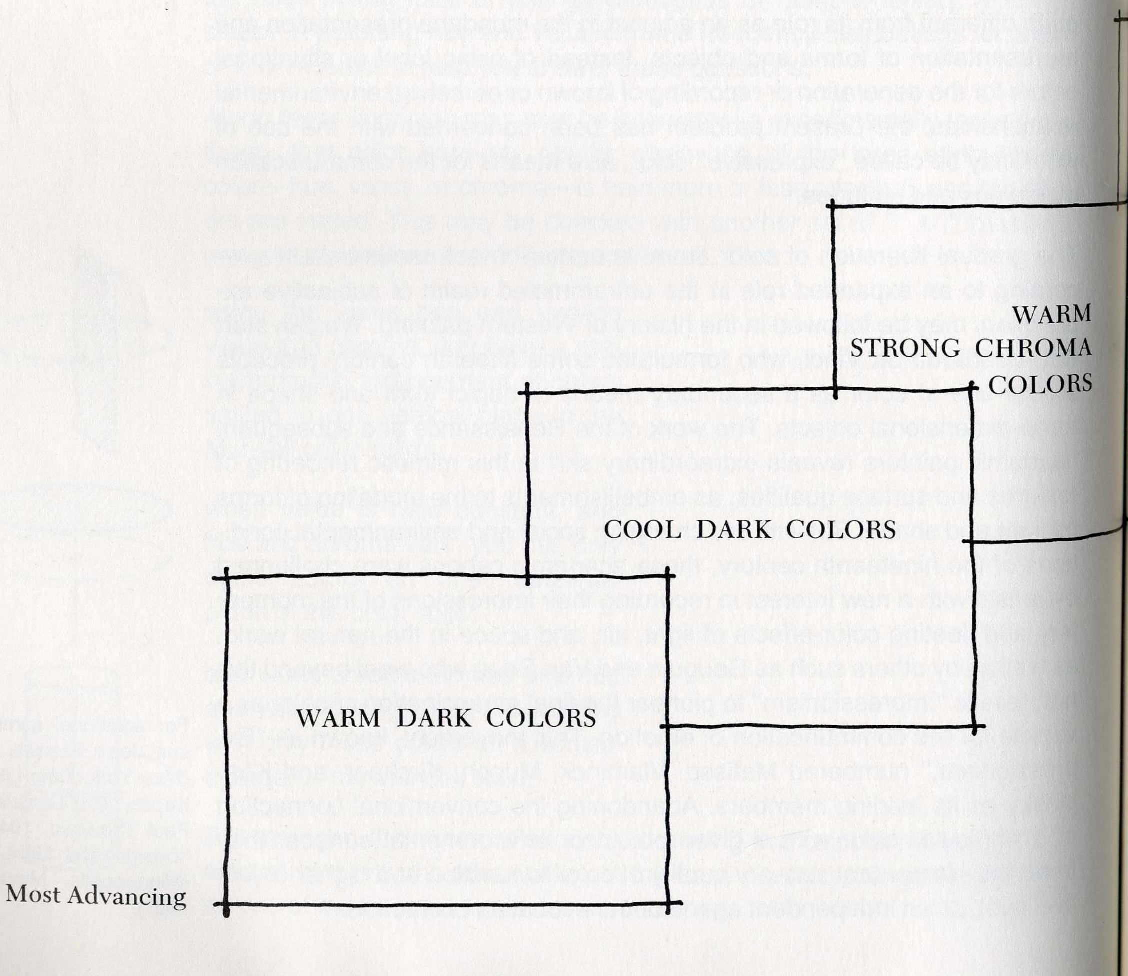
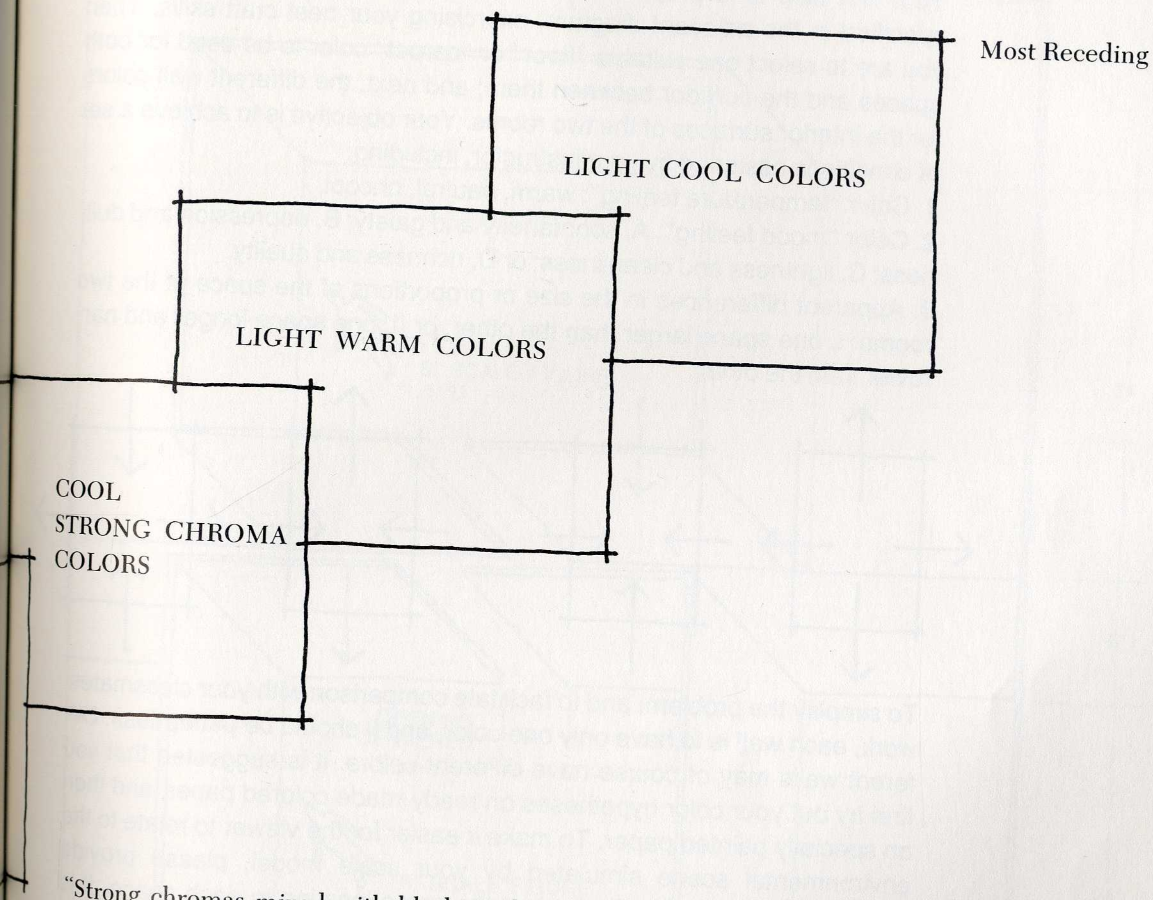
Problem 13


WARM
STRONG CHROMA
COLORS
COOL DARK COLORS
WARM DARK COLORS
Most Advancing

Color and Space

Earlier we made reference to the presumed advancing and receding properties of color. Now we present a formulation of these properties *as applied to their use on environmental surfaces.*

"When the color area occupies the total peripheral field like the walls of a room, black and dark red are the most advancing and light blue and white the most receding. Thus:



"Strong chromas mixed with black tend to advance, making a room seem smaller. Strong chromas mixed with white tend to recede, making a room seem larger. Conspicuousness through contrast should not be confused with the tendency to advance. Contrast can easily counteract the sense of position in space."

Adapted from "Color and the Use of Color by the Illuminating Engineer," *Illuminating Engineering,* vol. 57, no. 12 (December 1962)

In this problem you and your classmates will have an opportunity to collectively evaluate this conventional wisdom with the aid of three-dimensional models. Your model will represent two adjacent and physically identical spaces of the same "temperature feeling" and "mood feeling," and you will try through the use of color to make these spaces appear to be of different sizes or proportions.

Materials

1 15″ x 20″ white illustration board

Additional white illustration board

Paint and drafting gear

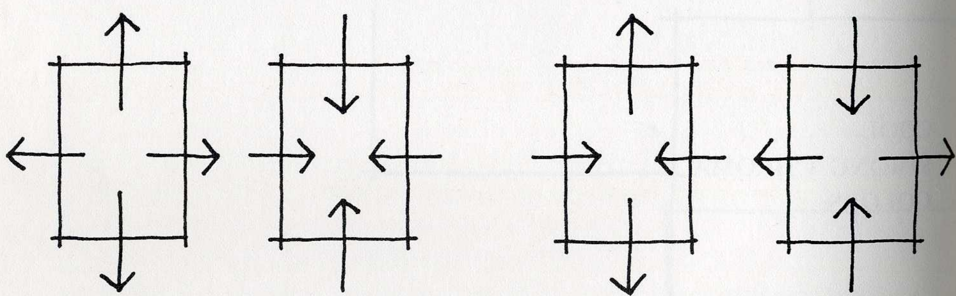
Casein cement

Colored paper

Procedure

Your first step is to prepare the model out of white illustration board as specified in the adjacent diagram, exercising your best craft skills. Then you are to select one suitable "floor" or "carpet" color to be used for both spaces and the corridor between them; and next, the different wall colors for the interior surfaces of the two rooms. Your objective is to achieve a set of conditions assigned by your instructor, including:

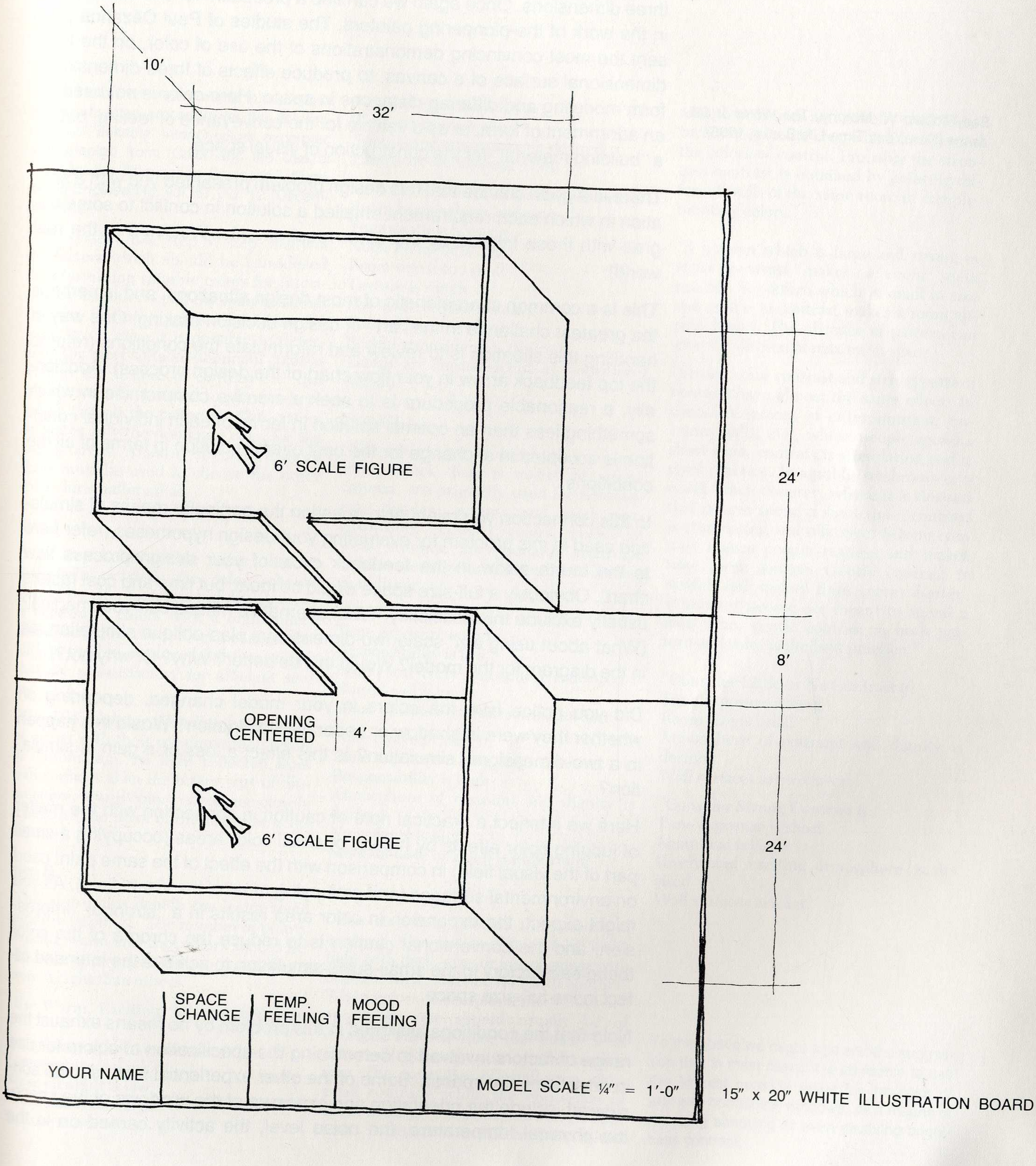
1. Color "temperature feeling": warm, neutral, or cool.
2. Color "mood feeling": A, spontaneity and gaiety; B, depression and dullness; C, lightness and cleanliness; or D, richness and quality.
3. Apparent differences in the size or proportions of the space of the two rooms: I, one space larger than the other; or II, one space longer and narrower than the other.



To simplify the problem, and to facilitate comparison with your classmates' work, each wall is to have only one color, and it should be patternless. Different walls may of course have different colors. It is suggested that you first try out your color hypotheses on ready-made colored paper, and then on specially painted paper. To make it easier for the viewer to relate to the environmental scene simulated by your scale model, please provide identical six-foot "scale figures" at the same location in each space. It is important that these clues to the relative size of the spaces be carefully made in true adult proportions, and that they are recognizable as human figures.

Be sure to include your name, and a diagram of your assigned conditions (space size/proportion change, "temperature feeling," and "mood feeling") along the bottom 15″ edge of the board.

Since the model you constructed for this problem will be reused later, in connection with the texture and space studies of Problem 17, you are well advised to photograph it now so as to have a record of your work on this problem.


10′
32′
24′
8′
24′
6′ SCALE FIGURE
OPENING
CENTERED
4′
6′ SCALE FIGURE
SPACE
CHANGE
TEMP.
FEELING
MOOD
FEELING
YOUR NAME
MODEL SCALE ¼″ = 1′-0″
15″ x 20″ WHITE ILLUSTRATION BOARD

Discussion

The spatial effects of color investigated in this problem represent yet another mode of color use. In the present problem we have employed color on environmental surfaces as a means for the modeling of space in two or three dimensions. Once again we can find a precedent for this use of color in the work of the pioneering painters. The studies of Paul Cézanne present the most convincing demonstrations of the use of color, on the two-dimensional surface of a canvas, to produce effects of three-dimensional form modeling and differing distances in space. Here color is not used as an adornment of form, or as a vehicle for the conveyance of feeling, but as a "building material" for the construction of visual space.

See Richard W. Murphy, *The World of Cézanne* (New York: Time-Life Books, 1968)

There is a good chance that this design problem presented you with a situation in which each requirement entailed a solution in conflict to some degree with those implied by the other requirements. Welcome to the real world!

This is a common characteristic of most design situations, and is perhaps the greatest challenge in the "art" of design decision-making. One way of handling this situation is to review and reformulate the conditions (refer to the top feedback arrow in your flow chart of the design process). Additionally, a reasonable procedure is to seek a creative compromise in which something less than an optimal solution in terms of each individual condition is accepted in exchange for the best overall solution in terms of all the conditions.

In this connection you might also question the particular means of simulation used in this problem for evaluating your design hypotheses (refer here to the fourth arrow in the feedback cycle of your design process flow chart). Obviously a full-size space would be ideal, but time and cost factors usually exclude this possibility. What alternative means can you imagine? (What about using a ¼″ scale *two*-dimensional plan-oblique simulation, as in the diagram for the model? Would this be better? Why? Or why not?)

Did you notice how the colors in your model changed, depending on whether they were in shadow or under full illumination? Would this happen in a two-dimensional simulation? Is this effect a loss or a gain in simulation?

Here we interject a practical note of caution in connection with the matter of judging color effects by means of small color areas (occupying a small part of the visual field) in comparison with the effect of the same paint used on environmental surfaces (and occupying most of the visual field). As you might expect, the expansion in color area results in a "stronger" impression, and the conventional caution is to reduce the chroma of the color found satisfactory in the small-scale simulation to achieve the intended effect in the full-size space.

Note that the conditions assigned in this problem by no means exhaust the range of factors involved in determining the specification of colors for use in environmental spaces. Some of the other experiential factors to be considered include the orientation and exposure of the windows of the space, the physical temperature, the noise level, the activity carried on in the space, the nature and type of artificial illumination, the preexisting forms and textures, and other factors connected with the users of the space themselves.

These factors are incorporated in the following step-by-step procedure for the determination of "suitable" interior colors, excerpted and adapted from "Color and the Use of Color by the Illuminating Engineer," *Illuminating Engineering,* vol. 57, no. 12 (December 1962).

"This system lists, step by step, many of the factors which should be considered in determining suitable colors for interiors. By considering all the known factors such as warmth, spaciousness, excitement level, etc., it is possible to determine the most suitable dominant color as well as the degree of contrast . . .this procedure is best suited to places where public taste is the criterion. The system indicates only the dominant color for the largest areas. A sense of color relationships must be used to choose the other colors for smaller areas. . . .

Step I

"This step helps decide *value,* that is, how light or dark the color scheme should be. If a high level of illumination is necessary, colors with a high reflectance should be used. Dark color combinations tend to produce brightness ratios that are unsatisfactory for efficient seeing.

"The *IES Lighting Handbook* lists tasks or rooms with their recommended levels of illumination. As light reflected from wall surfaces is an important part of illumination, a wall color reflectance closely related to the level of illumination is indicated . . . ."

Step II

"This step helps decide the 'color temperature [feeling].' The number of points favoring warm and cool colors should be checked, allowing that some points have more weight than others.

"Use Warm, Exciting, Advancing Colors *if*:
Room has northern exposure
Temperature is cool
Noise element is low
Room size is too large
Texture is smooth
Physical exertion is light
Time exposure is short
Stimulating atmosphere is desired
Lamps are fluorescent (cool).

"Use Cool, Restful, Receding Colors, *if*:
Room has southern exposure
Temperature is warm
Noise element is high
Room size is too small
Texture is rough
Physical exertion is heavy
Time exposure is long
Restful atmosphere is desired
Lamps are incandescent or fluorescent (warm)."

Step III

"This step helps to decide the *chroma*. Pure colors, that is colors of strong chroma, are primarily used for advertising, display, accents and food merchandising. Grayed colors, colors of weak chroma, are primarily used for fashion areas, general interiors and merchandising.

"Use Pure Color *if*:
Time exposure is short
Responsibility is low
Bright and lively atmosphere is desired
Noise level is low
Sense of taste or smell is unimportant.

"Use Grayed Color *if*:
Time exposure is long
Responsibility is high
Atmosphere of restraint and dignity is desired
Noise level is high
Sense of taste or smell is important."

Step IV

"This step helps decide the amount of contrast. Contrast is obtained by using light with dark, gray or low chromas with high chromas, and one hue with another. When colors of complementary hues are employed, one should usually be of stronger chroma than the other. This color will normally occupy the smaller area. The opposition of small areas gives small contrasts while the opposition of larger areas gives a sense of stronger contrast. In interiors small contrast is obtained with trim and usually with furniture, equipment, etc., which are beyond the colorists' control. Probably the strongest contrast is obtained by painting different walls of the same room in complementary colors."

"A pattern which is large and strong in value contrast makes a room seem smaller. A pattern which is small in size and gentle in contrast makes a room appear larger. The absence of pattern can give the illusion of maximum space.

"Strong color contrast and strong pattern contrast have almost the same effect. In corridors, places of entertainment, entrance halls, etc., where people spend a short time, contrast is stimulating and is good practice. In a public washroom or a quick-lunch counter, where it is desired that people spend a short time, contrast is stimulating and effective. Strong contrast makes people restless and makes time seem longer. Gentle contrast is restful and makes time seem shorter. Wherever people are meant to spend a long time, gentle contrast in both pattern and color is the best practice."

"Consider Little or No Contrast *if*:
Time exposure is long
Room size is small
Atmosphere of restraint and dignity is desired
Wall surfaces are textured.

"Consider Strong Contrast *if*:
Time exposure is short
Room size is large
Lively and exciting atmosphere is desired
Wall surfaces are flat."

To the above we might also add the suggestion that in most cases it is advisable to use the highest possible value for the color of any wall containing windows, as a means of reducing annoying or even disabling brightness contrast.

" 'A person of fair complexion standing between a green bush and a red brick wall has certainly a face green on one side and red on the other, and if the sun shines on his forehead it may be at time intensely yellow. Still, we are, or at least were, not accustomed to depict these eminently realistic traits. We rather concentrate our attention upon what is permanent in the individual complexion as seen in the ordinary diffused daylight. We are accustomed to see the accidental momentary lights weakened in favor of the permanent impression.' Color appears to reside in the objects entirely independent of illumination.

"From the memory also comes another kind of association. Seeing an object means more than placing it in a frame of reference of the three-dimensional world. Even while one is seeing color as substance, one also sees it as cold or warm, bright, gay, sad, depressing, irritating, pleasing, crude, refined, wild, tame, exciting, relaxing, dirty, clean, rich, and possessed of innumerable other feeling qualities. These associations have their origin partly in the neuromuscular process, but partly also in sum total of the dominant other sensations connected with the color seen. The red of the flower, the blue of the sky, the white of the snow bring back feelings one already has for these things. When one says he sees cold water or a burning red, he is saying that his perception is an intersensory blend, a fusion of two or more sensory experiences."

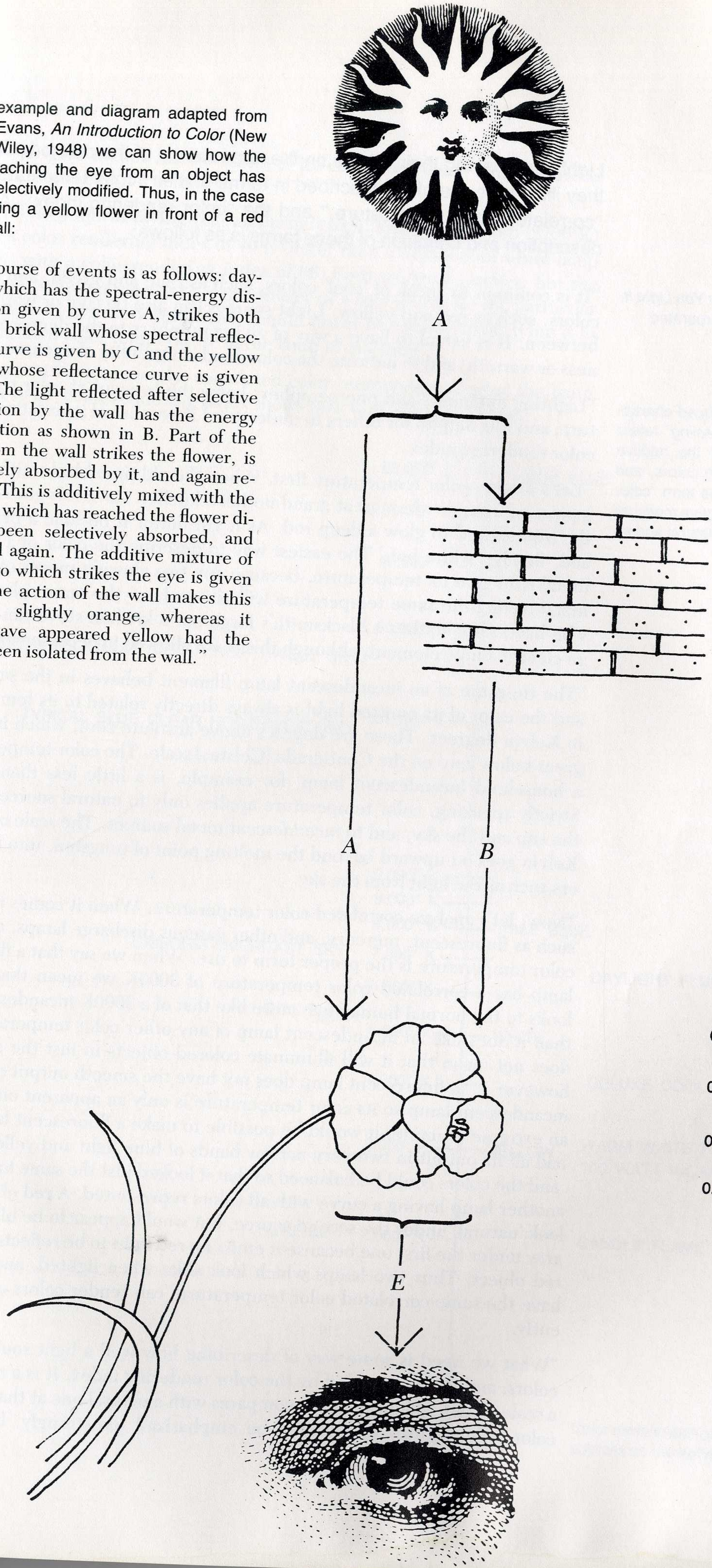
—Gyorgy Kepes, *The Language of Vision* (Chicago: Paul Theobald, 1944)

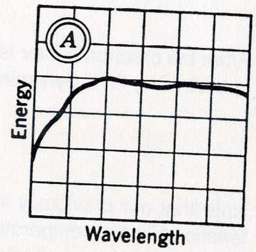
You will find it worthwhile now to repeat this problem, this time incorporating some arbitrary combination of conditions from this longer list of factors as the "givens" in the problem. Again we offer the caveat that the appended suggestions for handling these other factors should not be taken as sure-fire formulae, but only as first approximations, subject to modification for intentions and contexts other than those explicit and implicit in these suggestions, and, as always, also subject to your own empirical verification.

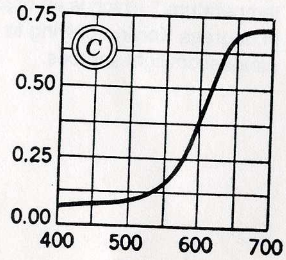
At this point let us enlarge on the matter of the influence of the light sources on the appearance of surface colors. A given space may be illuminated by one or more sources of light, including such natural sources as zenith skylight, north skylight, overcast sky, sunlight plus clear sky, and direct sunlight (all of which vary with the time of day), and such artificial sources as incandescent lamps, the many different fluorescent lamps, and the several high-intensity discharge lamps. The *physical differences* between these *light sources* can be described by means of a "spectral energy distribution curve" showing their relative energy at each wavelength in the range of visible spectrum. In a similar manner the *physical differences* in *environmental surfaces* may be characterized by the relative amount of energy they reflect at each wavelength in the visible spectrum. This can be described by means of a "spectral reflectance curve," and is a fundamental property of the material involved, independent of the incident light. Thus, when a given environmental surface is illuminated by light from a given source, the light reaching the observer's eyes from that surface is the unique consequence of the properties of that surface and that light, as described by these two curves. The accompanying diagram illustrates several aspects of this situation.

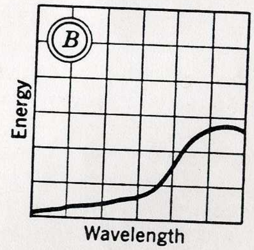
In an example and diagram adapted from Ralph Evans, *An Introduction to Color* (New York: Wiley, 1948) we can show how the light reaching the eye from an object has been selectively modified. Thus, in the case of viewing a yellow flower in front of a red brick wall:

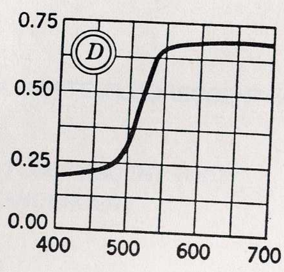
"The course of events is as follows: daylight, which has the spectral-energy distribution given by curve A, strikes both the red brick wall whose spectral reflectance curve is given by C and the yellow flower whose reflectance curve is given by D. The light reflected after selective absorption by the wall has the energy distribution as shown in B. Part of the light from the wall strikes the flower, is selectively absorbed by it, and again reflected. This is additively mixed with the daylight which has reached the flower directly, been selectively absorbed, and reflected again. The additive mixture of these two which strikes the eye is given in E. The action of the wall makes this radiation slightly orange, whereas it would have appeared yellow had the flower been isolated from the wall."

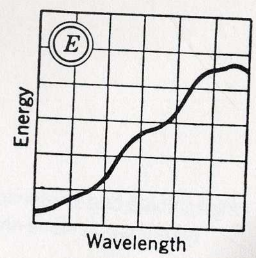








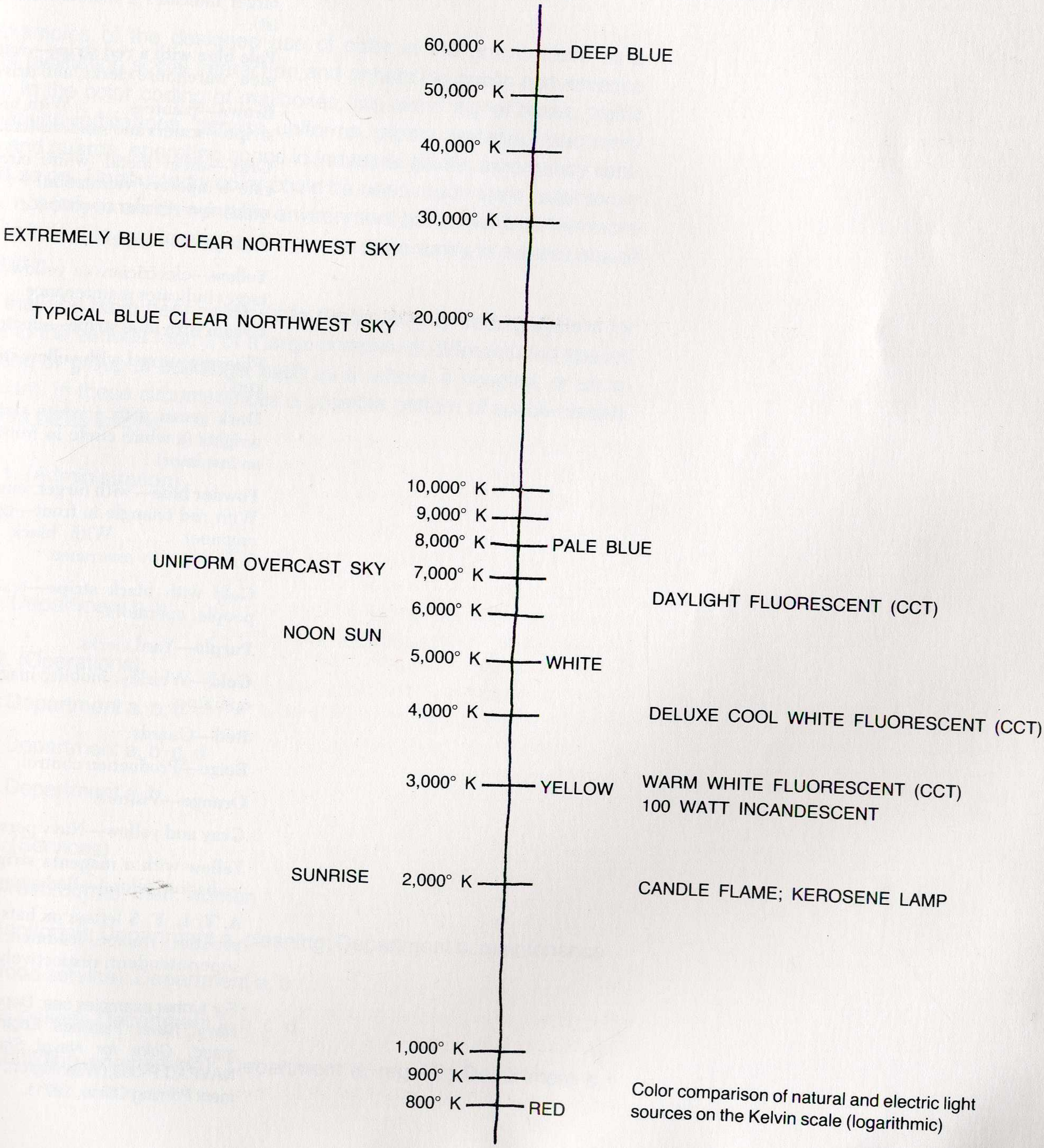




source can give a cool cast to colors if its correlated color temperature is high, or a warm cast if it is low.

"There is no point in saying that an incandescent/fluorescent lamp (2700°K) having a color rendering index of 90 is better than a deluxe cool white lamp (4100°K) with a color rendering index of 86. Both are good sources, but the question is whether we want a warm source or a cool source for the particular application. Color rendering index should never be used without tying it to the correlated color temperature of the lamp in question.

"Putting it still more simply; correlated color temperature is what the lamp is trying to be; color rendering index shows how well it is succeeding . . . ."



Color comparison of natural and electric light sources on the Kelvin scale (logarithmic)