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The Power of Colors

—Visual Perception and Comfort—

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○ Visual Stimuli in the Interior of a Train Car

Compared to other transports and facilities, it is characteristic of a train car that the ceiling, the walls, the floor etc. occupy a large proportion of its user's visual field. In a passenger car or a bus, the areas of wall-like parts are relatively small, and the floor and ceiling seldom catch the eye of a passenger. Though the ceiling occupies the upper half of a passenger's visual field in a plane, it rather functions as a storage. In a wide space such as a theater or a hotel lobby, the walls and the ceiling are viewed only from afar, and never at close range. In a vehicle or facility equipped with seats, the lower half of the visual field is occupied by seats lying before. In a school, a work place or a house, the psychological influence of the interior on people is small because their attention is always directed to other, more important objects (work etc.).

Once passengers have boarded a train, they generally do not engage in any pressing work. Unless they sleep, read or get absorbed in cell phone manipulation, they spend their time looking at the window or objects nearby. This means that the interior of a train car is likely to be observed by people, whether intently or desultorily. As the compartment is long and narrow, the interior is perceived both as a distant view (that forms a general impression) and as an object close by. Since the view of the interior is composed of large colored surfaces (the walls, the ceiling, the floor and seats) extending from afar to just before your eyes, the colors, patterns and feels of interior materials exert a great psychological influence on you.

○ Ideal Compartment Space

Passengers are different in age, sex, ethnicity and health condition. They have various reasons for making a train trip - attending office or school, sightseeing etc. Also, they have different ways to spend their time during a trip. Therefore, it isn't always appropriate to single out some type of passengers as target for a color plan, research their taste, and use findings from the research as basis for the plan. Likewise, it is difficult to define some purpose in using the compartment space, and determine interior colors that suit this purpose. Accordingly, colors must be selected so as to prevent the greatest possible proportion of passengers from feeling discomfort, as well as from being obstructed in spending time in a manner they like. Another noteworthy point is that a train car has a longer service life than a passenger car etc. A train car design will become quickly obsolete if it is developed to ride a short-lived fad, though this matter depends on the frequency of interior renewal.

This is a reason why a train should be designed not for attention, but for durability.

Generally, a train car compartment is designed with the aim of making it appear as spacious and bright as possible. By contrast, there is a need to create a dark space in designing theaters, movie theaters and other facilities in which light must be controlled; as well as restaurants and bars that are open in nighttime. Part of a vehicle compartment may be designed as a dark space in some special cases - e.g. when the effect of indirect lighting must be enhanced. However, it is very rare to see a compartment as dark as a windowless facility. Even a sleeping car is designed to take in abundant light in daytime. In a train in which passengers can move freely, poor illumination can cause safety problems. Passengers may feel uneasiness if they have difficulties in getting sufficient information in a dark compartment. Furthermore, sufficient illumination is indispensable in terms of ensuring a clean interior appearance and preventing crimes.

In the past, the standard feature of long-distance trains in Europe was a passenger car composed of walled compartments and private rooms. They offered a sense of security created by enclosing walls and narrowly partitioned spaces. However, this design has never become a standard in Japan, where most passenger cars are designed as single compartments for all who come in. It may be interesting to discuss the relationship between the size of compartment space and comfortableness, or between the openness of the space and a sense of security, in connection with differences between the characters of people and cultures in the East and the West. I hope to discuss this subject on another occasion.

Spaciousness and brightness being the common requirements for passenger cars in Japan, a key to realizing passenger comfort is how to prevent the cars from looking narrow. In this context, efforts should be made to expand compartment space physically e.g. by introducing innovative structural designs. It is also important to widen the perceived space through visual designs, e.g. by implementing appropriate color plans and selecting suitable interior materials.

○ Functions of Color

Most information we use in our life is furnished by our vision. Especially, our color vision is an important faculty that provides us a variety of information. Color is a sensory input which our brain creates based on signals from some cells; these signals are sent when the cells are excited under the influence of received light components of

particular wavelengths. While there are some individual differences in color vision, a greater part of sensory inputs and psychological influences attributable to color are thought to be common to all humans.

Most of us perceive a reddish color as warm, and a bluish color as cool. Also, we tend to feel that an object of a dark and thick color is heavier than that of a bright color. Even with regard to the same color, we see it as brighter and clearer if it occupies a larger area. Also, the perceived distance between an object and us varies according to the color of the object. A pattern of different colors, if designed appropriately, has the effect of making this perceived distance ambiguous, and thereby suppressing an oppressive feeling which we would have if we were watching a one-color area.

Also, contrasted colors exert largely common influences on our minds. If a color is contrasted with a darker background color, the former looks brighter than usual. If contrasted with a brighter color, the same color in the foreground looks darker than before (Fig. 1). If placed beside a clear color, a dull color looks even duller than usual (Fig. 2). A "hue circle" is composed of different colors, which are arranged in a ring form based on the principle that the closeness in hue should correspond to that in terms of distance on the ring (Fig. 4). A pair of colors at opposite positions on the hue circle (e.g. red and green, bluish green and orange, violet and yellowish green) is called complementary colors. If placed beside each other, a pair of complementary colors is perceived as clearer than usual. (However, this perceived effect does not translate into a higher visibility. A combination of highly saturated complementary colors should not be used for a direction board etc. Rather, a contrast in brightness should be preferred, in view of individual differences in color vision [Fig. 3].)

As has been discussed, colors produce visual effects common to all humans, in terms of perceived warmth, coolness, weight, area and distance; as well as contrast between colors that are different in brightness or saturation, or complementary to each other. If handled adeptly, these functional aspects of colors can contribute to enhancing the design of spaces and products.

○ Importance of Color Combination

In our daily life, we seldom experience a situation in which our entire visual field is occupied by the same color. Rather, the world as we see it is always filled with a multitude of colors. A color is always juxtaposed with another color lying aside or placed as background. This juxtaposition creates contrasts and relationships. Even the same color produces constantly changing impressions on the same person, which may be biased or truer depending on other colors in the surroundings, the characteristics of a light source, the perception of surface quality etc., and the person's health condition.

There are some set phrases on color, like "red is a

symbol of passion." However, such expressions are too rough, in light of the fact that the characters of individual colors are determined by the relationship among them. The same color, say a red, can make different impressions, as gloomy, refreshing etc., depending on colors in the surroundings. Classification of red as a warm color, of blue as a cold one etc. is also inaccurate. The character of a particular color should be defined only on the basis of combining it with some other color(s). Also, it should be noted that in case of color combinations based on the same set of colors, the impressions of these combinations could change depending on the sizes and forms of colored areas. This means that even the general effects of a particular color combination should be regarded not as a decided matter, but as a mere reference. Designers must study colors by checking their actual conditions.

○ Resources for Color Planning

The definition of a comfortable color design varies from person to person. While there may be a general tendency in people's preferences about color, there is no single method for satisfying all of them. The first step toward realizing a vehicle of universal comfort is to eliminate elements that may be perceived as uncomfortable by someone. Designers should note that they are charged to move not vehicles, but passengers. Based on this recognition, they should frame color plans that aren't too original.

The history of mankind represents only a small part of that of mammals. In this perspective, the development of civilization by humans is a recent phenomenon. A wild nature still lies dormant in us. Many of our impulses triggered by colors cannot be fully explained without recognizing the existence of an animal deep within us. The workings of our inner nature make us perceive some visual stimulus as pleasing, relaxing, threatening or alarming. By studying these workings objectively, designers can find color combinations that are comfortable and stress-free for everyone. Nature provides us limitless resources for color and spatial design. A key to achieving passenger comfort is to recognize, extract and understand signals from nature, and mold something conformant to nature from them.