Reversed grounds

CHAPTER VI

VI-3 Hold the plate with the yellow rectangle on the left. We see here 2 rectangles of 2 different colors connected as a pair. Within the pairs are 2 X-like forms which look different.

The longer we observe the X's, and the more we compare them (best at some distance), the more we see that each repeats the color of the opposite, neighboring ground. We perceive the whole (both studies together) in 2 colors of which each appears 2 times, namely as ground and as figure.

We do not see
that the whole consists of more than 2 colors, and that the X's are alike—meaning of one and the same color—
and therefore different from the colors of both grounds.

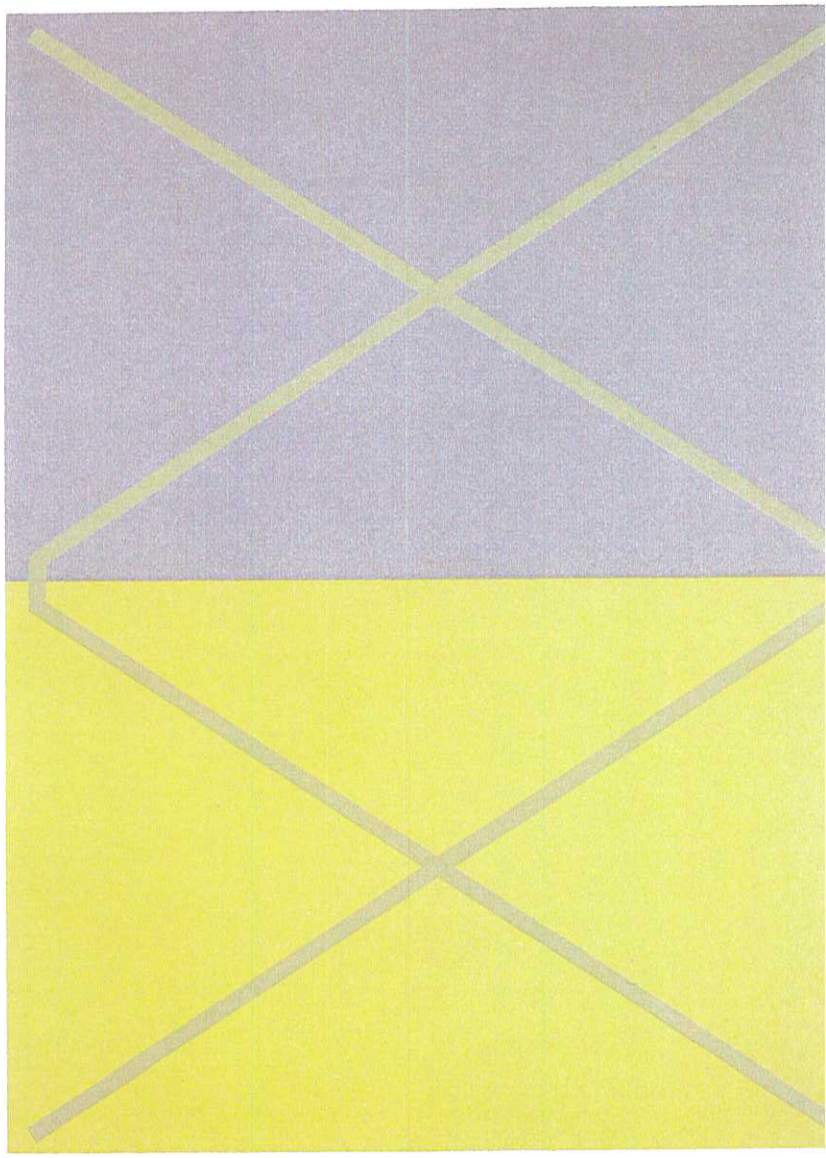
Consequently, we do not see that the
study consists not of 2 colors, but of 3.

This is made visible
only through the small horizontal connection between the X's.

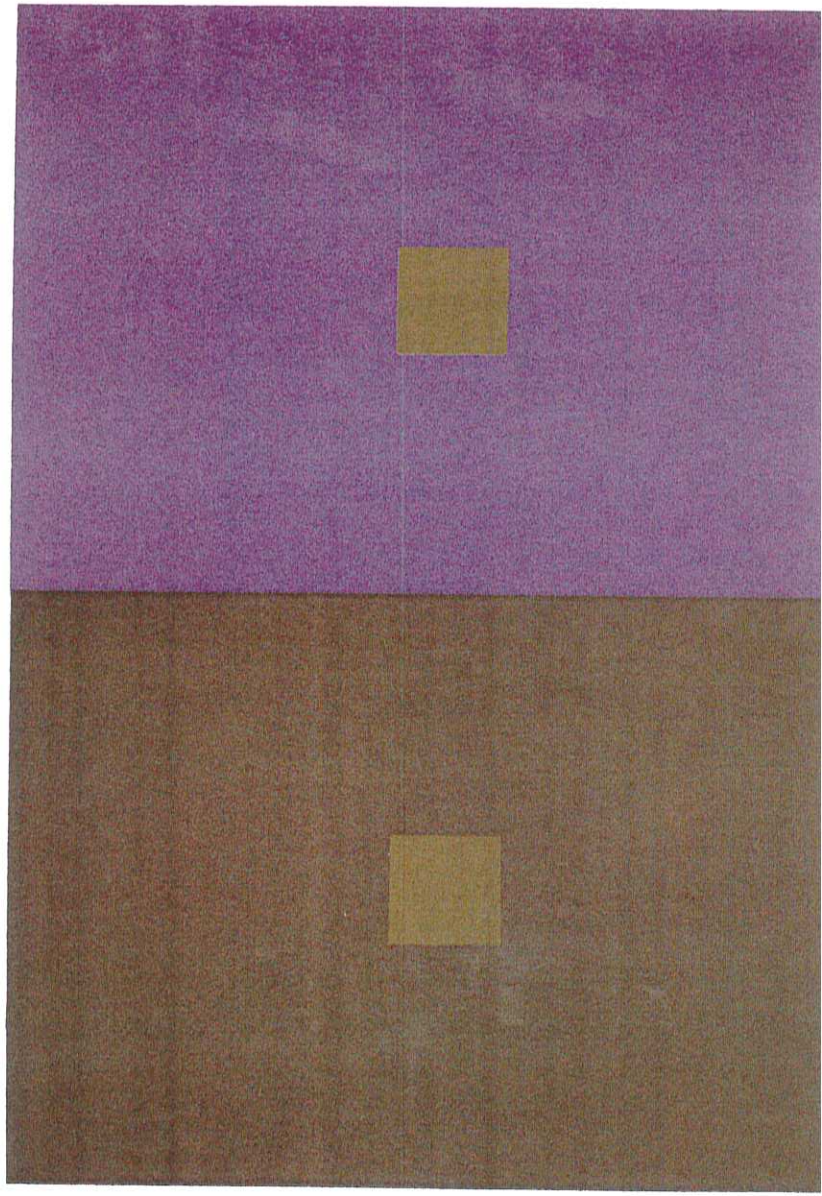
This demonstrates
a discrepancy between factual colors of the X's and the visual perception of these colors. In other words, we do not see what these colors physically are.

We study this
first, not as a surprising or entertaining illusion but to make eyes and mind aware of the wonders of color interaction; second, to learn to utilize color deception in creative color performance.

The problem is:
Find that color which on 2 different grounds loses its identity.
The question is:
What color relatedness makes 3 colors look like 2?



VI-4 3 colors appear as 2.
On brown and violet grounds, the center squares look like the grounds exchanged, violet and brown. But they are of the same color, precisely alike, and at the same time refer to the neighboring grounds. The true color of the 2 central squares therefore becomes unrecognizable, as it loses its identity.



VI-4 The semicircular forms appear as different colors above and below,
and these refer to the reciprocal grounds.
The visible connection between the 2 groups
reveals that they are of the same color, therefore alike.
Question: Which color produces such deception?
And notice how the half-rings lead us to compare them with
"the other side." This study therefore presents an example of
"psychological engineering."

Subtraction of color

CHAPTER VII

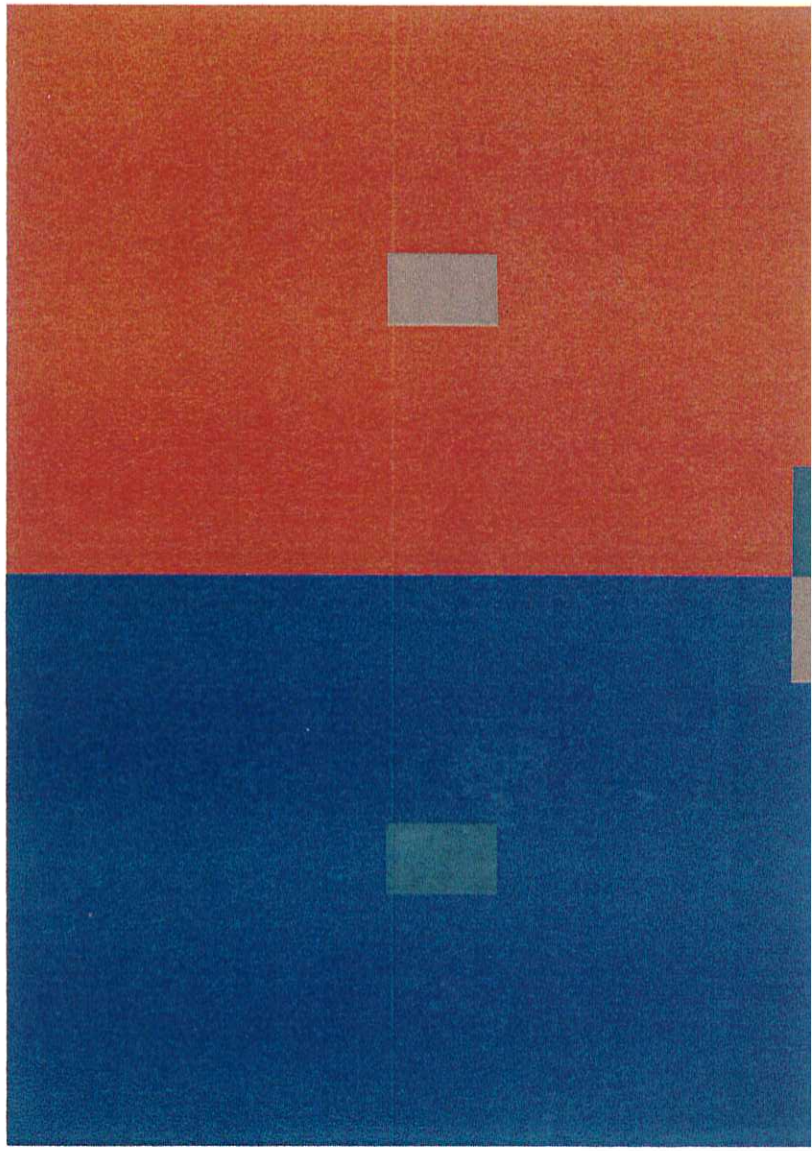
A new task: 2 different colors are to look alike,
or 4 colors are to look like 3, as explained on page 20 of the Text.
We consider this color change as color subtraction.

In order to present these unusual and little-known effects appropriately,
first cover the 2 colors in the margins or peripheries of the studies.
Then compare the centered small rectangles and find out
how equal or how similar they look.

For the best simultaneous comparison do not look from one center to
the other but focus firmly on a point in the middle between them,
which will be within the boundary of the grounds.

Now, after the likeness or similarity has been recognized in the centers,
uncover the small color blocks in the margins (noted above), and see
what they really are. These 2 colors were the point of departure
for the study.

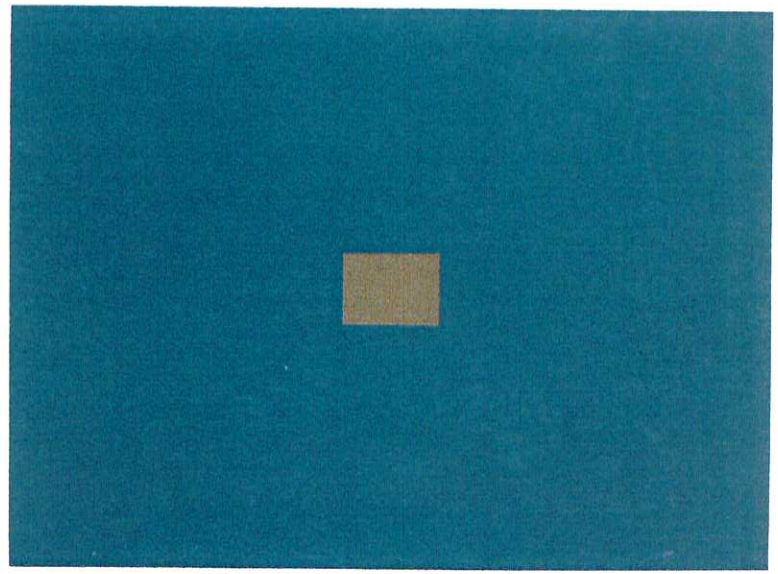
VII-2 A solution in heavy color.



VII-4 Hold plate VII-4 with the deep green ground on the left, and the light grey ground on the right.

Below them are 2 contiguous horizontal stripes, the upper one a brownish-green on top of a thin ochreous yellow.

The small rectangles in the centers of the large rectangles seem to be alike.

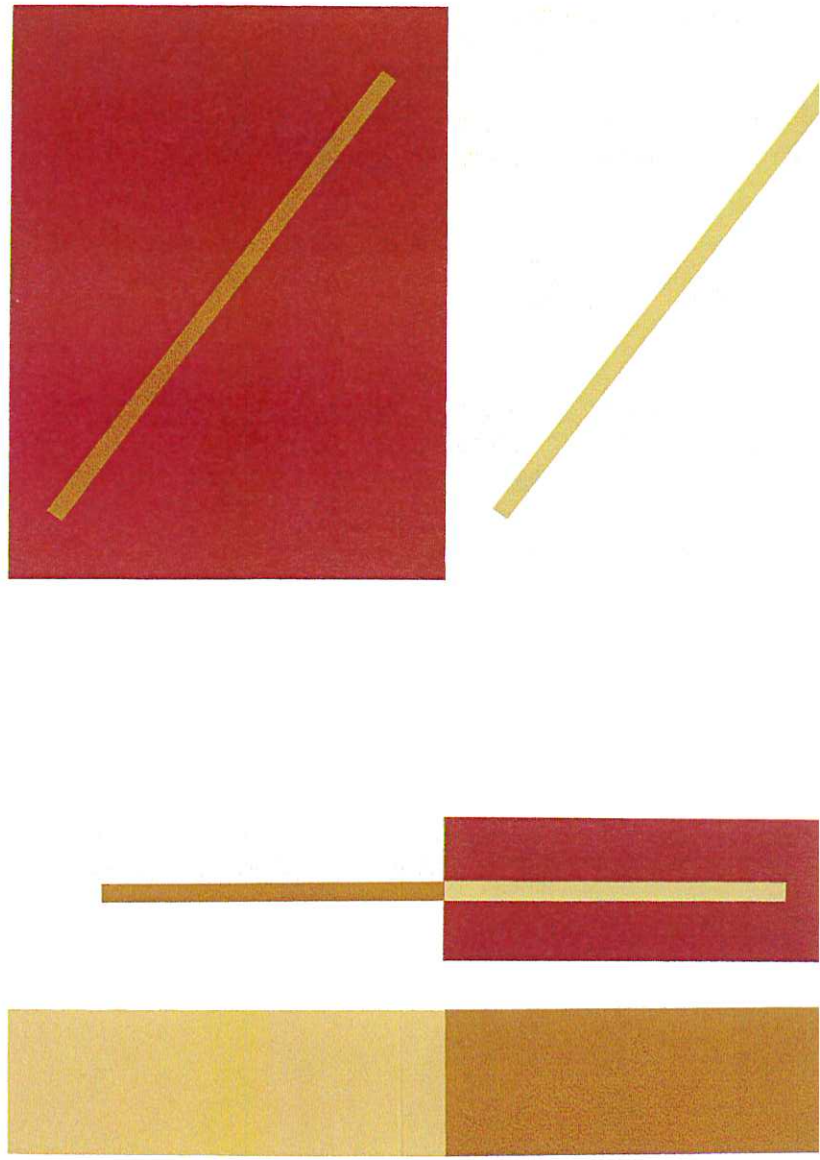


VII-5 We see 1 pair of larger upright rectangles and 2 pairs of smaller horizontal rectangles, each pair connected along a vertical axis. The 2 upper pairs carry narrow stripes, on the larger as diagonals, and on the smaller connected in a central horizontal axis.

As to color, the deep red and yellowish off-white grounds at top are reversed in the second pair. The quite different lower pair contains a clear contrast, Naples yellow and ochre.

When comparing the 2 diagonals simultaneously, that is, not in sequence but focusing on the middle between them, they will appear very similar or even alike. But they are precisely the same as the horizontal stripes beneath them, and therefore factually as different as the colors at the bottom, which are ochre and Naples yellow.

Reading the study in the opposite direction—upward—the quite different Naples yellow and ochre, when seen reversed on the contrasting grounds of the middle pair, appear even more different. But when shown in the same order on the reversed colors of the upper grounds, they change from a distinct contrast to a pair of similar colors. Naples yellow and ochre are changed to look alike.



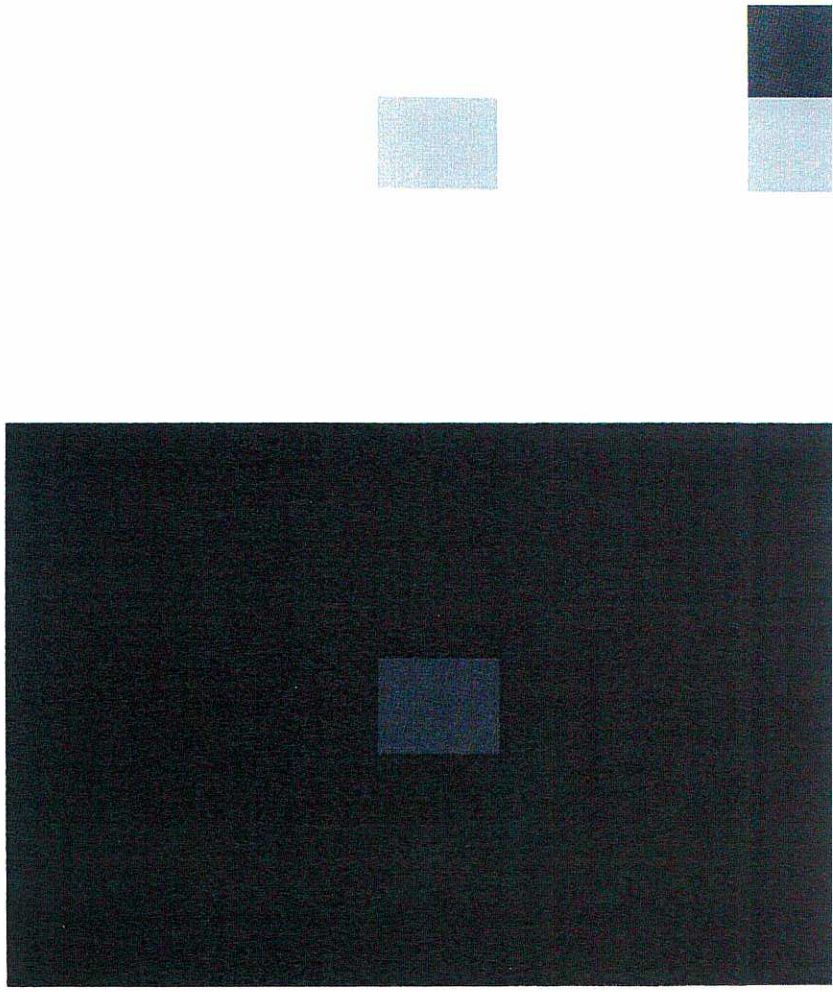
VII-7 Hold the plate with the 3 small rectangles at the right. This study shows a very courageous solution to the problem because it makes a very light grey and a dark, almost black-grey appear alike.

Of the 3 small rectangles, the 2 lighter ones (above each other) are exactly alike, and look exactly alike since they are seen on the same ground, white.

The third small and connected rectangle—because of its darkness—appears in color similar or equal to the large dark ground at the left. Thus, it seems unbelievable that the small dark one is precisely repeated in the center of the dark ground where it looks much lighter—unbelievably lighter.

Now, having next to each other dark on darker and light on lighter—the left and right center as horizontal neighbors in parallel optical conditions (equal placement, shape, and quantity relationship)—we are able to compare them. If this is done properly, which means simultaneously (not alternatingly, as explained before), we will perceive that the white-grey and the black-grey, seen first as connected contrasts, appear alike. Q. E. D., what was to be proved.

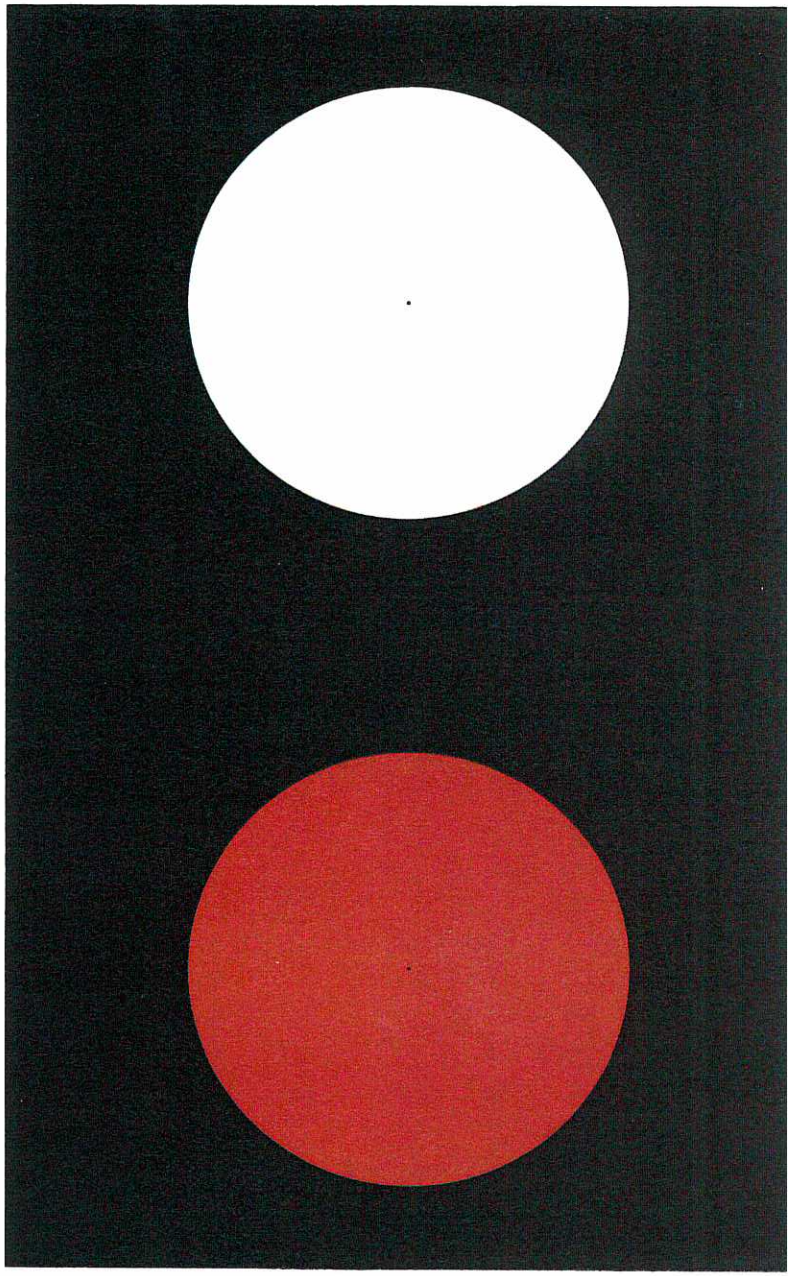
For a visual proof, make a flap by tracing the 2 dark-grey rectangles on a sheet of paper from your school notebook (usually slightly translucent), cut them out, somewhat smaller, and compare what you see through these openings.



After-image

CHAPTER VIII

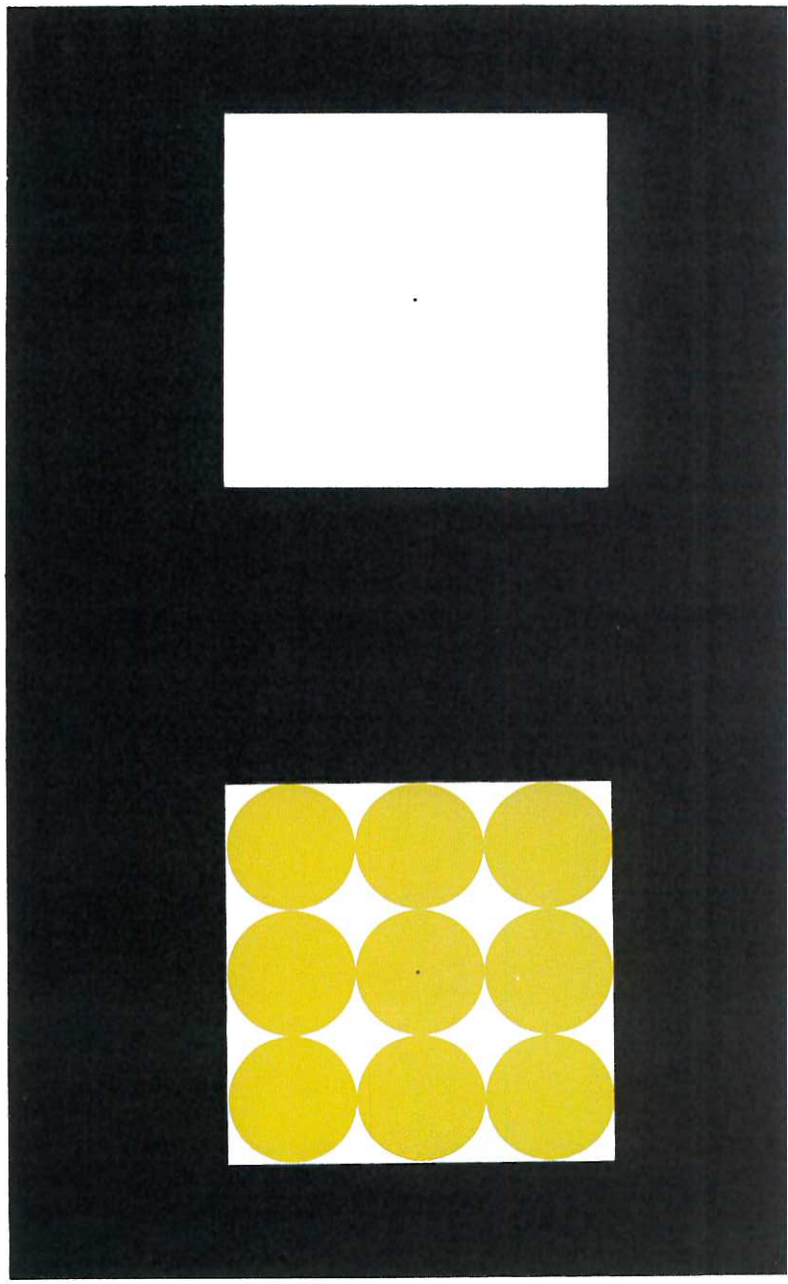
VIII-1 Turn the page so that the red circle is on the left.
If we stare for half a minute at the red circle, focusing continually
on the marked center, and then focus on the white center,
we do not see white. The color we see there
is the after-image of red and is a simultaneous contrast.



VIII-2 For a clear understanding of interaction of color caused by interdependence of color we should experience what "after-image" means. Before going on to study plate VIII-2 complete the exercise described on page 22.

Now hold the plate with the white square on the right. On the left are yellow circles of equal diameter which touch each other and fill out a white square. There is a black dot in its center. On the right is an empty white square, also with a centered black dot. Each is on a black ground. After staring for half a minute at the left square, shift the focus suddenly to the right square.

Here one experiences a very different after-image. Instead of seeing the complement of the yellow circles (blue), diamond shapes are seen—the leftover shapes of the circles—in yellow. This illusion is a double and thus reversed after-image, sometimes called contrast reversal.



Color mixture in paper

CHAPTER IX

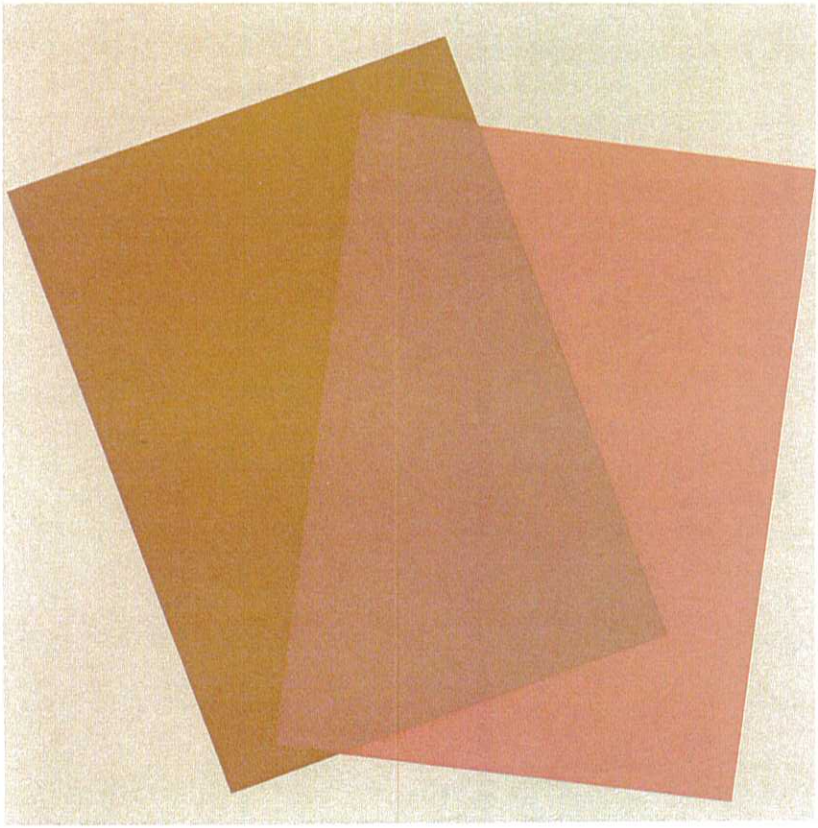
IX-1 In painting it is easy to mix pigments by pouring them together and stirring them, which achieves an in-between color as a mixture. Since this is not possible with paper, we must imagine a possible "in-between color." In plate IX-1 we superimpose part of a brown rectangle on a rosy-red rectangle. First we pass our eyes from left to right several times across the overlapping area, in which the mixture should appear.

After several passages back and forth we see that the red appears to come through the brown at the left, and the brown seems to come through the red at the right border of the overlap. This is proof that we have a true mixture.

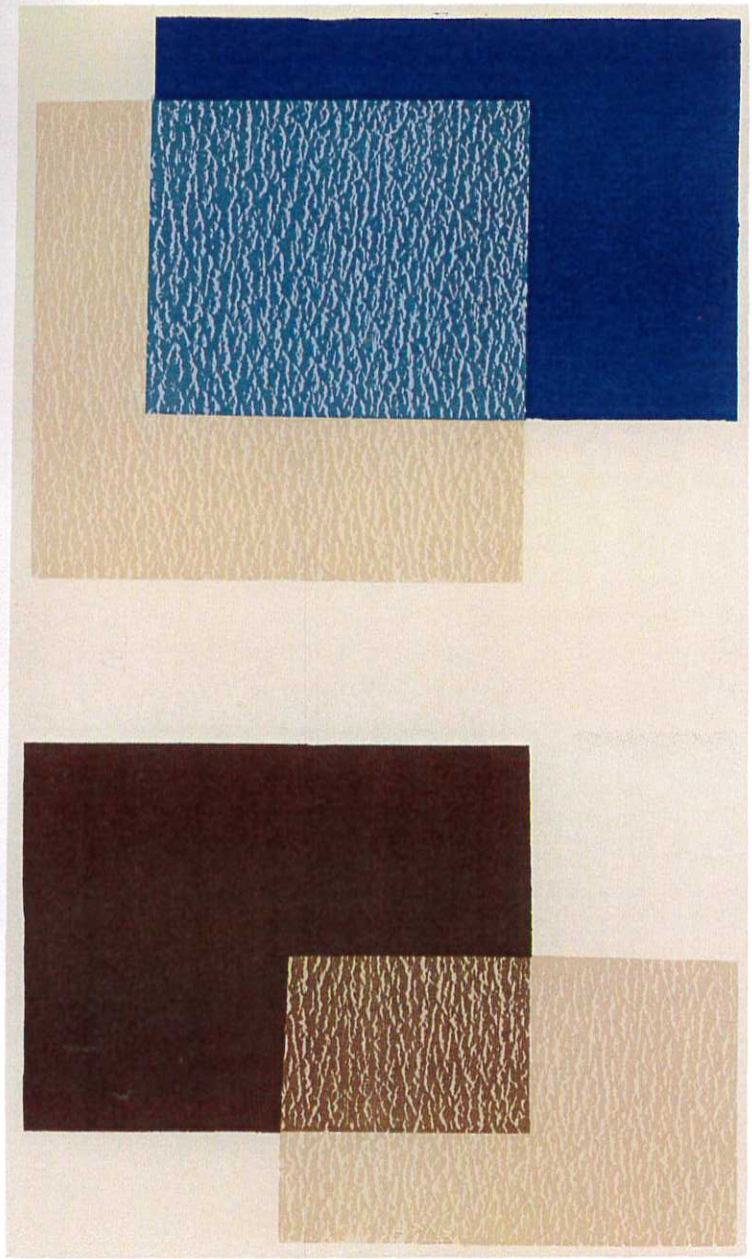
It is easy to see that the right edge of the brown rectangle has a heavier boundary than the left edge of the red. Therefore this mixture contains more brown than red. Thus, the brown is on top; in other words, the brown is dominant in the mixture.

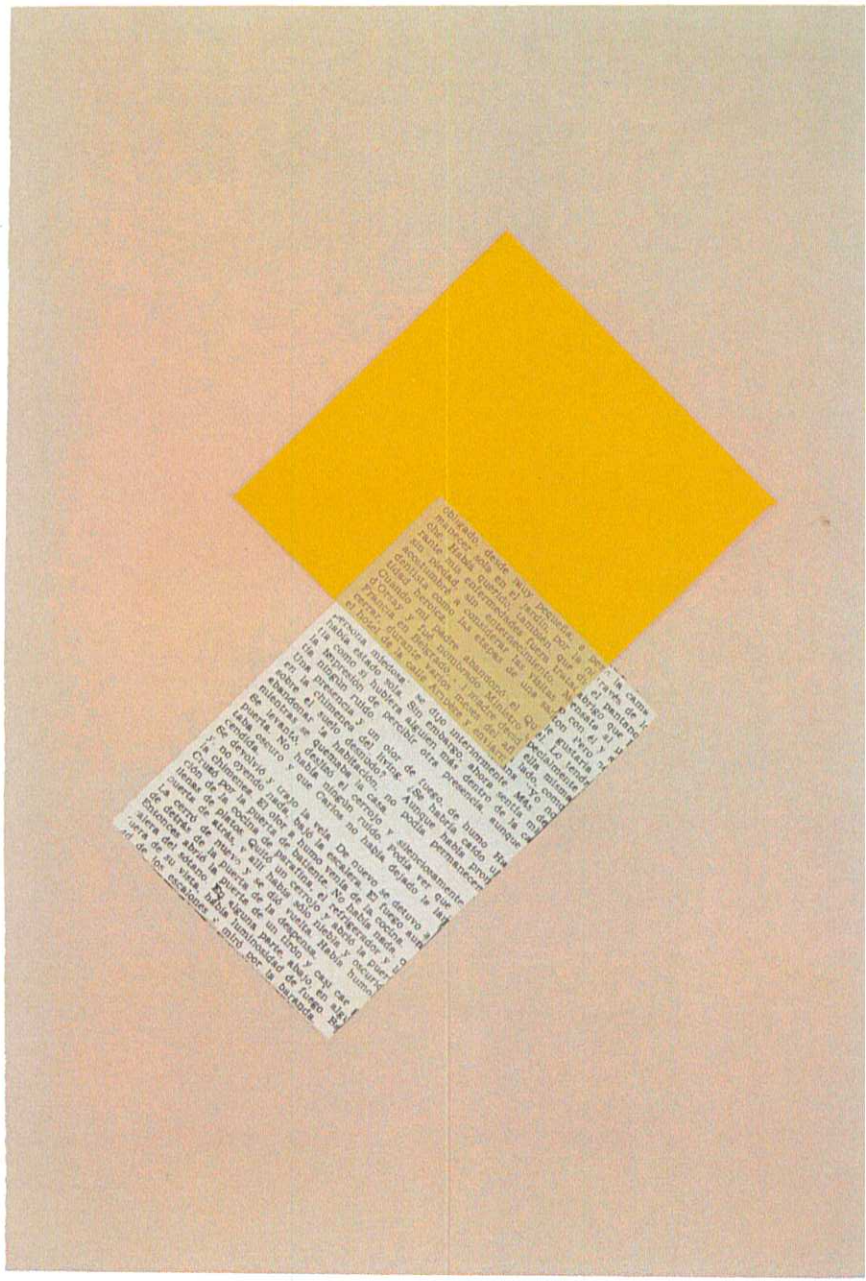
Now try to find a mixture in which the red is on top and therefore dominant.

Read Chapter XI and find some color mixture in paper that produces various space illusions.



IX-3





Additive and subtractive mixture

CHAPTER X

X-1 Hold plate X-1 with the dark background on the left.
Obviously both studies are based on the same underlying design
of 3 overlapping rectangles, providing a common subdivision of area.

The 3 rectangles are of equal shape and size,
and hinged in their combined left corners. They are, furthermore,
related as tints of the same color, namely a grey-violet.

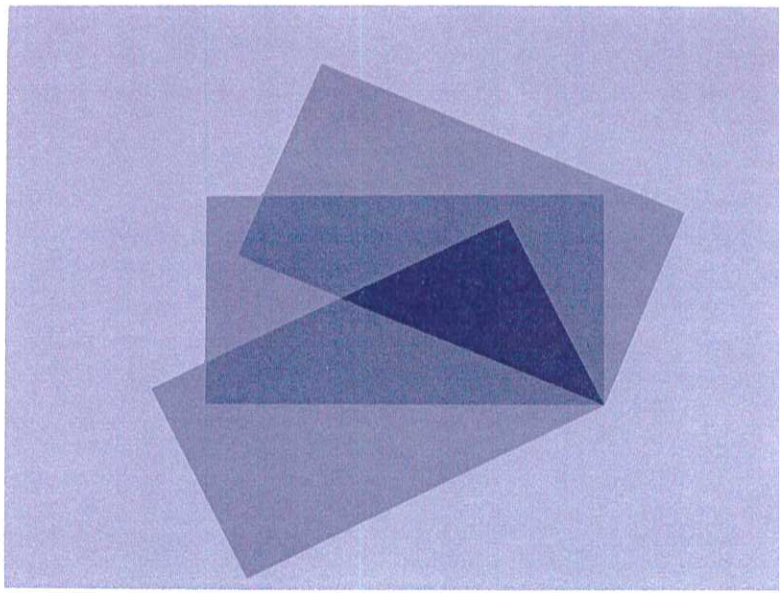
With regard to light, the 2 groups of rectangles move
in opposite directions. At left, from a dark ground to a light center,
at right from a light ground to a dark center.

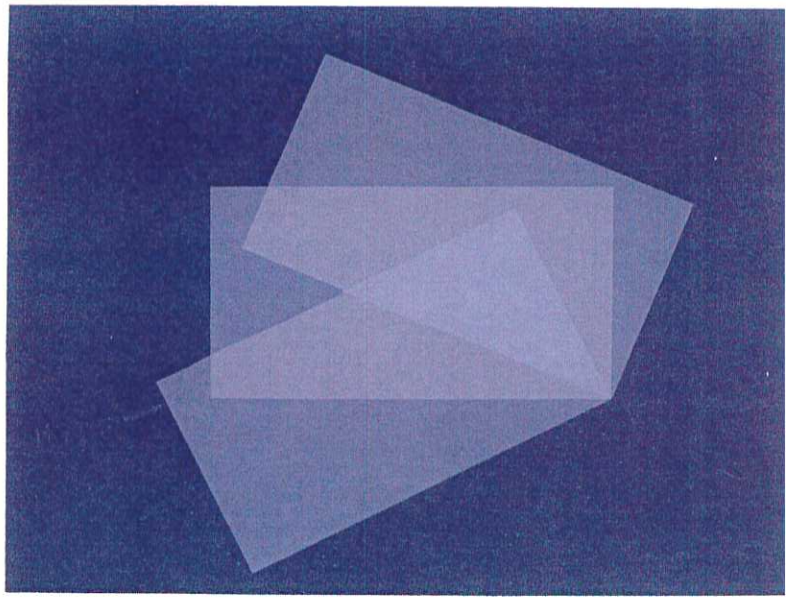
On both sides, each of the 3 rectangles overlaps the 2 others
only once. By looking transparent (in fact, they are opaque)
they produce in our perception illusions of mixture, in 3 steps
of either light or shade—a gradual increase in light at the left
but a decrease in light at the right.

With their contrasting results of gaining and of losing light,
these studies explain a basic difference in mixture,
that is, mixture in direct color—which is light—and its opposite,
mixture in reflected color—produced by pigment.

The first, the product of a mixture by a physicist,
by combining light (direct color) results in addition of light.
Whereas the second, a combining of pigments (indirect, reflected color)
and done by the colorist, results in subtraction of light.

Now, since both studies are done in pigments (inks),
they "present," in fact, reflected light only;
they also "represent," in illusion only,
at right, subtractive mixture, the area of the painter,
and at left, additive mixture, the realm of the physicist.

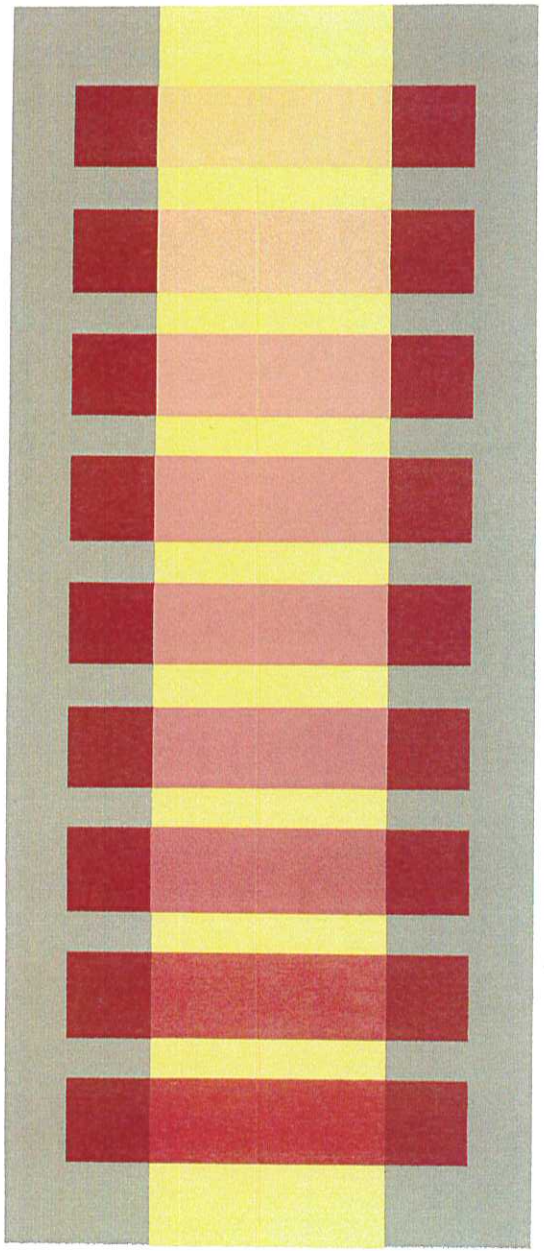




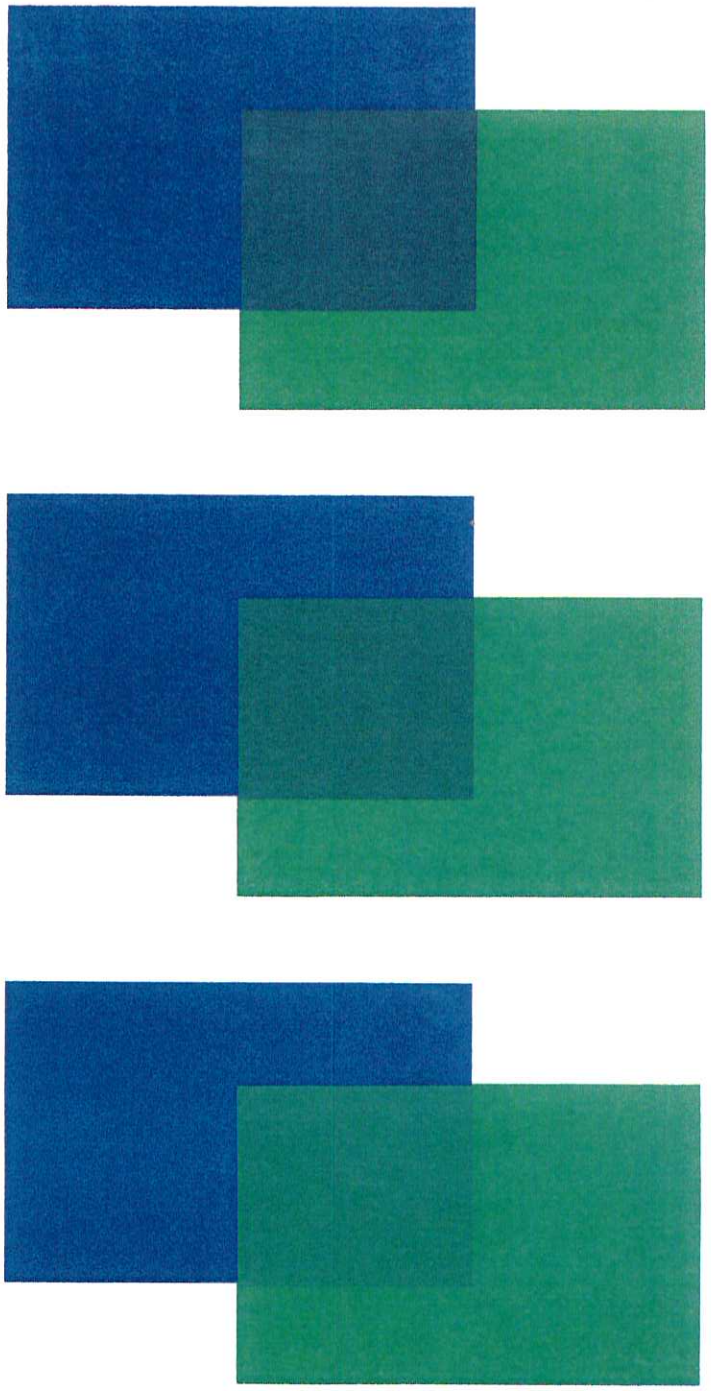
Transparence and space-illusion

CHAPTER XI

XI-1 This deserves recognition as an unusually precise study of a mixture of 2 colors in a gradation of 9 equidistant steps of red—equidistant by their proper increase of yellow content. It presents itself most actively when seen with the little dot in the upper left corner. Then the gradual upward increase in light reads more decisively than the equally precise increase in red in the opposite direction.

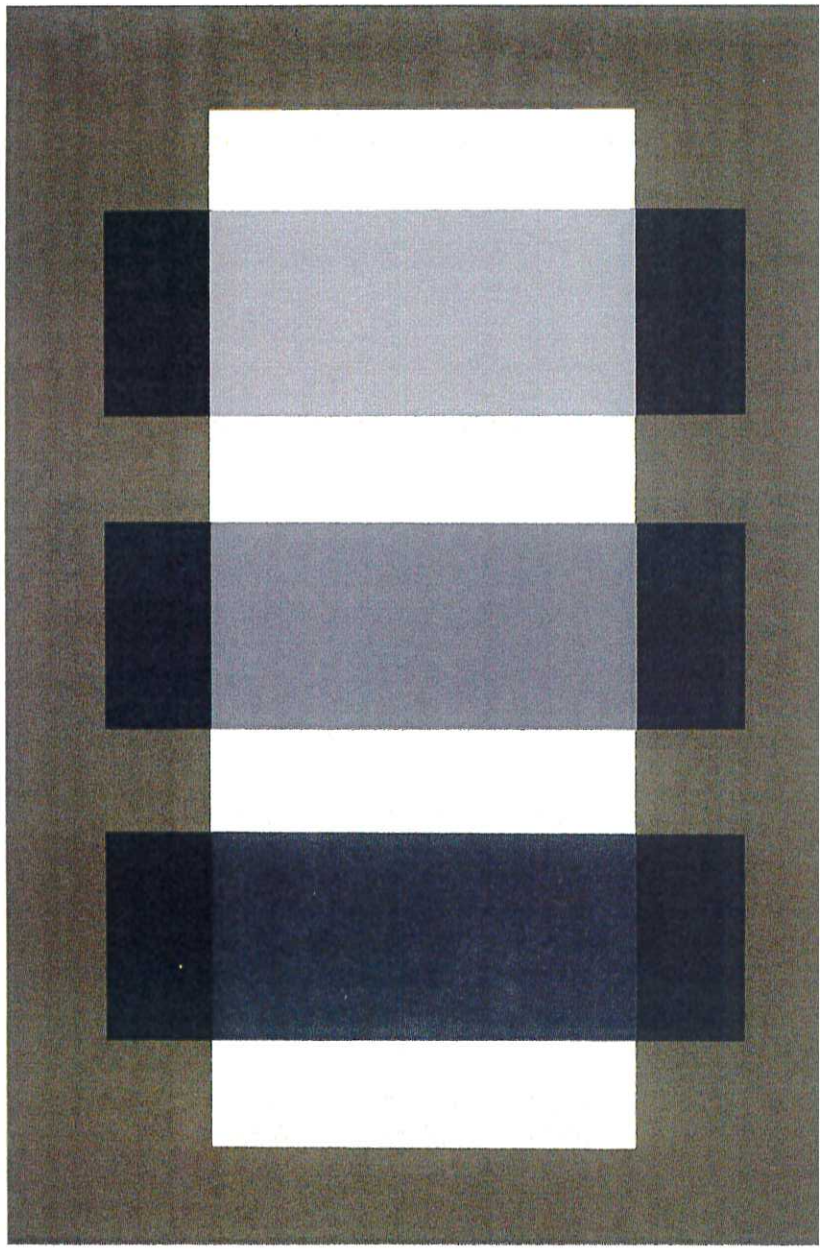


XI-2 A presentation of a blue and a green overlapping each other in 3 different mixtures. At the bottom, green is in front, at the top, blue dominates, and in the middle there is almost a middle mixture. Compare and differentiate the boundaries on both sides of each mixture.



XI-3 It will be immediately clear that of the 3 horizontal black bars which overlap and mix with the broad vertical white (in 3 different greys), the lower bar appears on top of the white, whereas the upper bar looks overlapped by the white and therefore behind or underneath it.
Or, when following the white upward, it starts behind the black, but ends up on top of it.
Such readings are caused by the dominating contents of the mixtures, as well as by their boundaries.
The lower mixture obviously contains more black and the upper mixture, just as clearly, more white.

Since the harder and therefore leading boundaries are products of the dominating stronger contents, they define the movement of the mixture.
As a result, the harder, louder boundaries of the lower bar are horizontal, which means separation upward and downward, and moving sideward. The dominating boundaries of the upper, lighter mixture are vertical connections, sideward separations, and moving upward.
Indirectly, this also explains the mixture in the middle.
The black and white contents are equal, or nearly equal, and so are the mixture boundaries; all of which indicates that neither black nor white is on top, but that both penetrate each other on a 2-dimensional level—without any spatial separation—and thus show a "middle mixture."

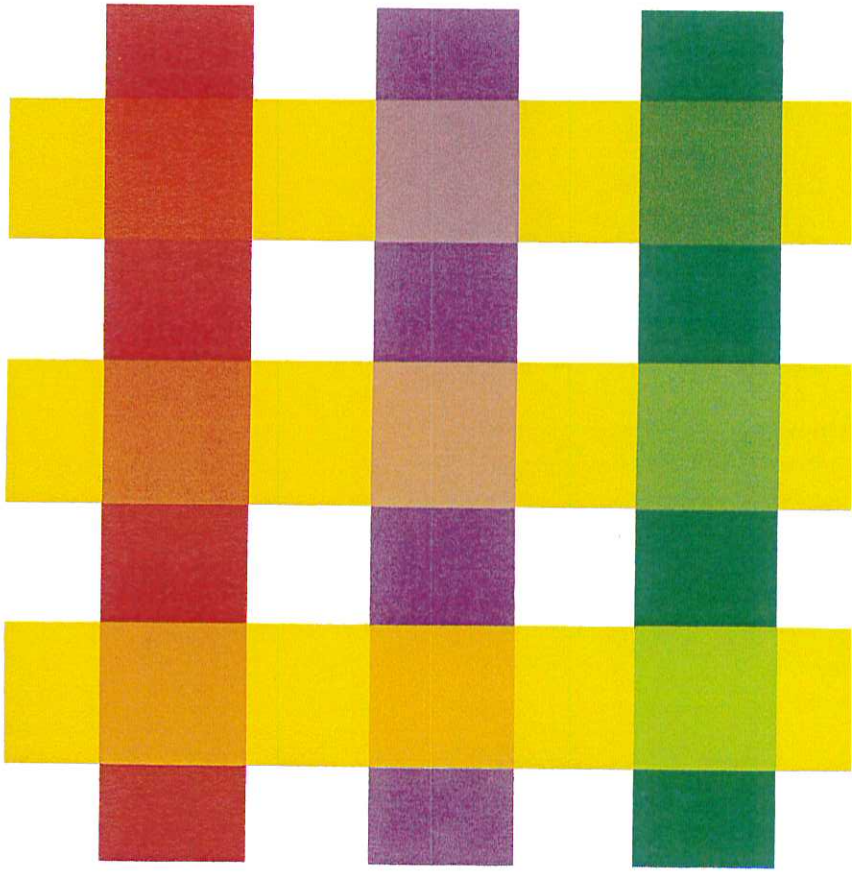


XI-3 This bright study is more or less self-explanatory.
3 unconnected vertical bars of different deep colors are crossed
by 3 separate horizontal bars of 1 and the same light color.

Within their crossings appear 9 illusionary mixtures. The
3 lower ones are dominated by the same light color and therefore
appear on top of the darker verticals. The 3 upper mixtures
are dominated by the 3 different deep colors which therefore
appear on the top of the light color. In the middle horizontal
bar, all colors meet on 1 and the same level.

For a closer study, compare the 6 trios of mixtures. First,
their similar increases and decreases within the horizontal bars;
then, the gradual changes within the trios of the vertical bars.

Be aware that any mixture is darker
than the lighter of the mixture parents.

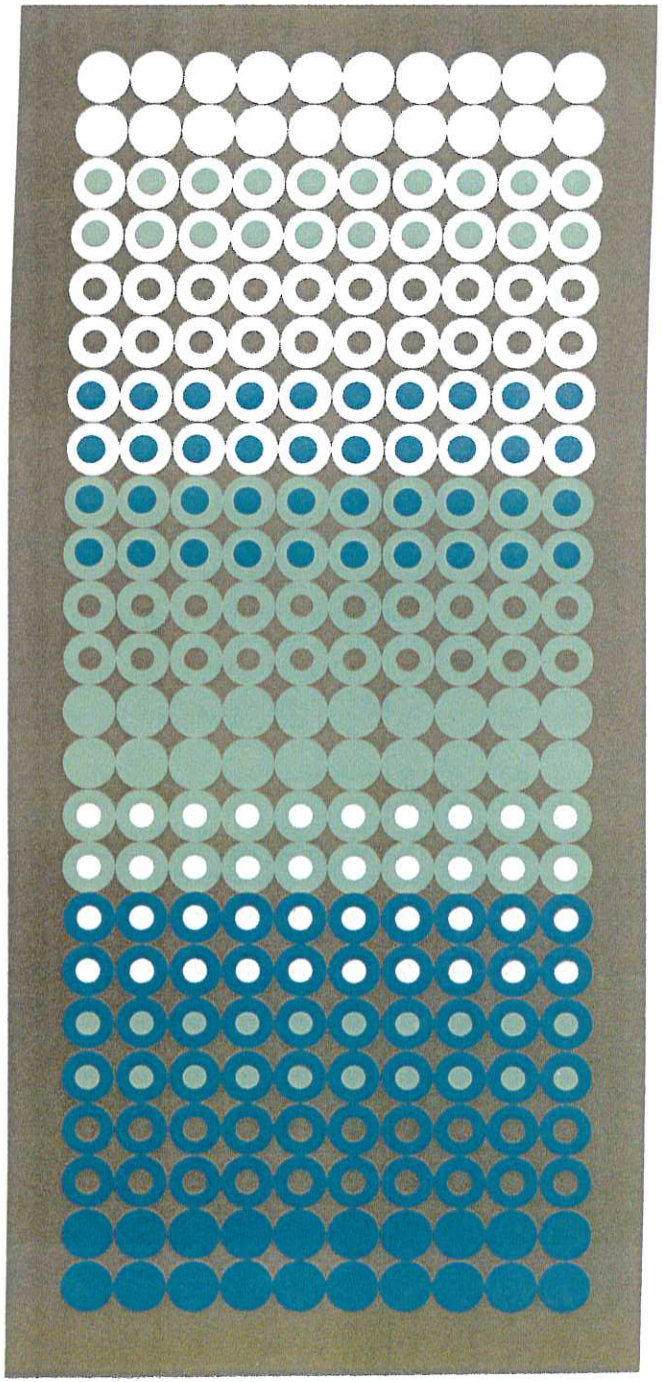


Optical mixture

CHAPTER XII

In contrast to after-image, here is another very different color illusion, "optical mixture." 2 or more colors perceived simultaneously appear combined as a third actual color, a mixture which annuls and replaces the previous factual colors. (See Text, page 33.)

2 Turn the page so that the white dots are at the right.
The size of the circular elements in blue, green, and white demands observation from a distance. At right, compare the lightest whites with the empty and filled whites, then with the smaller whites at the left.
Looking from the left, compare all the blues—those with and without ground in the middle, those with green and with white centers, and those appearing as centers of green and white. In the middle see and compare similarly the greens and their changes through optical mixture.
See the whole also in a vertical position when more than 3 colors seem to appear in varying spatial positions.



The Bezold Effect

CHAPTER XIII

XIII-1 The French Impressionists (after 1870) aimed at an optical mixture effect. Instead of mixing their colors on their palettes, they applied them in small dabs on the canvas so that the colors were mixed, at a distance, in our eyes.

A similar effect is named after Wilhelm von Bezold (1837–1907), a meteorologist in Berlin, who discovered that certain strong colors, when evenly distributed, changed entirely the effect of his rug designs, which were his avocation.*

One of my color students, following Bezold's example, showed in plate XIII-1 light red bricks laid up with very white mortar, and then showed the same bricks laid up with pure black mortar. The red with the white looks much lighter than the red with the black, particularly at a distance.

**The Theory of Color and Its Relation to Art and Art Industry*, trans., Boston, Prang, 1876.