Chapter 6
Relationship Between Car Color and Car Accident on the Basis of Chromatic Aberration

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Abstract In choosing a car, we consider car performance, design, price, and safety as the most important things without reference to accident occurrence probability. We first studied on the concepts of advancing color and receding color as well as relationships with car accidents. Consequently, advancing color causes less accidents since the color looks closer than it actually is. And receding color causes more accidents since the color looks farther than it actually is. And we classified car colors into seven ones such as black, white, blue, green, silver, red, and yellow. Each representative color includes its detailed colors corresponding to its domain. We also proposed accident occurrence probabilities ordered by each color. The descending order is blue, green, white, red, black, silver, and yellow. The rate of relationship with 74.64 % is high than that of disrelationship with 25.36 %.

Keywords Car accident · Advanced color · Receded color · Chromatic aberration

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6.1 Introduction

In choosing a car, we first of all consider its use for private, family, and freight. And we consider its price. In the ear of high oil price, we check its average mileage a liter. We also check whether we will drive it in the town or on the high ways as well as on the paved road or on the unpaved road. Lastly, we consider its design and color that we like. However, the selected color is closely related with car accident. The relationship between accident and color is very important although it doesn't look. There are various colors of car body. But, only 7–8 colors are widely used. We will express relationship between accident and color by use of only limited 7 colors. In the days when cars were rare in Korea, deep colors like black were widely used. In these days of Korea, light colors like silver, gold, and white are largely used. Lately, cars in white or silver are increasing more and more. Cars in light colors make lighter and cleaner impression than those in other colors. It is however important that these colors have a lot to do with citizen safety with their feeling of expansion. Also, car drivers of these colors tend to show off self-display. What color of cars is used the most in Korea? In Korea, black, white, and silver are most widely used. It would be so because many Koreans like quite tones. But, from the last 2011 until a recent date, colors of cars have been changing little by little. Small-sized cars show this phenomenon remarkably rather than large-sized ones. Yellowish and pinkish colors have been increasing. Sales volume of yellowish and pinkish cars actually increased. This phenomenon shows the expressions of personality and tendency of car owners. But, it is considered to have a lot to do with car accident. This paper studies on relationship between car color and car accident in Korea. Section 6.2 shows related works on relationship between car color and car accident and Sect. 6.3 checks concepts of advancing color and receding color. In Sect. 6.4, we perform an experiment for relationship between car color and car accident. Lastly we make conclusions in Sect. 6.5.

6.2 Related Works

The studies of Stuart Newstead & Angelo D'Elia [1] have assessed the relationship between vehicle color and crash risk through the analysis of real crash outcomes described in mass crash data reported to polices in two Australian states. S. Furness, etc. investigated the effect of car color on the risk of a serious injury from a crash, using a population based case control study designed to identify and quantify modifiable risk factors [2]. Numerous studies modeling risk factors pertaining to traffic safety have been conducted [3]. Examples include modeling injury severity studies [4, 5]; seat belt use effects on traffic safety [6, 7]; geometric effects on safety [8]; impaired driving effects [9]; large truck crashes [10, 11], etc. Also, many studies have investigated the relationship between color and visibility (e.g., [12]) and most of them have focused on reflectivity of sign visibility (e.g.,

[13–15]). However, very little research has been conducted to study whether vehicle color may have an effect on motor vehicle crash. Particularly, scientific studies to determine the relationship between vehicle color and crash risks have been scarcely investigated [1].

The damage extent of car accident and social cost are as follows. According to data of Korea Road Traffic Authority in Table 6.1, there are 897,271 car accidents in 2011 with killing 5,229 and wounding 1,434,786 (seriously wounded 173,809, slightly wounded 935,449, and wounded reported 325,528. The yearly cost of road accidents in Korea increases to 13 trillion won. For example, the cost of 2010 is 12,959.9 billion won, which is 1.1 % of GDP or 6.4 % of a national budget of Korea. The cost of 2009 increases 10 % (118.24 billion won) more than that of 2009. This scale is 1.1 % of GDP 1172.8034 trillion won or 6.4 % of Korea national budget 201.2835 trillion won.

6.3 Advanced Color and Receded Color

Let us assume that a blue car and a golden car stand in the same location. The blue car looks smaller as if it would be far from its real location. On the contrary to this, the golden car looks closer than it really is. The retraction index of color and focusing function of our eyes make location of an object look differently according to color. In chromatics, this phenomenon is called as Chromatic Aberration. Since the retraction index of light is small in case of gold chromatic aberration, the image is focused behind the retina. Then, the eyeball inflates crystalline lens in order to focus the image on the retina. At this moment, the crystalline lens inflates and becomes convex lens. So, the golden car looks closer than it really is. On the contrary, the blue car looks farther than it really is. We assume that the concept of chromatic aberration is the same as that of advanced or receded color. Therefore, all colors in the world have their advanced color and receded color. An advanced color means the color that looks closer although it really is farther. Advanced color is also called expansive image such as white, yellow, red, and so on. A receded

Table 6.1 Year-on-year traffic accident overview

Basic year (unit: person, %)	2011	2010
Number of cases	897,271	979,307
Increasing/decreasing number	−82,036	
Increasing/decreasing rate	−8.4	
Killed	5,229	5,505
Increasing/decreasing number	−276	
Increasing/decreasing rate	−5	
Injured	1,434,786	1,533,609
Increasing/decreasing number	−98,823	
Increasing/decreasing rate	−6.4	

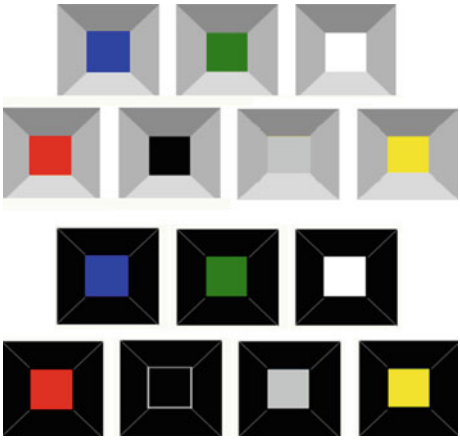


Fig. 6.1 Advanced color and receded color

color means the color that looks farther although it really is closer. Receded color is also called contractive image such as black, deep blue, grey, and so forth.

Advancing phenomenon could be checked by use of relationship between a certain color and its background color in the same location like Fig. 6.1. Advanced color is the color that looks about to stick out forward rather than background color. Adversely, receded color is the color that looks about to draw back backward. Warm colors such as yellow and red are advanced colors since they look about to stick out forward rather than cold colors such as blue and blue-green. Cold colors are receded colors since they look farther. Chromatic colors tend to advance rather than achromatic ones. In case of dark backgrounds, lighter colors are more advanced. But, in case of bright backgrounds, darker colors are more advanced. Warm colors are more advanced than cold ones. Bright colors are more advanced than dark ones. Colors with a high chroma are more advanced than those with a low chroma.

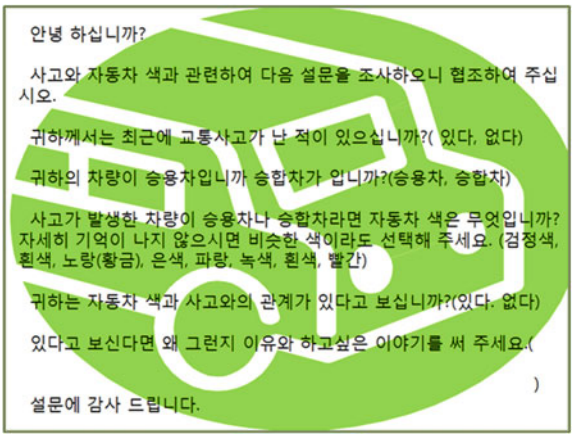
6.4 Experiment: Relationship Between Car Color and Car Accident

In choosing a car, most of people consider various conditions. Color is an important factor to be considered. People choose their car colors by use of their favorite colors. From a safe perspective, it is recommended to choose expansive color with bright colors rather than contractive color with dark colors. In order to check relationship between car color and car accident, we performed an experiment with scrapped cars in Kunsan. Figure 6.2 shows the arrangement of car colors. All Colors are classified into seven colors from blue to yellow (gold) and each color represents its region. For example, car colors of blue are six colors and these six colors are commonly called ‘blue’ in Fig. 6.2.

Fig. 6.2 Arrangement of car colors

There was any kind of data related to car colors in government offices. So, we should check colors of scrapped cars or perform phone interviews with individuals for ourselves. Figure 6.3 shows the questionnaire performed in phone or direct interviews. 138 persons responded to the 250 questionnaires. That is to say those 138 persons would have experienced a car accident. We checked accident rates for each color by use of 138 responses. The number of accidents is calculated redundantly for cars. The number of total car accident is 298. In Table 6.2, 'ratio of vehicle per accident' means percentage of number of accidents for accident vehicles. The rank is the order of car accidents. Our research does not consider driving experiences of all drivers.

In Table 6.2, the rank of blue is 1 since it is a receding color. The rank of yellow (gold) is 7 so its probability of car accident is the least. Since yellow has no chromatic aberration, it is focused on the retina when entering eyes. Yellow has properties to expand on the retina like ink and look larger among colors. So, for drivers, it is used as hats, raincoats, backpacks of preschool and elementary school. The descending order of accident occurrence probabilities is blue, green, white, red, black, silver, and yellow (gold).


안녕 하십니까?

사고와 자동차 색과 관련하여 다음 설문을 조사하오니 협조하여 주십시오.

귀하께서는 최근에 교통사고가 난 적이 있으십니까?(있다, 없다)

귀하의 차량이 승용차입니까 승합차가 입니까?(승용차, 승합차)

사고가 발생한 차량이 승용차나 승합차라면 자동차 색은 무엇입니까? 자세히 기억이 나지 않으시면 비슷한 색이라도 선택해 주세요. (검정색, 흰색, 노랑(황금), 은색, 파랑, 녹색, 흰색, 빨간)

귀하는 자동차 색과 사고와의 관계가 있다고 보십니까?(있다, 없다)

있다고 보신다면 왜 그런지 이유와 하고싶은 이야기를 써 주세요.(

)

설문에 감사 드립니다.

Fig. 6.3 Questionnaire on car accident

Table 6.2 Number of Accidents per Vehicle Color

Vehicle color	No of accident vehicle	No of accidents	Ration of vehicle per accidents	Rank
Black	25	48	192	5
White	29	70	241	3
Blue	12	39	354	1
Green	11	36	327	2
Silver	40	69	172	6
Red	13	28	215	4
Yellow (Gold)	6	8	133	7
Total	138	298	216	

Table 6.3 Relationship between car color and car accident

Relationship	Yes	No
Persons	103	35
Percentage	74.64	25.36

In Table 6.3, 103 responders (74.64 %) think that there is relationship between car color and car accident. The number of the responders is three times as many as that of rest (25.36 %) who does not think any relationship between car color and car accident. Consequently, most of drivers think that color has something to do with accident. The reason why there is a relationship between car color and car accident is that there are good colors in light and in darkness respectively. Many people think that yellows cars would belong to preschools or elementary schools. And, even though yellowish cars have low probability of car accident, they are neglected for yellow's puerile color.

6.5 Conclusions

In buying a car, its performance, design, price, and safeness are considered with ignoring its color. However, for safety, color should be considered on the preferential basis before other options. As we already studied, advanced colors have low probability of car accident since they look closer than they really are. On the contrary, receding colors have high probability of car accident since they look farther than they really are. And we classified car colors into seven ones such as black, white, blue, green, silver, red, and yellow (gold). Each representative color includes its detailed colors corresponding to its domain. We also proposed accident occurrence probabilities ordered by each color. The descending order is blue, green, white, red, black, silver, and yellow (gold). And we confirmed that there are relationships between car colors and car accidents.

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