

The Purpose and Power of Color in Industrial Design: Encouraging the meaningful use of color in design education

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Color may be the most influential factor in the decision to buy, or not to buy. In Malcolm Gladwell's book, *Blink: The Power of Thinking Without Thinking*, he suggests that when presented with a choice, the subconscious mind makes a decision within just a few seconds. Even before one rationalizes and investigates the choices, through rapid cognition the mind has already been made up. In relation to industrial design, that critical decision is the purchasing decision. Within those first few seconds the majority of the information that is available is visual information and one of the most dominant aspects of that visual information is color. So, considering this, the application of color and finish in design becomes much more important than one first thought.

The Power of Color

Color can dominate all other factors of a product designs success. One might not buy or drive a Porsche automobile if it were a hideous color, despite the quality of manufacture and engineering, prestige of the name, or the high performance. The same is true with home appliances, consumer electronics, soft goods, sports equipment, shoes, and practically every area of industrial design. A poor choice of color and finish can make or break the success of a product.

So why do industrial design students spend most of the time in school exploring form and usability, and color becomes a last minute after-thought? How many times have students presented a design, and instead of making a considerate decision on a color, have shown it in a rainbow of seven arbitrary colors? How can educators encourage their students (or design managers lead their design staff) to make the choice and application of color more intentional?

The main reason for this attitude is that students tend to view color as purely subjective decoration, and simply a matter of personal preference. However, colors chosen for a design can be meaningful, purposeful, and even functional. The goal is for students to understand that choosing color in design is an objective decision and that this consideration is as important as the function and form. By understanding the purposes of color, students can then practice how to apply them into their design.

This paper attempts to define and categorize the application of color as it can be used in industrial design. It differs from traditional discussion of color, which is usually from the viewpoint of the two-dimensional artist, because industrial design deals with functional three-dimensional objects. It offers examples of each category and suggestions for engaging design students in the meaningful use of color in industrial design. In this paper "color" refers to not just hue, but also value, chroma (saturation), and finish.

The following is a discussion of ten ways that color can be purposefully used in industrial design.

1. Color as association

Color can have high emotional and symbolic associations. It can be applied in design to conjure up soothing emotions or vivid memories to the user. These associations vary by culture, geography, and generation. These emotions seem to come from general associations the mind

makes with that color, though long-term memories. These memories were developed throughout our lifetime through repetition or specific indelible events.

For instance, when asked to describe what they like about the Apple iPod, most people say that it looks clean. Why is this a common description? Consider the material, finish and colors. It is glossy white and polished stainless metal. For most people in America, every morning of every day of their lives they spend time cleaning themselves in a room that is usually made of white porcelain with polished metal fixtures. The bathroom is a place of cleaning and cleanliness, and this association is engrained deeply into the mind.



Figure 1. Cleanliness associations with the Apple iPod

Colors can also be meaningful by associated symbolism. This is particularly true with national flags. In the African country of Cameroon, for instance, the national flag consists of three panels of green, yellow, and red. For the Africans, green is symbolic for the vegetation, growth, and prosperity. The yellow represents the sun and the happiness it brings. Red represents unity of the African people. This brings significant symbolic meaning, recalling history, struggle, and pride.



Figure 2. Symbolic associations in the flag of Cameroon

The following are some common associations with colors in Western culture:

color	common associations	emotions and symbolism
red	blood, fire, lava, roses, apples, lady bug, ball, balloon, sports car	warmth, passion, love, stimulating, vigorous, exciting, irritating, danger, courage
orange	fire, sunset, orange (fruit), tiger (Bengal), pumpkins, autumn	heat, burning, glory, laughter, harvest, happiness
yellow	sunlight, daffodils, cheese, duck, birds	brightness, liveliness, joy, happiness, egotist, intelligence, cowardice, decay, sickness
yellow/green	spring leaves, amphibians	growth, youth, verdant, fresh, cheerfulness, peace, faith
green	leaves, grass, evergreens, frogs, pears	restful, growth, relaxation, efficient, quiet, victory, environmental
green/blue	sea, Caribbean ocean, turquoise	cool, clean, mystery, song, poetry, aloofness
blue	blueberries, water, sky, sea, ocean	loyalty, cool, spaciousness, safe, conservative, sensible, spirituality, serenity, mystery, truth
violet/purple	grapes, royalty, scarlet	dignified, regal, seductive, richness, melancholy, aesthetic, sadness, piety
pink	Barbie, young girls, pigs	feminine, delicate, youthful, romantic, sweet
brown	earth, dirt, wood, bread, dogs, bears, leather, chocolate	grounded, earthy, soft, furry, substance, stability
black	night, olives, dominoes, shadow, tuxedo	mourning, dignity, death, formal, classic, elegant
white	clouds, milk, snow, polar bears, swans, sheep, porcelain, doves	purity, clean, holy, winter
grey	fog, shadow, elephant, pavement	practical, timeless, classic, ambivalent, distance, shadowy
silver	silver, platinum, steel, spoon, faucets	classic, cool, strength, value, high tech
gold	gold, jewelry, coins	value, rich, preciousness, radiant, warm

2. Color as user interface

Color can give cues as to how to operate a machine or an appliance. Even without understanding of the function of a form, a contrasting colored feature indicates how and what to do. A green button usually indicates “go” or “start,” a red button may indicate, “stop” or on a trigger may mean, “fire.” Our traffic lights use green, yellow and red to direct drivers with its color cues.

The white stripes of a crosswalk on the street direct the pedestrians where to safely cross and warn drivers. The controls of an X-Box game controller are colored differently. Gray is used for the controls that are ordinary and commonly used and colors are used for the special functions. With a series of controls, only the most important and critical ones are usually colored.

This application should be used carefully and with consideration. Liberal use of color on many buttons or controls dilutes the power and influence of the colors. Contrasting colors can be applied to those controls that are critical and most important, even though they may be rarely used.



Figure 3. User interface cues on the X-Box video game controller.

3. Color as fashion

Fashion announces a fresh new palette of trendy colors every season. Application of these colors in design can attract buyers who are, consciously or not, affected by today's hot palette. These colors change depending on the target market, the geographic region, the season of the year, the culture and the design. Because of these factors of variability, considerable research must be done to select an appropriate palette.



Figure 4. Fashionable colors available for the Apple iPod mini.

How does one find out about color trends and fashion? Current periodicals and design magazines will exhibit what is hot at the moment, but can't be relied upon for predicting the future of color trends. Besides for industrial design, the products shown were likely to have been designed two or three years earlier.

One option is to work with a professional color forecaster. Color forecasters are service firms that work with a design firm on their particular design project and present a series of color options. Pantone color matching system, has color matching and specification tools and trends on their website. Color Marketing Group is an international association for color and design professionals. Twice a year they release a report of color trends based on a conference of their members.

How can one do this without paying a professional? Do what these firms do, make observations from the world of fashion, art, and world events. Inspiration can come from fashion runway

shows, trade shows, and boutique shops. Ideas can also come from new art exhibitions and galleries. The best graphic designers produce creative designs with fresh colors in magazines such as “Graphis,” “Print” or “How.”

One can also look at what’s happening in the current culture? Observations can be made of the people and objects in TV or movies that influence our world. For example, the recent Winter Olympics in Turin, Italy, was a virtual fashion show of snow sports culture, as observed by sports enthusiasts worldwide. The outerwear of top snowboarders at the Games will no doubt influence the fashion of riders next season.

4. Color as identity

Color can be used to identify the object with a person, a company, or a group. The use of color for a corporation becomes critical for those with strong brand recognition. Even a sports team is identified through its application of color on helmets and uniforms. Color can also identify a user or efficiently organize items.

Astro, a product design firm based in San Francisco, changed the power-strip market through a simple yet ingenious use of color. On the SmartSockets for Kensington, each plug outlet on the strip is colored with a ring, which matches a tab on the corresponding cord, identifying which piece of equipment with its plug.



Figure 5. Kensington SmartSockets designed by Astro.

Corporations are well aware how powerful color can identify them with their brand. The teal colored gift box with a white ribbon is synonymous with Tiffany’s. Green and yellow on a tractor immediately identifies it with John Deere.

Colors used to identify are most successful when they are strong, saturated, and primary or secondary colors. This is to easily distinguish one from the other. Complex and subtle color distinctions may be confusing and harder to identify. “Did we park in the fuchsia lot or the magenta lot? Our ticket looks red-violet to me.”

5. Color as form emphasis

Color can be used to emphasize the physical form, and to enhance the surface variation or three-dimensionality. This application is not dependent upon culture, but rather is based on how our minds process visual information. Our eyes equate value variation with surface variation. When this variation is pronounced through color its three-dimensional form is enhanced.

Considering the range of value possible on a form's surface, more contrast can occur with light (high value) colors, especially white. However, a dark color such as an 80% gray has only a small range of value to exhibit until it's fully black. So the perceived value change is small. The example below shows how the value change in the white bumper exhibits its curvature. However the dark blue bumpers curvature is hard to see, since its value remains mostly constant and is confused by reflections.



Figure 2. Comparison of gloss white with gloss dark blue to enhance form

Metallic pigments can enhance this contrast by reflecting more light at its highlights and extending those highlights further. Metallic pigments also darken the values at the shadows. This is especially evident in car paint colors, where it is used to reveal the vehicle's surface contours. One can compare a metallic orange with a non-metallic orange of the same value and observe the difference.



Figure 3. Comparison of metallic orange (left) with non-metallic orange (right)

Form can also be emphasized through graphic color treatments in areas of focus. The Dyson vacuum uses bright colors on features to be showcased. Vertical stripes may be used to emphasize height and can outline a form by creating contour lines. A form may appear larger if it is colored in light values and warm advancing hues.

6. Color as form alteration

This application of color alters the three-dimensional form by concealment or disguise. An extreme example is camouflage on a military vehicle. The purpose is to break up the form visually and to change its visual boundary, thereby causing the mind to not recognize its true form. The

changes of value in the color are contrary to the change of surface. This application may be used in design to hide or conceal a feature of an object, or to de-emphasize a form. The example below utilizes high contrast color graphic treatment to obliterate the perception of its three dimensional form.

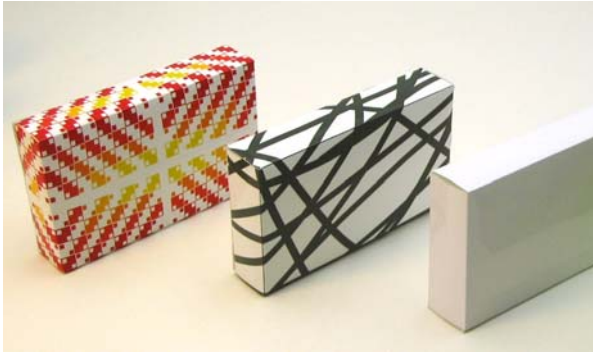


Figure 4. Using graphic color treatment to obliterate a form

On a matte black surface it is very difficult to read its form since the value change is minimal. This is true of any hue of low value. The F117A Nighthawk stealth fighter aircraft takes advantage of this aspect by using a matte black finish that not only absorbs light, but also RADAR wavelengths. It becomes very difficult to distinguish its form, especially at night, when it performs its missions. (Airforce-Technology)

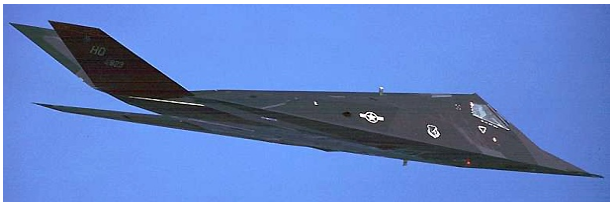


Figure 9. F117A Nighthawk matte black finish absorbs light and RADAR

7. Color as material emphasis

Color may be used to celebrate a material's properties, rather than hide them. This is used when the material make up is valuable or has exemplary properties to be emphasized. Jewelry designers do this naturally with precious metals and gemstones. The polishing of gold brings forth its luster and richness. The precise cutting of rare gems highlights their natural color and refractive properties.

A wood stain can bring out the natural grain of a wood, for example. The candy colored translucent skin of the iMac personal computer celebrates the wonderful visual and tactile potential of plastic. The high tech look of machined aluminum can be emphasized through colored anodization treatment. The strength and durability of steel can be exhibited with a brushed stainless finish or through plating.

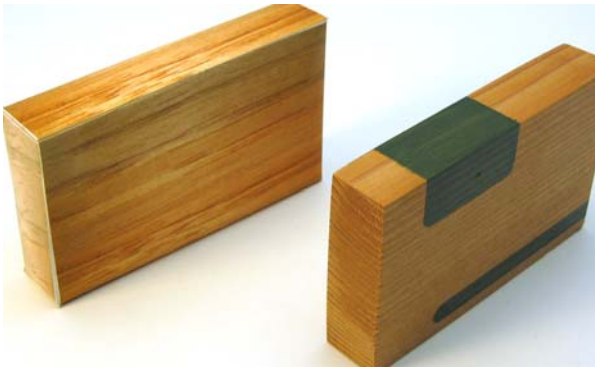


Figure 10. Material deception (simulated woodgrain) versus material emphasis (real wood grain)

8. Color as material deception

The application of color can be used to deceive the viewer of its true material make up. This is especially useful where the faux material is too expensive or impractical to be used in low cost, high volume production.

Station wagons in the 1930's were truly built with hardwood doors and side panels. They were also quite prestigious and expensive to own. The wood had to be hand cut and fit. And, the maintenance of varnishing and adjusting bolts due to expansion was tedious and time consuming. By 1953 automakers ceased using real wood and used all steel body panels. The 1955 Ford Country Squire achieved a wood aesthetic using simulated wood grain made of vinyl. And even today one can buy an aftermarket wood grain application kit for most any vehicle on the road. (Narus)

A more common example is the current mobile phone designs available. Most have simulated metallic finish, either to represent a polished aluminum or brushed stainless steel, even though the actual material is some type of injection molded polymer.

9. Color as harmony

Color can be used to make a design visually compatible with its environment. A white kitchen appliance, for instance, is made to blend into and match the kitchen environment. This application of color can be used to achieve a quiet, neutral, harmonious environment and reduce visual chaos. It is also used when a particular color and finish is prevalent with other items in the environment. A Band-aid bandage, for example, is colored to match the majority of skin colors.

In the 1980's beige computer housings and monitors were meant to blend into the conventional office environment of the era. The beige box era was prevalent in all desktop computers, printers, accessories, office furniture, and even walls and carpet. This had the intention of matching all items in the office environment, making it visually cohesive and harmonious.

10. Color as contrast

In order to stand out and contrast with its environment, color can be critical. Whether it's an orange traffic cone or a yellow taxicab, color is a powerful differentiator. Distinction from environment can happen through contrasting hue, saturation, or value. This application is important when safety is a concern. On tools with cutting or rotating parts, a contrasting color can be used to focus the operator's attention where it needs to be directed. A garden tool may be colored a contrasting color to its predominately green environment in order to avoid being lost or stepped on.

Contrast is also useful where the product needs to stand out from its competitors, whether on the store shelf or on the streets. If one just spent a quarter of a million dollars on an exotic sports car, they may want others to take notice by choosing a bright red or yellow. Or if a product needs extra attention on a store shelf of look-a-likes, a contrasting color may be useful.

Color in the Design Classroom

When color is seen as having purpose, students take it more seriously and begin to think of it as more than subjective decoration. So, how can these purposes be introduced into the studio? The following are three sample projects for students to think through their color application and integrate color with their forms.

Color Purposes Image Search

A very simple but effective project is to introduce students to the categories above through examples and discussion. Then to have them search for the best designed examples of each category. This requires them to look at designs critically and evaluate how the design is using color. Visual sensitivity is one of the goals of design education, and this search and study of images is a way of exercising that sense.

Students can look for examples in nature and interiors as well as in product design. If students submit digital images, a slideshow and discussion could follow. Also, a database of examples can be accumulated for future presentations.

Make Color First

Instead of applying color decisions at the end of the design process, why not choose a palette at the beginning? As part of the early research phase of a project, color should be explored and considered. Students might investigate what colors are appropriate for the project based on its function, target market, branding, and culture. Alongside concept sketches of forms could be various color palettes for critique and discussion. The *Pantone Guide to Communicating with Color* has a standard template for making color palettes and defining CMYK values for reproduction.



Figure 11. Designing the color palette at the beginning of the project at WWU



Figure 12. Varied color application to identical forms at WWU

Purposeful Application to Multiple Objects

A memorable exercise from the color coursework at Pratt Institute was to experiment with the application of color on several duplicate objects. Have the students find an inexpensive but functional product and buy five exactly the same. For example, nightlights, pens, pencil sharpeners, or flashlights. They then paint the object with different purposes in mind: to encourage its operation, to emphasize its form, to alter its form, or to appeal to a particular market. These newly colored designs are then critiqued and discussed. Did they communicate the intention? How has the forms appearance changed? Is it clear how it's to be used?

This can also be done with abstract three-dimensional objects, such as boxes, cylinders, or more complex forms. An advanced study may include the use of varying the color of the illumination and observing its effects on hue, value, and chroma. The book, *Dimensional Color* by Lois Swirnoff, has additional studies and explores these phenomena in more depth.

Conclusion

When the shopping customer glances at their choice of products and makes a quick decision on which to buy, they are determining the failure or the success of that product. If designers don't consider and choose the colors of their products well those products are left on the shelf, unsold, unused, and eventually become garbage. This is a crime to the environment, the manufacturer, the retailer, and the general public.

This paper discusses just a few ways to encourage industrial designers to make their choice and application of color more intentional, meaningful and well considered. Color serves numerous functions; it's not just decoration. Color has tremendous power that is usually underestimated and underutilized by design students. Because of the way the eye perceives and constructs the world, color is inextricably integrated with form, line, texture and shape. The visual process does not separate those factors, and neither should the visual designer.

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