

Color measurement and management in automotive industry using Sensegood spectrophotometer

After World War II, companies recognized that color would help to sell much more automobiles. Styling executives of leading automobile manufacturers George Walter (Ford), Harley Earl (General Motors) and Virgil Exner (Chrysler) made extensive analyses of sales and preferred colors according to fashion and interior decoration trends. Automobile companies established wide and well-equipped color departments to obtain new and attractive color schemes for both interior and exterior finishes. [1]

Significance of color in automotives:

Use of Color in Marketing:

Color is silent salesperson to attract customer's attention. Color is a dominant decision maker for us when we're making a purchase. Color sells, but the right color sells better. Larry Getlen mentioned that according to researches of Yankelovich and Partners, a marketing consultant, "As many as 40 percent of customers would switch car brands if unable to get the car color they desire". [2] Consumer color preferences are influenced by many variables such as age, gender, education level, ethnic origin, nationality, geographical region, continent, memories, society, symbolization and perception of color, personal characteristics and experiences. [3]

Effect of color on weight and length perception:

White colored objects appear lighter and larger, whereas dark ones are perceived dense and smaller. To illustrate, darker automobile in the figure seems to be heavier and smaller even if the weights and sizes are equal. The relation of color and weight also influences the length of automobiles. [4]

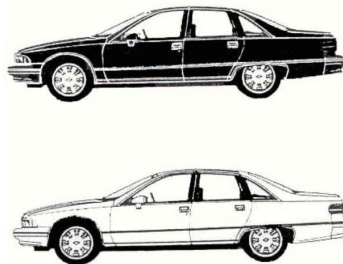


Illustration: Dark-heavier-smaller and White-lighter-larger. Source: IES Color Committee, 1990 [4]

Color and Safety:

According to Levent Köprülü [5], colors can have a significant role in accidents. Visibility is a function of contrast and reflectance. Some colors can influence the conspicuity of automobiles. White is the most visible automobile color in almost all light and weather conditions.

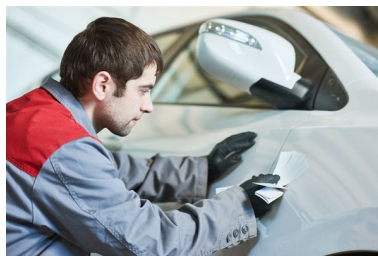


Photo: Correct paint matching is critical: Which shade of white suits the best? Visual color match has limitations. Be confident by measuring perfect match and associated whiteness index using Sensegood spectrophotometer. Source: www.suburbanautobody.com

Importance of color measurement:

Body, bumpers, mirrors, doors, dashboards, roofs and many other things require uniformity and consistency in their visual appearance. Any appearance differences between car body and add-on parts will be most

noticeable and be associated with poor quality. Difference in shade of two cars with the same color will throw the brand image of the manufacturer into bad light.



Sensegood spectrophotometer assists in determining such color mismatches and eliminating off-colored products being launched in market. Photo: Jeff Cobb who is raising issues with color mismatch in his new car.

Citing above photo, user posts, “With the asking price for a (car brand name) being around \$40,000 for a new car, I expect the paint job to be uniform with all of the body panels matching. What’s more, a number of (car brand name) owners have noticed that the front and rear bumper panels do not match the rest of the body paint. Now these aren’t glaring issues.”

Use of Sensegood spectrophotometer for color quality control in automotive industry:



- ✓ Benchtop/ Tabletop: (a) (b) (Rotating sample platform)
- ✓ Handheld/ Portable: (c) (d)
- ✓ Online/ In-process: (e)

- ✓ Solid: (a) (c) (d) (e)
- ✓ Liquid: (b) (e)
- ✓ Paste: (b) (e)
- ✓ Powder: (a) (b) (e)

- ✓ Contact measurement: (c) (d)
- ✓ Non-contact measurement: (a) (b) (e) (Adjustable height)

- Works with:
- ✓ 5V adapter (cell phone charger)
- ✓ Power bank
- ✓ Computer/ Laptop (f)

- ✓ Averaging
- ✓ Auto repeat measurement mode
- ✓ Color match percentage
- ✓ Color indices (whiteness, yellowness, ...)

- ✓ *SensegoodSmart*
– computer interface software utility

Manufacturers:

It is important to the manufacturer’s branding image that the color of the car delivered to the customer matches the color in the brochure or on the sales demonstration model. Manufacturers are concerned with ensuring the homogeneity in the colors of different parts that compose their products. This quality objective of primary importance is especially challenging when the parts are sourced by different suppliers. Color can be influenced by a variety of material, substrate and process parameters. Color measurement devices such as Sensegood spectrophotometers are used extensively by the manufacturers in their R&D and production lines. Using these devices, manufacturer can bring perfect consistency in the color of the cars manufactured in different countries.



$L^*=23.43, a^*=16.81, b^*=20.94$

Photo: Convergence and uniformity in appearance: Interior of Ferrari F430. In automobile industry, different parts are being supplied by different suppliers with plants at distinct locations. Ensure tight control of color tolerances and comprehensive supply chain color management with Sensegood spectrophotometer.

Color Design of Automobile Interior: The color harmony of the materials in interior designs of automobile such as plastics, textile and leather have become of the utmost importance. Interior design of automobiles contributes presenting philosophy and the spirit of the company. They should be in harmony with exterior colors of automobiles. Interior trim color should emphasize the openness, clarity and space.

Aftermarket products: Aftermarket products, accessories and spares are a major part of the industry. Customers often look for original parts specified by original manufacturer. It is important that these replacement parts manufactured in various plants are consistent with the original vehicle color scheme.



Photo: External body, bumpers, spoiler, mirrors, dashboards, interiors and many other things require uniformity and consistency in their color. Manufacturers and suppliers need to coordinate to get right color. Manufacturer shares numerical color data generated by Sensegood spectrophotometer with the supplier. Using Sensegood spectrophotometer, supplier ensures desired color by measuring and matching product color with numerical color data supplied by manufacturer. This ensures bumper to bumper color consistency and uniform aesthetics of the car across global supply chain.

Suppliers:

Suppliers use Sensegood spectrophotometers to reject the parts that do not match the coloring standards as set by the manufacturer. Research cites the significant improvement in color quality and consistency in production of colored car bumpers by using a spectrophotometer. The quality index and customer satisfaction was improved by 67% in only 6 months. [6] This case study therefore illustrates how simple quality tool like spectrophotometer can be used in a rigorous search for process improvement toward total color mastering with zero defect objective.

Service and repair stations:



Photo: Car photos after color repair work. Using Sensegood spectrophotometer one can avoid such color mismatches and so any customer complaints. Sources: www.camaro5.com and f10.m5post.com

When a car is repaired and repainted after an accident, the repair should match the rest of the vehicle, in both color and texture. But paints can fade over time, so it may not be possible to match the color by simply referring to the original paint formulation. Hence, authorized service stations use our low cost tool like Sensegood spectrophotometer to match and justify the color to the customer which eliminates potential color mismatch complaints frequently raised by customers.

Automotive color researchers:

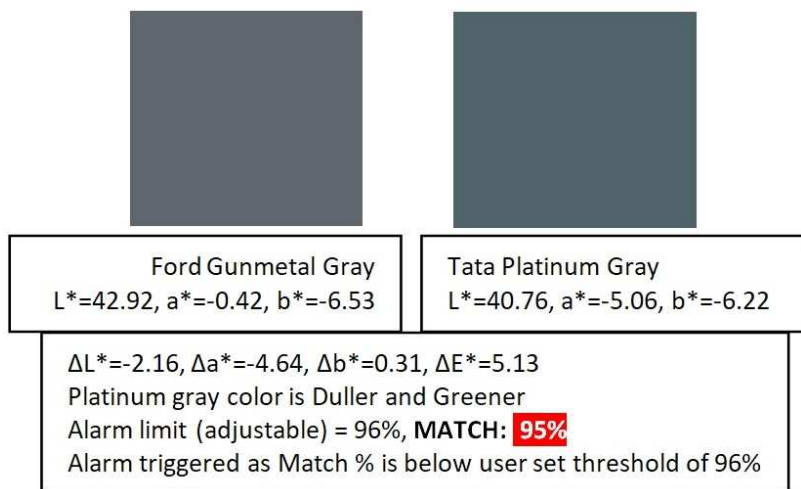


Photo: Color fading. Source: mercedessource.com

Success in the paint and coatings industry relies heavily on innovation and the continual advancement of science and technology into new frontiers. As such, strategies for the adoption of new technologies directly impact the performance of companies involved in all aspects of the paint and coatings value chain. [7] Sensegood spectrophotometer offers sophisticated instrumental method of analysis. It assists research groups in developing and characterizing new durable formulations, studying aging of the coating, studying the effects of color shift or fading due to environmental parameters or minimizing it by using additives like light stabilizers.

Benefits of using Sensegood spectrophotometer:

- Improve overall product quality and aesthetics
- No repeat and reprocessing steps due to potential off-color
- Minimum production downtime
- Tight color control on all interior and exterior parts supplied by different vendors
- Reproduce each coating consistently: Achieving desired product color across all batches of production
- Measure and convey color – Seamless management of color process across plants in multiple locations and global supply chain
- Deliver accurate formulation of colorants to meet customer provided standards
- Researching toward product improvement: Study the effect of stabilizers on fading of paint – light and temperature stabilizers
- Eliminate common visual errors caused by inadequate lighting or human estimate
- Process gets standardized – Advantages of instrumental color measurement and scientific approach toward production



Sensegood Spectrophotometer for color management and consistency control in automobiles

Photo: Sensegood spectrophotometer is a tool that analyses color attributes comprehensively. It provides percentage match between sample and reference. It alarms operator or supervisor if color match is poor, below set threshold. Sensegood spectrophotometer provides information regarding difference in components in color space. The information assists user to take appropriate action to reprocess the sample. Further, desired reference can be saved and can be used whenever required to compare it with the samples in every production batch.

Visual color matching is an art. However, when an individual sees a potential color match, because of the process of color vision, the nerve light receptors in the eye begin to fatigue. The result is that color matches begin to appear closer over time, usually after 15-20 seconds of viewing. Also viewing bright colors just before viewing deep colors can affect color judgment without enough time allowed for visual rest and recovery. There are also other factors like aging of the eye, stress and light source that affect the color match decision. Also scientifically it is proven that every individual has different expressive perception towards color.

Hence, it becomes difficult to make decision of accepting, reprocessing or rejecting the sample based on visual match. And this directly hampers the quality of the final product. While on other hand there are advantages of instrumental color quality control as it provides results with same accuracy, consistency and reliability. Spectrophotometer is an instrument used for color measurement and analysis. It provides numerical color data, a common color language amongst manufacturers and researchers. It eliminates subjectivity in color assessments, eliminates the variability among different analysts and maximizes accuracy and precision.

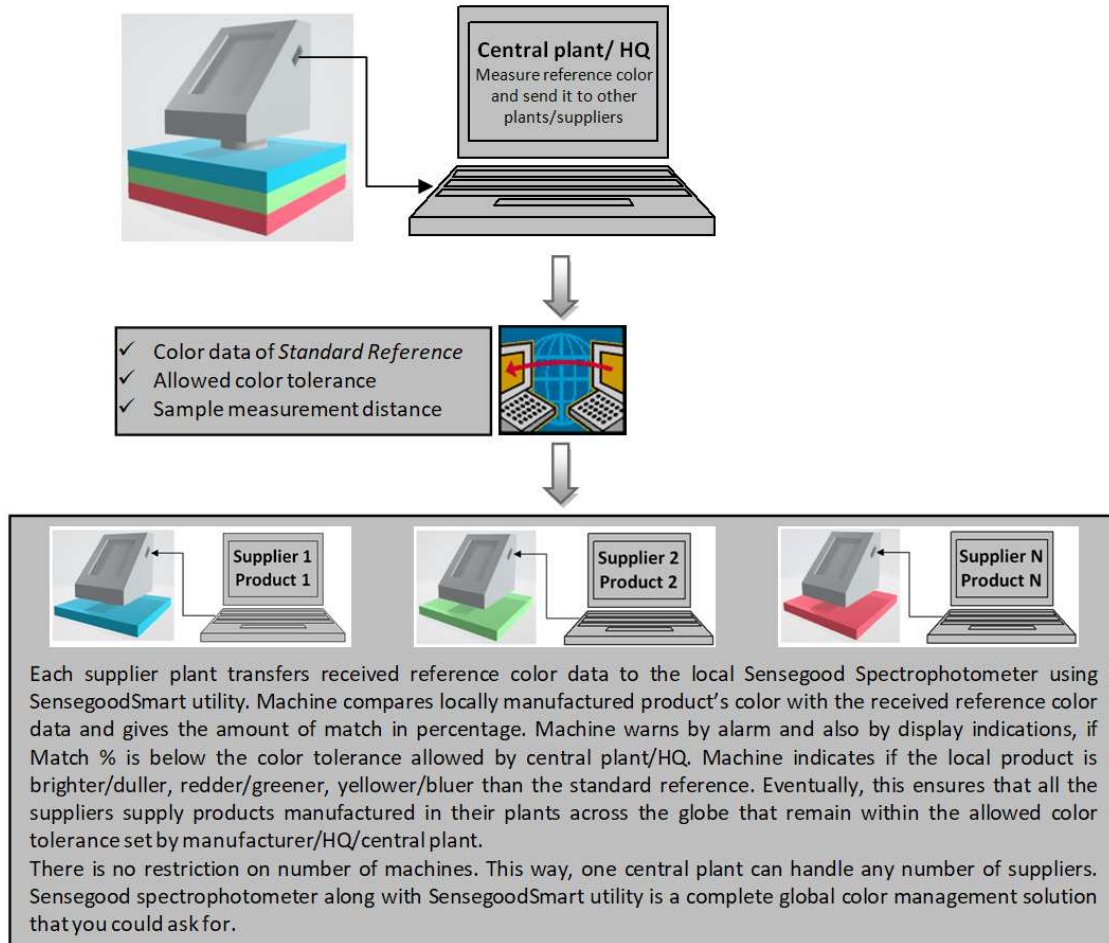
Same coating may look different depending on materials on which they are applied — wood, metals, plastic. Sensegood spectrophotometer is all-in-one non-contact versatile instrument designed to work as in-process/online, portable/handheld or benchtop/table-top device. From raw material to final product, Sensegood spectrophotometer comprehensively evaluates the color attributes of various samples, including solids, liquids, powders and pastes. Large viewing area (sensor's field of view) averages out sample and produces accurate repeatable color attributes.

Do more with Sensegood spectrophotometer:

Sensegood spectrophotometer also incorporates continuous auto measurement mode. In this mode, it wakes up at user selectable intervals, takes measurement, compares the sample color with the saved reference, displays percentage match, and alarms to the operator with beeping sound in case if the matching percentage is below preset threshold. It also has provision for averaging option in normal mode as well as in auto repeat measurement mode.

Sensegood spectrophotometer provides wide varieties of indices like whiteness index and yellowness index. Measured CIE L*a*b* values indicate strength of color parameters like: bright or dull, red – green and yellow – blue respectively. Measured color is also represented as reflectance graph, peak wavelength and color temperature on color touch LCD. Sensegood spectrophotometer is non-messy non-contact type instrument which has benefit of measuring sample's color from a distance. Because of this, sensor remains scratch proof enabling long life in retaining calibration.

SensegoodSmart utility:







Sensegood spectrophotometer provides computer interface software *SensegoodSmart* which lets you convey numeric color data across all production and supply plants that may be located at multiple places across the globe. Apart from this, SensegoodSmart utility enables user to store unlimited number of references to the computer. Any desired reference can be recalled and downloaded to Sensegood spectrophotometer whenever required. The utility provides all color related analytical information on single screen.

References:

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