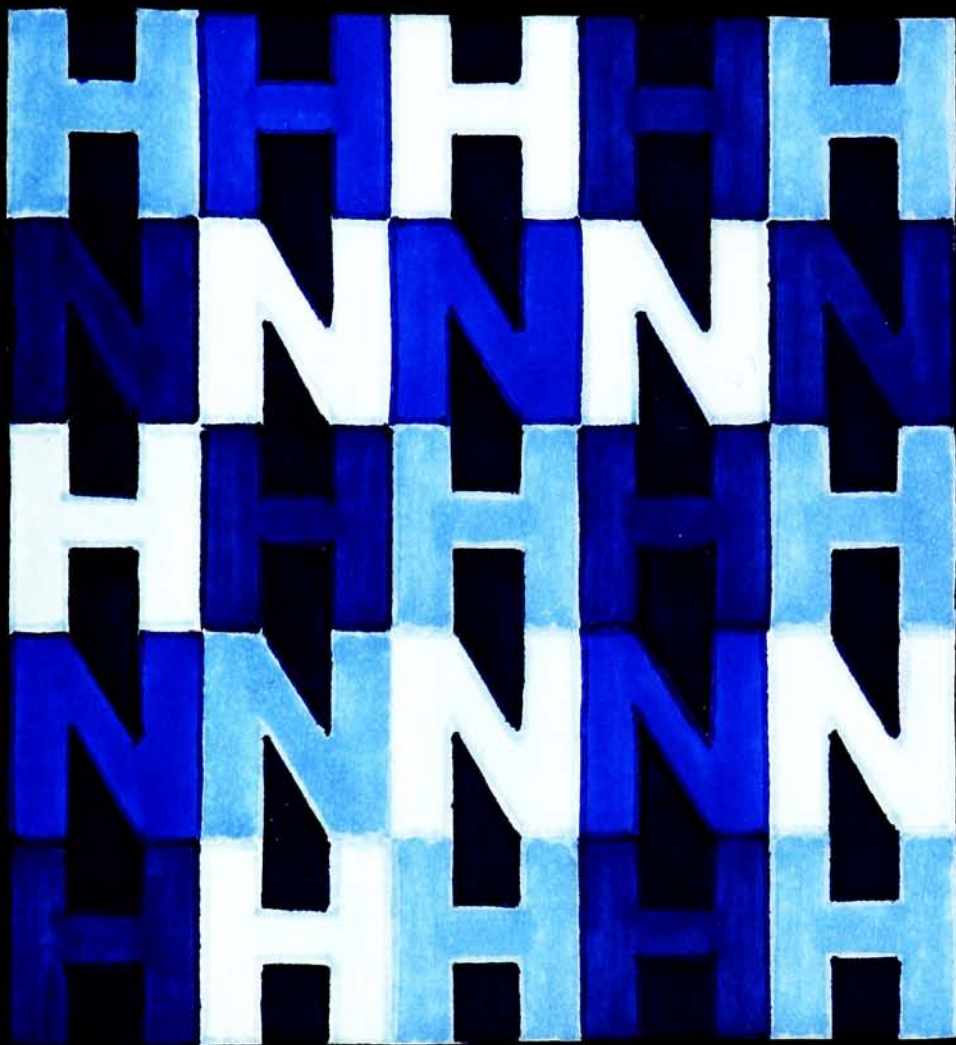
The light/dark panel utilized essentially the same colors throughout its development. In the first version the figures were light blue, mid-blue, blue, and dark-blue with a ground that was entirely blue-black. I did this with a blue-black, a white, and a black border. See Exhibits L/D-1, L/D-2, and L/D-3. Next I added white to the figures and replaced the blue-black ground with dark-blue, mid-blue, and white. See Exhibit L/D-4.

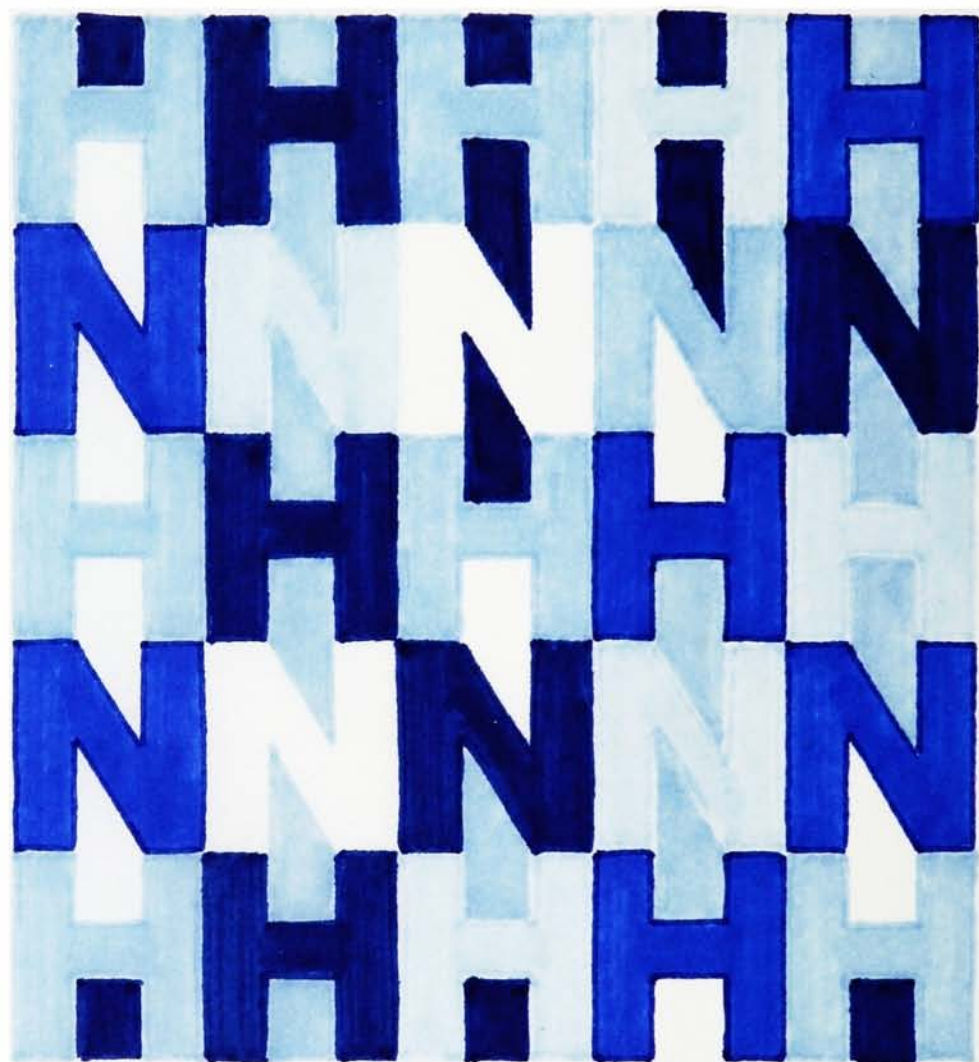
To balance the volume of white figures, I added a black figure and added more white to the ground. See Exhibit L/D-5.

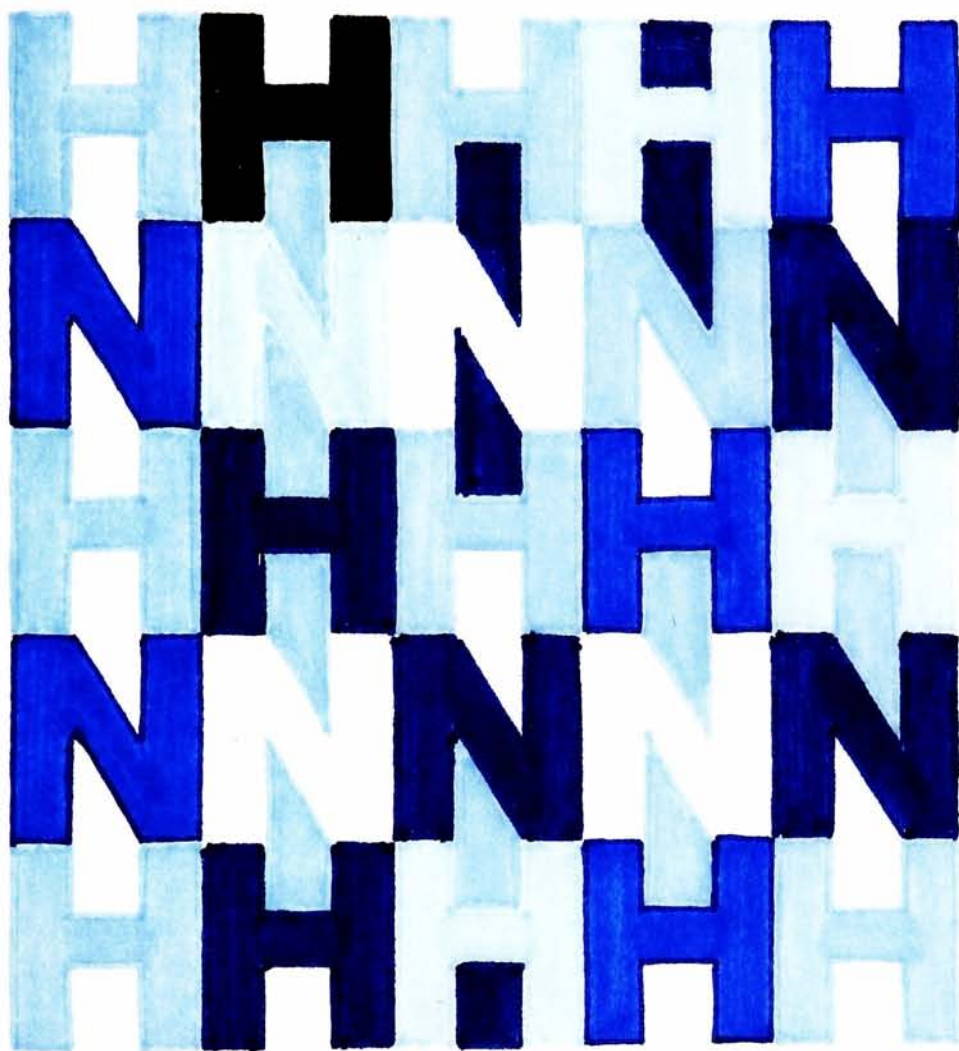
Up through this point, the letters had been "H" and "N" reading horizontally, but because of the overall series order, I changed to "N", "H", and "Z", while retaining the color positions of the figures. Because of the typographical change, I reinvestigated the position of the colors in the ground although the actual colors stayed the same.













IX. Informational Panels

Each of the seven color panels has a separate associated information panel. The purpose of these panels was to give a concise explanation of each of the seven color relationships so that the viewer would understand the associated color panel. The language was written in such a way as to be clear to the lay audience. Each informational panel was also visually identified with its color panel for the viewer's comprehension.

I determined that the overall dimensions of the substrate of the information panels would be the same as that of the substrate of the color panels. First I wrote a draft of the copy for the information panels. This gave me some idea of how much copy would be included on each panel. A clear statement describing each of the color relationships required between 1000 and 2400 characters.

After writing the copy, I decided on nine point type with three points of line spacing. I decided on this type specification based on research and review of many examples of body copy. This specification was large enough to be read easily, but small enough to fit within the viewer's area of focus.

I used a four column layout with two twelve point units for each margin and one twelve point unit for each gutter (See Ill.5). This layout was based upon a square modular grid composed of sixteen modules. Each square module was composed of

121 twelve-point units: fifteen across and fifteen down. The line length of a four column layout with this size type was easy to read, lacking the distraction of a layout with more columns in which the eye must travel continually up and down the page, or a layout with fewer columns and longer lines, in which the eye must travel a long distance across the page.

Further, a one-column or two-column layout lacked the figure-ground interest of a multi-column layout such as this one. After establishing this layout, I developed a headline and body copy horizon line which were placed consistently throughout the informational panels. Initially the headline was to be a medium typeweight and the copy was to be a regular typeweight. The headline was medium typeweight for emphasis and the copy was regular type weight, which is easy to read in a columnar format.

This first series of black and white panels served as sketches for later developments of the informational panels. Looking at the overall appearance of each panel, each would contain a white (substrate) area, a gray (copy) area, and a black (headline) area. Because of the "color" variation, each section of the panel would appear to be on a different plane. The relatively large volume of white made it the ground. The value of the body copy made it the midground. Finally, the boldness of the typeface in the headline made it the foreground. Naturally, these depth relationships were relative to each other rather than absolute.

Using linespacing as a typographic element, in each case I separated the first sentence of copy from the remainder of the text. Between paragraphs, I added an additional linespace.

I manipulated the copy so that column lengths varied. All headlines remained in the same position in the upper left quadrant, flush with the left margin. The headline was immediately above, and the same length as, the left column of body copy -- simply one module higher. This placement allowed the headline to provide an introduction to the body copy.

Looking at the informational panels as a group presented in a horizontal row, the headline and copy horizon line remained constant throughout. Each panel, however, displayed a different gray/white, or figure-ground relationship based on the variance in length of columns and overall quantity of type. See Exhibit TS-1.

After developing this black and white series, using an identical layout and format, I developed a color series. See Exhibit TS-1.1 - TS-1.7.

In the headline space, I placed a graphic band that I will refer to as the "header," consisting of a line of two, three, four or five characters from the associated color panel. Beneath the header was a narrow band of color which I will refer to as the head-line. This created a variation in length of the headline that had not existed in the black and white sketch series. These characters were in the color palette of the color

relationship panel, but not necessarily in the particular color or color in which they appeared on the color panel itself. The use of the characters from the color panels gave the information panels visual continuity with their respective color panels.

In each panel the body copy was only one color. This color was not necessarily identical to that in the head-line, and was in most cases identical to at least one of the colors that appeared in the header band. In the extension panel, the color of the body copy was the same as that of the head-line and header.

Each of the information panels in this series also contained a background color that illustrated the color relationship described in the panel but provided a contrast with the body copy, head-line, and header colors. The hue, (TS-1.1), complementary, (TS-1.2), cool-warm, (TS-1.3), and light-dark, (TS-1.7), panels all had both figure and ground colors taken from their respective color panels. In saturation, (TS-1.4), and extension, (TS-1.6) I investigated the use of colors that did not appear in the color panels but that still illustrated the color relationships.

After completing this color series, I rejected this strong horizontal format because there was too much tension between the strength of the horizontal element and the vertical-reading columns. In order to lessen the horizontal emphasis, I changed to an overall vertical format. In other words, the panels were

to be displayed in a vertical, rather than a horizontal, row. In addition, I made changes within the panels themselves. At this same time I made a corresponding change from a vertical to horizontal format within each of the color panels which is described earlier in the Seven Color Relationships section.

In addition to the changes within the color panels I moved to a different overall exhibit format consisting of seven panels down and two across (information panel and color panel) instead of three panels down and seven across.

A new overall layout was developed through black and white sketches in which the headers and head-lines occupied various geographical locations within the panels, rather than remaining in the upper left quadrant they had previously occupied. See Exhibit TS-2.

In order to visualize how this new system would look in a color format, I investigated the first six color relationships: hue, (TS-2.1), complementary, (TS-2.2), cool-warm, (TS-2.3), saturation, (TS-2.4), extension, (TS-2.5), and light/dark. See TS-2.1 - 2.6. In this investigation, the header was identical in color and characters to the bottom row of characters in the associated color panel. The ground was a less-saturated color taken from a color in the color panel, except in extension, (TS-2.5). In the information panel for hue, (TS-2.1), the copy is violet and the head-line is red. Both of these colors appeared

in the header. The pale yellow ground was drawn from the lightest color that appeared in the color panel.

The cool-warm panel, (TS-2.3), used pale red-violet for the ground, with blue-green copy, and a fully-saturated red-orange head-line. The complementary panel, (TS-2.2), used a pale gray ground, red body copy and a green head-line.

In each panel of this series, the ground color is the lightest one that appears in the panel, while the head-line is darker, and the copy is the darkest of the three. In the complementary panel, (TS-2.2), although red and green are equally brilliant, the red was easier to read on the ground color chosen, so I used it for the body copy and used green for the headline.

It is easier to read dark copy on a light ground than vice versa, and legibility was a primary concern in the information panel series.

I did not investigate all seven color relationships in this color series because after completion of the three panels, I detected some problems that needed to be corrected in the area of layout. The shape relationship among the header, the copy, and the ground was too visually basic and required development to increase visual interest.

In this series I moved all headers to the lower right quadrant, where they remained through the final version. This movement necessitated a change in the header from the characters contained in the top row of the color panel to the characters in the bottom row. I separated the headline and the header for additional interest.

The final series of sketches had both horizontal and vertical continuity among themselves as well as with the color panels. Vertical continuity was a result of positioning of the columns of body copy and margins. Horizontal continuity grew from placement of the header, the head-line and the first line of copy in each column.

Because of the originally planned presence of the photo panels, the credit captions were placed in such a way as to provide horizontal continuity with the information panels. The three lines of copy in these sketches on the extreme right

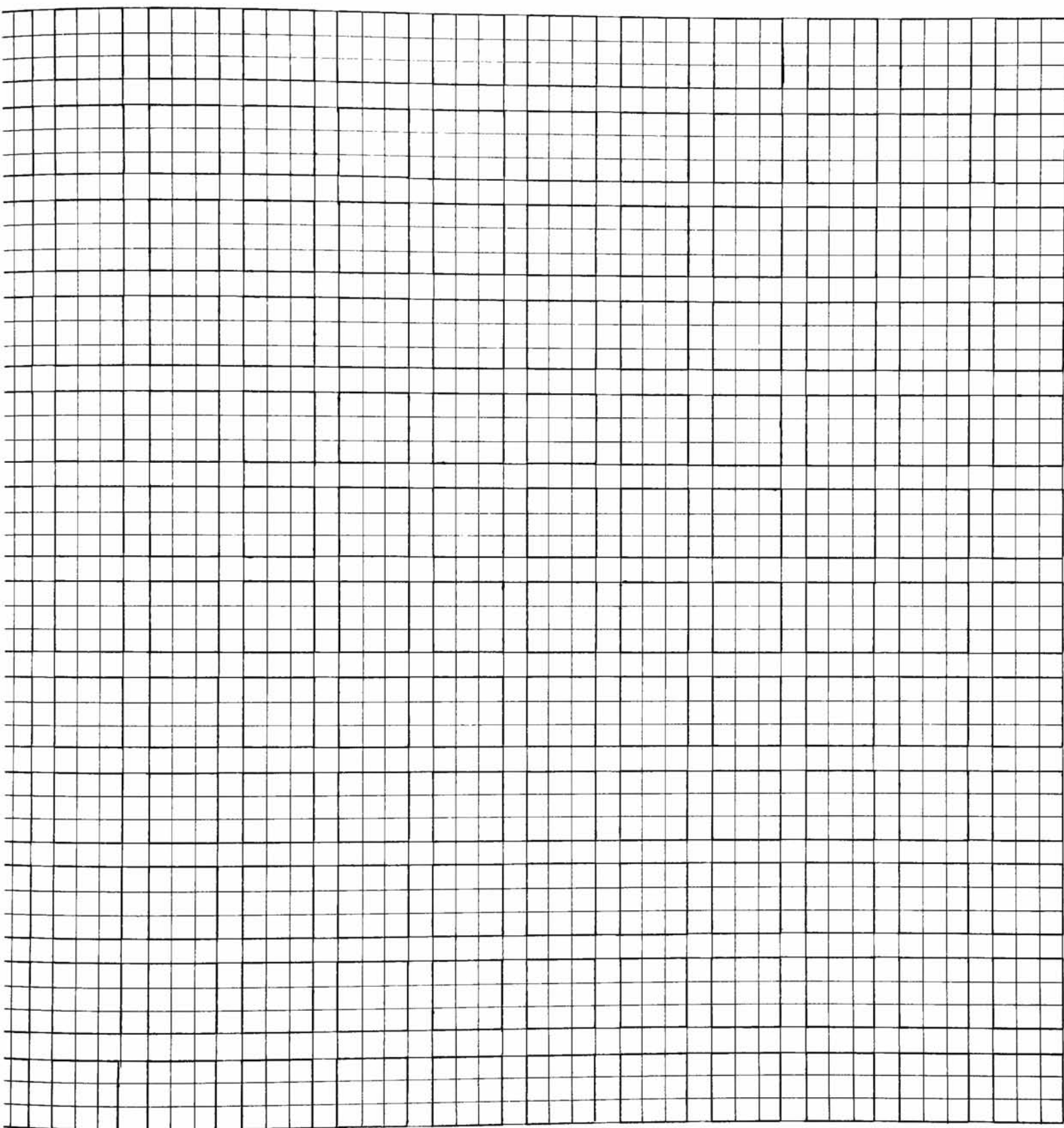
represent the credit captions. There is a progression in placement of those captions that also adds continuity to the series.

This black and white sketch series developed into the final version of the informational panels. See Exhibit TS-2.1 - 2.6. The concept of light-color ground, mid-color head-line, and dark-color type, continued in this series with the exception of the extension panel. This panel used a dark (black) ground and light copy but retained the mid-color headline. This reversal was necessitated by the interplay between black ground and color figures that identified and characterized the Extension color panel, before I made my ground color correction from black to gray.

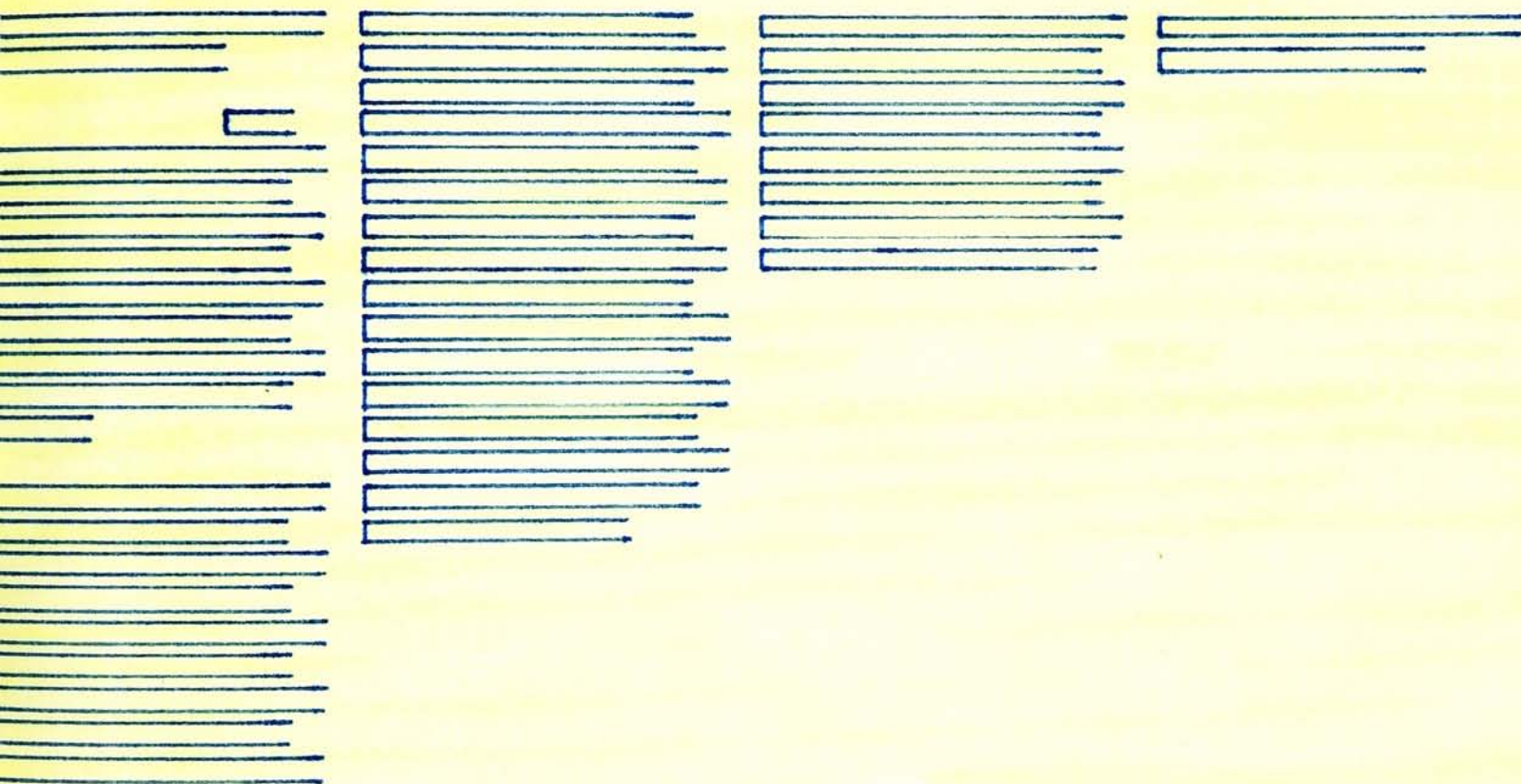
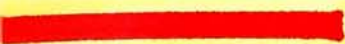
This series could have been the final version of the information panels except for practical cost considerations. The cost of producing these seven panels in this color version was prohibitive. Accordingly, in the exhibit version, I retained the grid and the layout, using black type, black head-lines, and white ground. The only color that appeared in the panel was in the header, which still consisted of the bottom row of characters of the associated color panel.

Interestingly, this provided another level of continuity with the color panels, which in their final version have a white border. The black on white format was easier to read, on the whole, than any of the color versions because of the high

contrast. In addition, elimination of the ground color did not detract substantially from continuity because typically, the light ground was not identical, at least in degree of saturation, to any of the colors in the associated color panel. Upon reflection, had cost been no object, it may well have developed that the final version of the information panels would have had a white ground, color body copy, color head-lines, and color headers.



	<p> 1970-1971 1971-1972 1972-1973 1973-1974 1974-1975 1975-1976 1976-1977 1977-1978 1978-1979 1979-1980 1980-1981 1981-1982 1982-1983 1983-1984 1984-1985 1985-1986 1986-1987 1987-1988 1988-1989 1989-1990 1990-1991 1991-1992 1992-1993 1993-1994 1994-1995 1995-1996 1996-1997 1997-1998 1998-1999 1999-2000 2000-2001 2001-2002 2002-2003 2003-2004 2004-2005 2005-2006 2006-2007 2007-2008 2008-2009 2009-2010 2010-2011 2011-2012 2012-2013 2013-2014 2014-2015 2015-2016 2016-2017 2017-2018 2018-2019 2019-2020 2020-2021 2021-2022 2022-2023 2023-2024 2024-2025 2025-2026 2026-2027 2027-2028 2028-2029 2029-2030 2030-2031 2031-2032 2032-2033 2033-2034 2034-2035 2035-2036 2036-2037 2037-2038 2038-2039 2039-2040 2040-2041 2041-2042 2042-2043 2043-2044 2044-2045 2045-2046 2046-2047 2047-2048 2048-2049 2049-2050 2050-2051 2051-2052 2052-2053 2053-2054 2054-2055 2055-2056 2056-2057 2057-2058 2058-2059 2059-2060 2060-2061 2061-2062 2062-2063 2063-2064 2064-2065 2065-2066 2066-2067 2067-2068 2068-2069 2069-2070 2070-2071 2071-2072 2072-2073 2073-2074 2074-2075 2075-2076 2076-2077 2077-2078 2078-2079 2079-2080 2080-2081 2081-2082 2082-2083 2083-2084 2084-2085 2085-2086 2086-2087 2087-2088 2088-2089 2089-2090 2090-2091 2091-2092 2092-2093 2093-2094 2094-2095 2095-2096 2096-2097 2097-2098 2098-2099 2099-2100 2100-2101 2101-2102 2102-2103 2103-2104 2104-2105 2105-2106 2106-2107 2107-2108 2108-2109 2109-2110 2110-2111 2111-2112 2112-2113 2113-2114 2114-2115 2115-2116 2116-2117 2117-2118 2118-2119 2119-2120 2120-2121 2121-2122 2122-2123 2123-2124 2124-2125 2125-2126 2126-2127 2127-2128 2128-2129 2129-2130 2130-2131 2131-2132 2132-2133 2133-2134 2134-2135 2135-2136 2136-2137 2137-2138 2138-2139 2139-2140 2140-2141 2141-2142 2142-2143 2143-2144 2144-2145 2145-2146 2146-2147 2147-2148 2148-2149 2149-2150 2150-2151 2151-2152 2152-2153 2153-2154 2154-2155 2155-2156 2156-2157 2157-2158 2158-2159 2159-2160 2160-2161 2161-2162 2162-2163 2163-2164 2164-2165 2165-2166 2166-2167 2167-2168 2168-2169 2169-2170 2170-2171 2171-2172 2172-2173 2173-2174 2174-2175 2175-2176 2176-2177 2177-2178 2178-2179 2179-2180 2180-2181 2181-2182 2182-2183 2183-2184 2184-2185 2185-2186 2186-2187 2187-2188 2188-2189 2189-2190 2190-2191 2191-2192 2192-2193 2193-2194 2194-2195 2195-2196 2196-2197 2197-2198 2198-2199 2199-2200 2200-2201 2201-2202 2202-2203 2203-2204 2204-2205 2205-2206 2206-2207 2207-2208 2208-2209 2209-2210 2210-2211 2211-2212 2212-2213 2213-2214 2214-2215 2215-2216 2216-2217 2217-2218 2218-2219 2219-2220 2220-2221 2221-2222 2222-2223 2223-2224 2224-2225 2225-2226 2226-2227 2227-2228 2228-2229 2229-2230 2230-2231 2231-2232 2232-2233 2233-2234 2234-2235 2235-2236 2236-2237 2237-2238 2238-2239 2239-2240 2240-2241 2241-2242 2242-2243 2243-2244 2244-2245 2245-2246 2246-2247 2247-2248 2248-2249 2249-2250 2250-2251 2251-2252 2252-2253 2253-2254 2254-2255 2255-2256 2256-2257 2257-2258 2258-2259 2259-2260 2260-2261 2</p>
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1. The first step in the process of creating a new product is to identify a market need. This involves conducting market research to determine what consumers want and what problems they are trying to solve. Once a need is identified, the next step is to develop a concept for a product that addresses that need.

2. The second step is to create a prototype of the product. This involves designing and building a small-scale model of the product that can be used to test the concept and gather feedback from potential customers. The prototype should be functional and look like the final product as much as possible.

3. The third step is to conduct a feasibility study. This involves evaluating the technical, financial, and market viability of the product. The study should consider the costs of production, the potential for sales, and the competitive landscape. If the study shows that the product is viable, the next step is to develop a business plan.

4. The fourth step is to develop a business plan. This document outlines the company's goals, strategies, and financial projections. It should include information about the market, the competition, and the company's marketing and sales strategy. The business plan is used to secure funding and guide the company's operations.

5. The fifth step is to secure funding. This involves raising capital to cover the costs of production and marketing. Funding can be obtained from a variety of sources, including venture capitalists, angel investors, and crowdfunding. Once funding is secured, the next step is to begin production.

6. The sixth step is to begin production. This involves manufacturing the product on a large scale. The company should establish relationships with suppliers and manufacturers to ensure that the product is produced efficiently and at a low cost. Once production is underway, the next step is to launch the product.

7. The seventh step is to launch the product. This involves marketing and selling the product to the target market. The company should develop a marketing strategy that includes advertising, public relations, and sales promotion. The product should be launched in a way that creates a buzz and generates interest among potential customers.

8. The eighth step is to monitor the product's performance. This involves tracking sales, customer feedback, and market trends. The company should use this information to make adjustments to the product and its marketing strategy as needed. If the product is successful, the next step is to consider expanding the product line.

9. The ninth step is to consider expanding the product line. This involves developing new products that build on the success of the first product. The company should continue to conduct market research and develop prototypes for new products. Once a new product is developed, the company should repeat the steps of the product development process.

10. The tenth step is to repeat the process. This involves continuing to develop and launch new products. The company should maintain a focus on innovation and customer satisfaction to ensure long-term success. The product development process is an ongoing cycle that requires constant attention and effort.

1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

2. Next, it is important to gather relevant information and data. This can be done through research, consultation with experts, or by analyzing existing data sets.

3. Once the information is gathered, the next step is to analyze it. This involves identifying patterns, trends, and relationships that can help in understanding the problem.

4. After analysis, the next step is to develop a solution or answer. This may involve applying theoretical knowledge, using logical reasoning, or conducting experiments.

5. Finally, the solution should be verified and validated. This can be done by comparing the results with known outcomes, conducting peer reviews, or using statistical methods to assess the reliability of the findings.

1. The first step in the process of identifying a problem is to recognize that a problem exists. This involves gathering information about the situation and identifying the specific issue that needs to be addressed.

2. Once a problem has been identified, the next step is to define the problem clearly. This involves stating the problem in a concise and specific manner, and identifying the goals that need to be achieved to solve the problem.

3. The third step in the process is to generate potential solutions. This involves brainstorming ideas and considering different approaches to solving the problem. It is important to consider a wide range of options and to evaluate the potential benefits and drawbacks of each.

4. The fourth step is to select a solution. This involves evaluating the potential solutions and choosing the one that is most likely to be effective. It is important to consider the feasibility of each solution and to weigh the costs and benefits of each.

5. The final step in the process is to implement the solution. This involves putting the chosen solution into action and monitoring the progress of the implementation. It is important to be flexible and to make adjustments as needed during the implementation process.

[illegible]

1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

2. The second step is to gather relevant information and data. This can be done through research, consultation with experts, or by analyzing existing data sets.

3. The third step is to develop a plan or strategy to address the problem. This involves breaking down the problem into smaller, manageable parts and determining the best approach to solve each part.

4. The fourth step is to implement the plan. This involves carrying out the tasks and activities that have been identified in the plan.

5. The fifth step is to evaluate the results. This involves comparing the actual outcomes with the expected outcomes and identifying any areas for improvement.

6. The sixth step is to communicate the findings. This involves sharing the results of the analysis with the relevant stakeholders and providing recommendations for action.

7. The seventh step is to monitor and review the progress. This involves keeping track of the implementation of the plan and making adjustments as needed to ensure that the goals are being met.

8. The eighth step is to document the process. This involves creating a record of the steps taken and the results achieved, which can be used for future reference and to inform other projects.

9. The ninth step is to reflect on the experience. This involves thinking about what has been learned from the process and how it can be applied to other situations.

10. The tenth step is to share the knowledge. This involves sharing the insights and lessons learned with others, which can help to improve the overall quality of the work.

[Redacted]

[The page contains approximately 20 horizontal red lines, likely representing a list or a series of entries.]

[illegible]

1. The first part of the document discusses the importance of maintaining accurate records of all transactions, including sales, purchases, and expenses. It emphasizes the need for consistency and transparency in financial reporting.

2. The second part of the document outlines the various methods used to collect and analyze data, such as surveys, interviews, and focus groups. It highlights the importance of selecting appropriate samples and ensuring the reliability of the data collected.

3. The third part of the document describes the different types of statistical tests used to analyze the data, including t-tests, ANOVA, and regression analysis. It explains how these tests help in understanding the relationships between variables and making informed decisions.

4. The fourth part of the document discusses the importance of interpreting the results of the statistical tests correctly. It emphasizes the need to consider the context of the data and the limitations of the statistical methods used.

5. The fifth part of the document provides a summary of the findings and conclusions drawn from the study. It highlights the key insights gained from the data and the implications for future research and practice.

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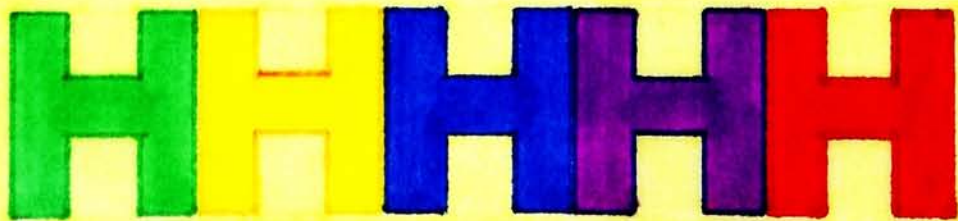
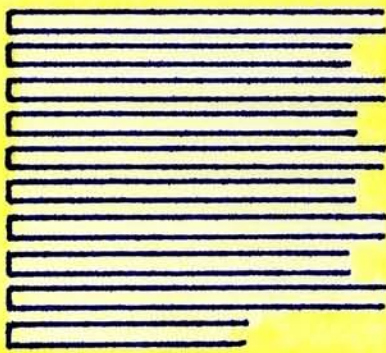
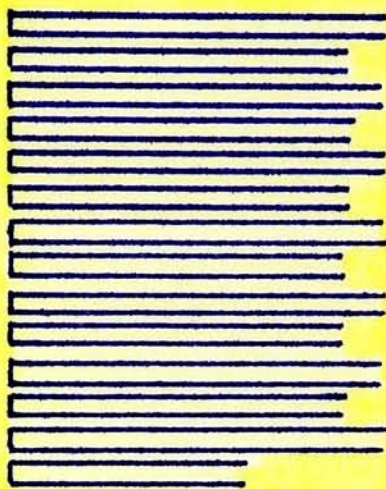
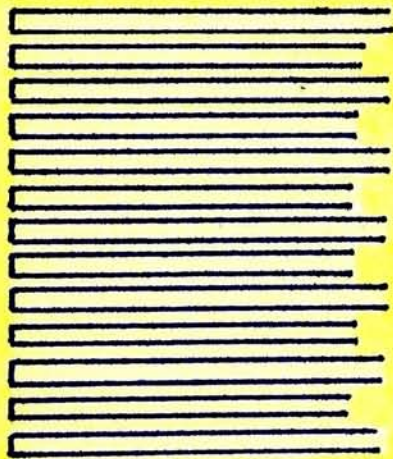
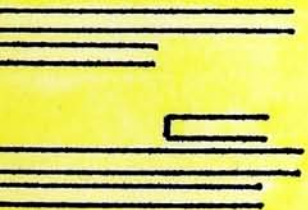
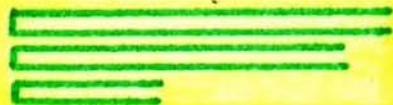
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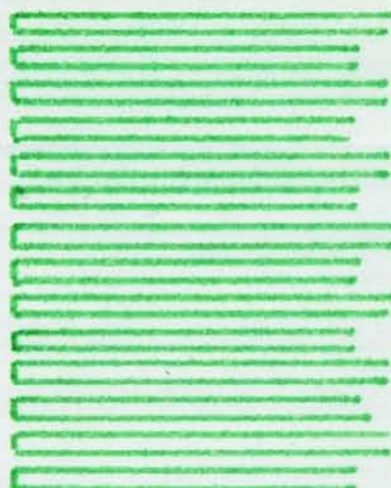
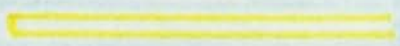
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Block of blue horizontal lines

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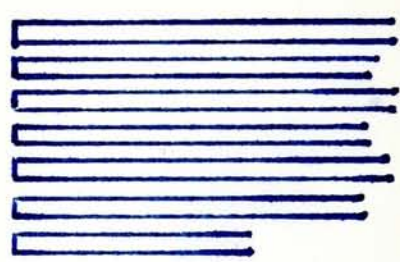
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VIII. Process of Production

A number of different processes were explored before the final cut-paper methodology was reached. First, I thought of screen-printing the project with the aid of faculty and/or students from the Department of Screenprinting of the School of Printing. This prospect did not materialize because there was no professor. At this time I also investigated professional screenprinting, but that process is very expensive. The only affordable screen printers seemed to be those who do T-shirts and the like, but their work product was not of a quality suitable for my thesis because of inconsistent color and inaccurate registration.

The next process that I thought would be appropriate was offset printing with the assistance of the School of Printing. The project was deemed to be too advanced for the first-year students and the more advanced students already had their course work approved. I then consulted with professional printers to see what processes were available to me.

They first suggested that I use a "Chromatec Four-Color Proofing System." This methodology produces inaccurate color results. Not only is "orange" for instance not accurately related to the Pantone Color system, but different batches of "orange" will vary widely.

The printers then suggested that I investigate a process called "Computer Generated Image Reproduction and Color Proofing

System." There are only two computers in the Washington, D.C. area that provide this process. It produces perfectly formed and registered colored letters. The problem with the process is that it is prohibitively expensive. Each of the seven color relationship panels would have cost approximately \$1,050.00.

It appears that this expense is caused by two factors. First, the machines themselves are very expensive, requiring high prices to recoup the capital expenditure. Second, the operator must draw each letter separately, as the machine has no ability to reproduce a repetitive pattern automatically.

The method finally adopted was that of cut paper. I obtained paper that matched the Pantone color scheme. The mechanical aspects of the cutting made complete accuracy difficult but the overall result was very satisfactory. The cut letters were then spray-mounted in place. I established the size of the letters and interstitial spaces by scaling the grid to two times that of the sketches and marker versions that I had developed.

With respect to the information panels, I wrote the copy and then did the copyfitting. After I set out the type specifications, I did a paste-up and a mechanical. Finally, I got a photo stat and spray mounted it on the white substrate. The colored letters on the information panels were cut and spraymounted just as those on the color panels were.

The framing was chosen after a review of the available options. I selected a plexiglass framing with a so-called

invisible framing system. The panel itself was sandwiched between two pieces of clear plexiglass, with no visible frame. The plexiglass was the exact size of the panel/substrate and seemed to disappear when applied. This method had the effect of smoothing out the textural effect caused by the cut-paper methodology without distracting at all from the work itself.

Conclusion

I found that the use of typography instead of abstract shapes created much more complex effects than those that I had seen previously. This thesis, with its developmental stages was not only a learning experience for me, but would be a very useful tool for introducing students to color relationships. Although the labor and expense of doing three cut-paper copies of the thesis were much more than if I had done a black and white project, I feel that it was a very valuable supplement to the rigorous black and white studies that R.I.T. provides. Finally, as I hope to teach, I am optimistic that this will prove useful to other students that I may have the opportunity to teach.

Bibliography

- Albers, Josef, Interaction of Color, Yale University Press, New Haven, (1975)
- Chevreur, Michel Eugene, Principles of Harmony and Contrast of Colors and their Applications to the Arts, Reinhold Publishing Corp., New York, (1967)
- Goethe, Johann Wolfgang von, Theory of Colors, The M.I.T. Press, Cambridge, (1970)
- Itten, Johann, The Elements of Color, Van Nostrand Reinhold Co., New York, (1970)
- Itten, Johann, The Art of Color, Van Nostrand Reinhold Co., New York, (1970)
- Kueppers, Harold, The Basic Law of Color Theory, Barron's Educational Series, Inc., Woodbury, (1982)
- Ostwald, Wilhelm, The Color Primer, Van Nostrand Reinhold Co., New York, (1962)
- Smith, Charles N., Student Handbook of Color, Reinhold Publishing Corp., New York, (1965)
- Stockton, James, Designer's Guide to Color, Chronical Books, San Francisco, (1984)
- Stockton, James, Designer's Guide to Color 2, Chronical Books, San Francisco, (1984)