



## A comparative study of the emotional assessment of automotive exterior colors in Asia

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### ABSTRACT

This article compares color assessments of automotive exteriors at four locations in China, Thailand and Japan. This study employed painted panels of twelve colors, thirty sensory words and fifteen pairs of emotion variables. It also used reference figures of nine cars that included four styling categories, namely sedans, compacts, sport utility vehicles and sports cars. The results of like–dislike tests revealed that basic automotive exterior colors, such as black, white and red, were highly preferred across locations. However, geographical differences are apparent in the preference for some non-basic colors. To elucidate these geographical differences, a Chi-square test and principal component analysis were performed on the data on emotion variables. The results revealed both similarities and differences in color preferences among the four locations. Color preferences were similar in Hong Kong and Shanghai when simply evaluated by color samples. However, similar preferences for automotive exterior colors were observed in Hong Kong, Kyoto and Bangkok, but not in Shanghai. These results suggest that there is fluctuation in the emotion evoked by a color when the color is considered in the context of automotive exteriors. Therefore, this study indicates that automotive sales can be secured in the global marketplace by creating a single palette of exterior colors based on similar color preferences across countries. However, these results also indicate that preparing market-specific automotive-color line-ups can be an effective marketing strategy.

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### 1. Introduction

Recently, automotive manufacturers have begun to pay more attention to Asian markets, including China and Thailand, in response to the increasing use of automobiles in that region. Automotive sales for 2001 were 5.9 million in Japan, 2.3 million in China and three hundred thousand in Thailand [1]. To expand automobile sales at the global level, automotive products must be adjusted to reflect the tastes and customs of each nation's market because each country has its own preferences for color, style and function. Because color is the most important factor in catching the consumer's eye, this paper primarily addresses color assessments of automotive exteriors in different countries.

Researchers have conducted cross-cultural studies of color preferences among Asian countries in the past by using colored paper chips as stimuli. With respect to color tastes in various countries, Saito compared color preferences in three Asian cities (Tokyo, Taipei and Tianjin) and found that white, vivid blue, vivid green, light violet and light blue were commonly preferred [2]. Saito also confirmed, in later work, that white is a favorite color in Jakarta and Seoul [3,4]. Chijiwa surveyed the color preferences of several Asian countries, including Japan, China, Korea and Taiwan, by using 47 colored paper samples. That study concluded that vivid purplish blue, vivid red and white were commonly preferred in those countries [5]. However, there are some colors that induce different emotions in different countries. For example, according to the Chijiwa survey, purple and black have different traditional meanings in Europe and some parts of Asia, whereas Saito remarked that purple elicits a different emotion in Japan and Taiwan.

Researchers have also conducted many cultural and geographical studies of color emotion among Asian countries. Xin et al. compared emotional responses to color in Hong Kong, Japan and

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Thailand using 218 color samples and twelve pairs of color emotions. That study concluded that the influences of lightness and chroma were much more important than that of hue on color emotions [6,7]. In the study conducted by Gao and Xin, a total of 218 color samples were assessed by seventy subjects in terms of twelve emotion-linked variables. The results indicated that color emotion can be specified in terms of three indices that are dependent on lightness and chroma. These results also illustrated that the influence of hue on emotional response is less significant, even for the variable “warm–cool,” than previous studies had indicated [8]. In the study by Gao et al., subjects from seven different regions were asked to evaluate 214 color samples on twelve emotion variables. Its authors observed that chroma and lightness were the most important factors triggering color emotions and that the influences of hue and cultural background were very limited [9]. However, the survey by Chijiwa did indicate a regional difference in color emotion when evaluated in terms of “somber–gaudy”, “light–heavy” and “cool–warm”.

While color is a definitive factor in consumers' decisions, little is known regarding how people assess automotive exterior colors in different countries. Although some companies handling durable goods, such as automobiles, have surveyed consumers' color preferences regarding specific products, the results of those surveys have never been disclosed because of the companies' need to secure a competitive advantage. Pigment companies and color-trend forecasting companies report and discuss color marketing from the perspective of consumers' color preferences when they provide details on the number of cars sold with specific exterior colors in various markets. Color trends were surveyed by counting the exterior colors of passenger cars on the heavily trafficked streets in Asian cities. Such surveys confirm that 50% of car exteriors are monochromatic, whereas medium and dark colors are preferred among achromatic colors [10].

Japan Color Research Institute has surveyed the favorite colors for a sedan and a mini-vehicle. Subjects were asked to choose a favorite color for a sedan and mini-vehicle from among 75 colored paper chips. The results showed the dependence of favorite colors on car category, with black being the favorite color for a sedan and vivid red for a mini-vehicle [11].

Saito compared color preferences among 50 colored paper sheets both with and without revealing the shape of a passenger car on the template. No particular preference was observed among neutral colors, such as black and white, but neutral colors were slightly preferred when the shape was not shown. Light, vivid and deep colors were preferred when the shape was not shown, but darker colors were favored when the shape was shown [12]. From these findings, it is possible to conclude that color preferences for automotive exteriors are influenced by the shape and category of an automobile. An automobile design is specific to its intended use, as represented by styling categories that include sports cars and sedans among others. Consumers identify the function and purpose of an automobile properly by its styling category, not by its square or round shape. For example, a zippy compact-type automobile is used for day-to-day purposes, whereas a sport utility vehicle-type automobile is used to take a family on a vacation. However, even if people from different countries have a similar image regarding the function of a certain styling category, consumers may form a particular image of an automobile and its possession by reference to their lifestyles, cultural traditions and the types of automobiles to be found in their country. In fact, as shown by previous studies, each country is characterized by its own most popular color for an automotive exterior. The most popular color in each country might be largely determined by practical considerations, including the influence of the strength of sunlight on the appearance of different colors. There are also other emotional factors for color determination. In the context of such factors, color images will be different

and the styling and function of an automobile may impact people differently in different countries.

To elucidate geographical differences in preferences for and the emotion-linked variables of exterior automotive colors, this study observed responses to categories of cars in Hong Kong, Shanghai, Thailand and Japan.

## 2. Methodology

### 2.1. Selection of colors and emotion variables

#### 2.1.1. Subjects

One hundred and one subjects were selected from among the students of Hong Kong Polytechnic University in Hong Kong and the Kyoto Institute of Technology in Japan, as well as from among the research staff of Nippon Paint Co. Ltd., Japan. At Hong Kong Polytechnic University, the subjects were  $20.7 \pm 0.86$  years old (mean  $\pm$  SD,  $n=40$ ), including 24 males ( $20.7 \pm 0.92$  years old) and 16 females ( $20.6 \pm 0.81$  years old). At the Kyoto Institute of Technology, the subjects were  $21.4 \pm 1.25$  years old ( $n=40$ ), including 20 males ( $21.7 \pm 1.53$  years old) and 20 females ( $21.0 \pm 0.79$  years old). At Nippon Paint Co. Ltd., the subjects were  $38.3 \pm 10.4$  years old ( $n=21$ ), including 11 males ( $43.2 \pm 11.4$  years old) and 10 females ( $32.3 \pm 4.44$  years old).

#### 2.1.2. Survey conditions

Colored sheets of paper were placed on a desk covered with gray color cloth facing a north window with natural sunlight (which shows less diurnal variation of color and quantity of light in fine weather). The colored sheets consisted of pieces ( $12 \text{ cm} \times 17.4 \text{ cm}$ ) of the 104b Color Chart, purchased from Japan Color Enterprise Co., Ltd., that were applied to the viewing objects. In addition, the figures of fifteen automobiles in four different styling categories, including sedan, sports car, sport utility vehicle and compact, were shown to the subjects to encourage them to engage in a survey of automotive exterior colors.

#### 2.1.3. Questionnaire

The subjects were asked to select their favorite automobiles by viewing a set of randomly arranged black-and-white photographs of fifteen commercial automobiles. The subjects were then asked to categorize the color pieces described above as “suitable”, “unsuitable” or “neither” for a selected automobile, and then to choose adjectives expressing the suitability or unsuitability of the specified automotive shape using the local language (Cantonese in Hong Kong and Japanese in Japan). Twelve colors were chosen for coating automobile exterior body panels, with four colors picked for each of the following categories: the most suitable color common to all countries, the most unsuitable color common to all countries and the color specified as the most unsuitable by a paint company but as the most suitable by university students. The colors were also specified vice versa.

#### 2.1.4. Selected colors and emotion variables for the main experiment

The selected colors vary either noticeably or subtly according to the objects and the subjects of the three categories. For the main experiment, the selected colors were coated on metal plates with automotive paint and were evaluated in terms of the CIELAB values by using a multi-angle spectrophotometer (X-Rite, MA68II), as shown in Table 1. The adjective words were composed into the pairs of antonyms, as shown in Fig. 1. Fifteen pairs of emotion variables were composed from the adjectives listed by the subjects in the questionnaire for purposes of evaluating degrees of preference on a seven-point scale. The six similar side shapes were removed from the original chart and nine monochromatic side views were

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