

design **1**st

Design Tip: Product Look

Styling, Aesthetics & Color

FORM FOLLOWS FUNCTION?

The phrase ‘form follows function’ was coined by American architect L H Sullivan around 1896. He argued that the traditional classical styles of architecture imposed unnecessary constraints upon architects, especially with the arrival of new building materials (he was pioneering the concept of the skyscraper). About the same time, Austrian architect Adolf Loos proposed the abandonment of applied decoration, especially in relation to the lavish rococo so loved by the Victorians (his rally call was ‘Ornament is crime’). The two ideas fused, giving birth to Functionalism (aka Modernism). Functionalism became the cornerstone of Industrial Design teaching at the Bauhaus, and was championed by Industrial Designers such as Raymond Loewy, Norman bel Geddes, and Henry Dreyfuss, enjoying widespread (if not uncritical) acceptance in Industrial Design from 1945 to 1985. It had at its core the idea that the product’s function – the way it was made, the job it was required to do and the way that it was used – should dictate product form, and the approach worked well with the predominantly mechanical products of the industrial era. Functionalism also inherited the architectural idea that there was beauty in simplicity and virtue in the honest use of materials, an idea taken to extremes by the Minimalist movement (late 1960s) and the work of architect Mies van der Rohe, in which a building or product would be stripped of all but the most elemental forms (slogan ‘Less is More’). Over the years, functionalism was progressively enlarged to encompass additional criteria such as attractiveness, affordability (price and whole life running costs), safety and recyclability.

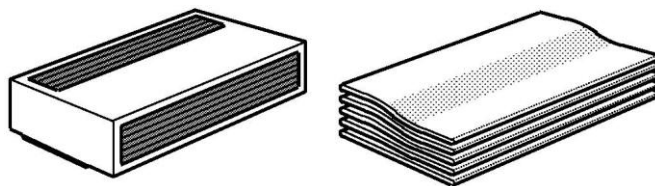
But functionalism has its limitations. Claw hammers and vehicle starter motors clearly derive their form from their function, but the perfect automobile shape from a functional (aerodynamic) perspective is the teardrop, and such a shape has limited market appeal. With the relentless miniaturization of components, and with product function becoming ever more abstract (particularly in the case of microprocessor and screen-based products), ‘form follows function’ often seems inadequate as a guiding principle in design, and in the extreme could lead to a world full of identical ‘rationalized black box’ products.

PRODUCT SEMANTICS

In the 1970s it became clear that a new set of guiding principles was needed in product design, to overcome the limitations of Functionalism. In addition to their functional requirements, it was recognized that products should engage the user at an emotional level, to give meaning to the product, and to enhance the experience of both ownership and use. A new language of design was needed to formalize this approach. This language became known as ‘Product Semantics’ – a term coined by psychologists Butter and Krippendorf in 1984 – and became associated with the slogans ‘form follows meaning’ and ‘design is making sense of things’. The Post-Functional (post-modern) approach to product design therefore embodies the idea that a product’s form should both clarify its function (where the product’s function would not be obvious from its functionally-derived form), and should communicate (through symbolism) abstract ideas and values associated with the product and its user, to engage the user at a cultural and emotional level. In particular, a product’s form should address the following requirements:

1) Clarify product function.

At its simplest level, form should clarify purpose. It should tell us what the product is, and what it does. For example: the fan heater on the left (below) has the traditional engineered box form; the one on the right has a form that suggests laminar air flow.



The form on the right better describes the product’s function – it communicates with us at a visual level to tell us what the product does.

2) Clarify product interaction.

By adjusting the look and feel of external component parts, we can arrange for a product to tell us how we are meant to use it – the product ‘invites’ us to use it in the appropriate way. Although complex products may require an instruction manual, simple products can be intuitive and self-instructing, and the product can reward correct use with a satisfying feel. Sculpted rubber grips on power tools say ‘hold me here’, and knurled control knobs say ‘grip here to rotate’. These visual and tactile cues are ‘signs’ that guide us towards a successful and satisfying interaction – they mediate between humans and technology.

3) Indicate quality and design direction.

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The materials used and manufacturing routes taken may be intentionally revealed or disguised. In either case, the product form and execution of detail provide indicators to the product's reliability, maintainability, recyclability, and overall build quality, from which buyers can judge product value-for-money and brand trustworthiness.

4) **Suggest provenance or origin.**

By using symbolism, product form can be made to trigger geographical, cultural or historical associations. The form may suggest ethnicity or country of origin, or evoke memories of a particular historical period, by tapping into the cultural and social 'memories' of target users. For example, the Chrysler PT Cruiser automobile (launched in 2000) has a radically different appearance to its contemporaries, having retro styling evocative of 1930s America, married with the latest technology. People with positive memories of this period in automobile history (whether real or acquired) respond positively to the new look.

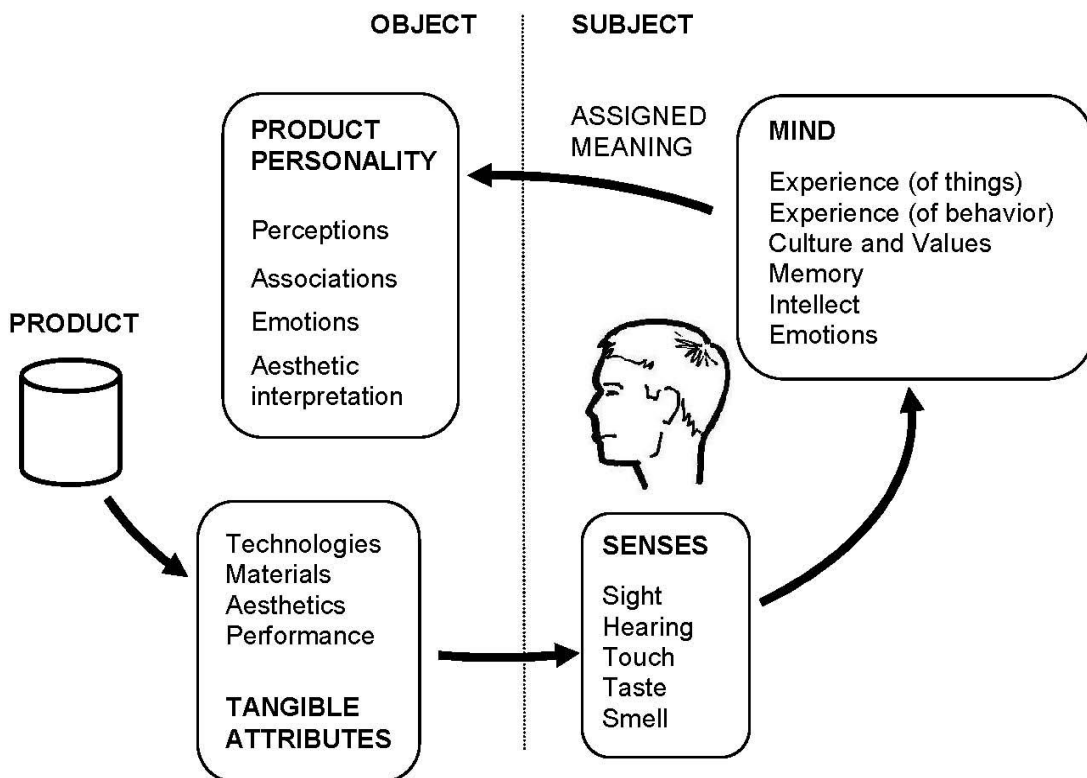
5) **Express cultural values.**

Symbolism may also be used to reflect cultural and social values, ideas or dreams. It may support or enhance the identity, self-image and status of an individual by reinforcing aspects of the user's lifestyle, values and aspirations. Designing for self-image requires a broad understanding of the cultural background and aspirations of target users. For example, a diamond-encrusted mobile phone may be irresistible to one group of users, but may be offensive to another group, because the cultural values of the two groups differ. In common parlance, we would say that the two groups have different 'tastes'.

Designers have always faced the dilemma of personal taste, yet products continue to incorporate irrational styling features and applied decoration (the latest footwear, consumer durables and vehicles of the 'bling' sub-culture for example), and they sell well into their respective markets. Symbolism may also communicate the brand values of the designer or product manufacturer, and may make the product more meaningful and desirable for users sympathetic to those brand values. Coca-Cola, Nike, Apple, Swatch, Adidas and many more companies see brand identity (a vehicle for brand values) as a major differentiator in a competitive market.

ELEMENTS OF MEANING

Every product has, by accident or design, characteristics that engage our memory, intellect and emotions. It is through these non-technical characteristics that a product's complete meaning is expressed.



Products most likely to become design classics or desirable antiques often have certain qualities in common:






- Innovative approach to an old problem.
- An established mythology or provenance (evocative history).
- Quality and dependability
- Longevity and the capacity to age gracefully.
- Simplicity and evidence of an honest use of materials
- Intuitive in operation
- A satisfying 'feel' and good looks.
- Aesthetic qualities that create positive associations

Inanimate objects do not possess personality – they have it assigned to them by humans. This 'meaning' given to products is the aggregate of all the interpretations, perceptions, associations and feelings experienced within the mind of the subject.

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THE IMPORTANCE OF ASSOCIATION

Sights, sounds, textures, tastes and smells can transport us to past times and places, or remind us of events or people. Some people associate numbers with colors, and some claim to be able to ‘taste’ colors. In the majority of cases, these associations can be traced to childhood or later learning experiences. In a very small number of people, the effect is due to neurological cross-connection in the brain (synaesthesia). The learned associations below are peculiar to the author and perhaps a small group of people of similar age.

The numbers 1 to 12	Spot patterns on dice. Primary school 
The smell of cooked fish and fresh paint 	Ships and government establishments 
A particular shade of blue 	1950's records on the Philips label.  Home in early childhood.

Personal associations such as those above can be strong, but they differ between individuals and cannot be used to convey a consistent meaning to large audiences. A better prospect arises where the designer can tap into collective associations, and these tend to be historical, cultural or symbolic. Note that very few collective associations are truly global. A symbol or visual cue used to access an association in one country or culture may have a completely contrary meaning in another culture. Some of the most widely recognized associations are shown below:

stimulus	associations	stimulus	associations
Color white	Purity, virginity, light, snow	Sound, bing-bong	Announcement, visitor arrives.
Color black	Night, solemnity, sophistication, death, sin	Material gold	Wealth, idolatry, aristocracy, marriage, high status.
Color red	Danger, stop, hot, blood, fire, revolution, good luck, war, positive, communism.	Material fur	Warmth, comfort, frivolity, animal welfare, feminine status, polar ice.
Color green	Safe, go, nature, vegetation, jealousy, earth (electrical), military (drab).	Material walnut	Luxury, high status, fine cabinet-makers, tobacco, maturity
Color blue	Sky, sea, water, cold, sadness, baby boy, do this, capitalism, negative.	Material stainless steel	Hygiene, precision, cold

It is also possible to create associations with recognized historical styles – Art Deco, Art Nouveau, etc. – by incorporating elements of the earlier style into a new product. In so doing, some of the values and mythology associated with the original style will be transferred to the new product.

PRODUCT FORM AND VISUAL STYLE

Every product (in fact every object, 2D or 3D) can be thought of as an assembly of component shapes – building blocks – blended and arranged to produce a complete image or object. In other words, the product form is a composite of simpler geometric elements. For 2-dimensional objects, the elements are the line, square, triangle and circle. For 3-dimensional objects, these elements are supplemented by the sphere, cylinder, cone and cube. Every conceivable shape can be constructed by assembling some combination of these elementary forms. Each has particular characteristics; the circle suggests a continuous, smooth flowing motion; the square suggests discipline in its straight horizontal and vertical lines, with jarring changes of direction at the corners. These characteristics are sub-consciously ‘felt’. In creative designers, they are internalized and become part of the nervous fabric of the designer.

In the mobile videophone (below), the overall form of the product reflects its ancestry – it is a hybrid of camera, television receiver, and mobile phone. The component elements – rectangles, triangles, circles – are clearly visible. Some of the visual elements are constrained by technical or ergonomic considerations: the rectangular screen and the shape of the rubberized handgrip, for example. Controls are grouped by proximity and color, and are aligned diagonally to echo the diagonals in the handgrip. External corners have been radiussed, to soften the overall form. The gender-neutral turquoise accents relieve an otherwise cold engineering appearance.



Johannes Itten (1888-1967) is noted for his teaching of form by the use of contrasts, for example:

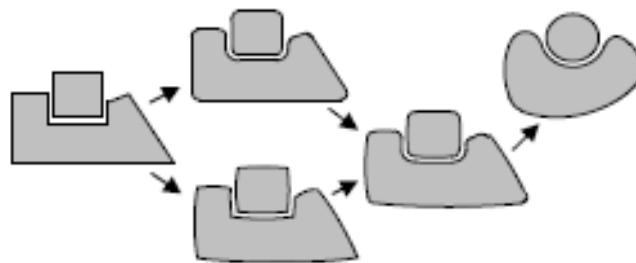
large-small	long-short	broad-narrow	light-heavy
light-dark	smooth-rough	hard-soft	liquid-solid
continuous-broken	black-white	straight-curved	still-moving
sharp-blunt	transparent-opaque	horizontal-vertical	diagonal-circle

Between these ‘poles’ of contrast lie all possible combinations of form. A point worth noting is that when two contrasting forms are brought together, proximity tends to exaggerate their difference, just as it does with contrasting colors.

Products constructed from straight lines and flat planes (rectilinear elements) are described as having inorganic form. We associate them with crystalline or artificial structures. Organic forms are those constructed from soft curved lines and surfaces, which we associate with plant or animal life. The armored tank (below left) is an arrangement of angled flat planes, partly to ease fabrication when constructing from thick steel plate, and partly to deflect incoming projectiles. The 1954 D-type Jaguar racing car (below right) contains visual cues that we associate with its muscular namesake, crouched as if ready to pounce – a prime example of an organic form.



The series of sketches below shows a rectilinear form progressively softened (made more organic) by rounding of corners and edges:



Useful visual elements can be borrowed from the natural world or from other disciplines. The wolf’s eye (below, associated with cunning and predatory behavior) can be seen in ‘windswept’ automobile headlights; the jutting jaw (associated with strength and masculinity) in the front profile of high-speed trains.



Humans have an innate ability to recognize and ‘read’ faces. We can pick out people we know from large crowds, using visual cues only. Any group of visual elements that can be interpreted as a face (human or animal) will be so recognized, and will have a ‘personality’ assigned to it (smiling, grumpy, etc) by the viewer. Vehicles are particularly susceptible to being anthropomorphized in this way – the front view being especially important. The Mat54 railway train (below) was dubbed ‘Hondekop’ (dog face) by the public in Holland.



It is also possible to ‘see’ a face (or elements of a face) in an automobile road wheel, video cassette recorder, ink jet printer, record player, etc. In fact every group of visual elements will be sub-consciously tested in this way – the air conditioner above has a smiling face.

GESTALT

Gestalt roughly translates as ‘pattern’ or ‘form’. Designers are particularly interested in aspects of Gestalt related to the interpretation of visual images, especially the relationship between a complete image and its component parts. The slogan for Gestalt is ‘the whole is greater than the sum of its parts’. If Product Semantics explores the meaning of products as conveyed through the vocabulary of aesthetics, then Gestalt, it is said, provides the grammar.



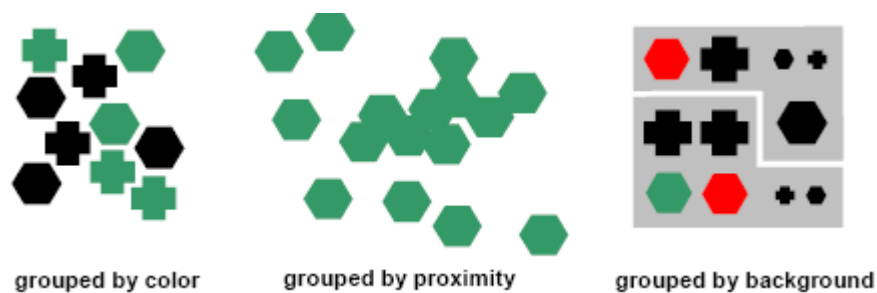
The image above left contains 10 elements of differing shape and size. Yet we ‘see’ three large shapes: a circle, a triangle, and a square. These shapes are visible because the mind ‘completes’ the image to reconstruct a simpler underlying pattern. In the right hand image, we ‘see’ a triangle – again a purely mental construct, but nevertheless part of our visual understanding of the pattern.

Group membership

This is an important aspect of Gestalt, especially when designing user interfaces (*see Human Factors -Senses*). Individual components can be grouped in two important ways: by similarity, and by proximity. To achieve **grouping by similarity**, components must appear similar, whether they are or not, and this similarity can take the form of size, shape, or color. Our first instinct is to distinguish large and small objects. Size matters. Recognition of relative size is an important survival mechanism in all animals (bigger = more threatening or more important).



In the absence of size cues (below left), we feel compelled to divide the collection of objects into a green group and a black group. If all the elements were the same color, we would instinctively group them by shape to give a group of hexagons and a group of crosses.

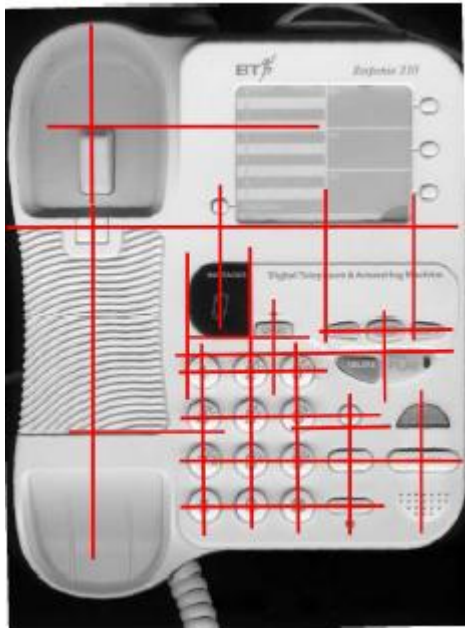


To achieve **grouping by proximity**, the members of a group must be closer together than non-members. Touching elements will be more strongly associated than closely spaced elements, and overlapping elements will have the strongest association of all (strongest Gestalt). In the image above (centre), nine hexagons appear to be clustering together to form a group. In the image above (right), shaded **background** areas have been introduced, to show us how the objects are grouped.

While grouping helps to associate disparate elements, it does not provide much by way of visual interest. One of the most powerful techniques in Gestalt is **alignment**. By aligning visual elements (or physical features), continuance effects relate otherwise unrelated elements, and create coherence at the whole product level. Elements can be aligned along their edges, or along a common centre line.

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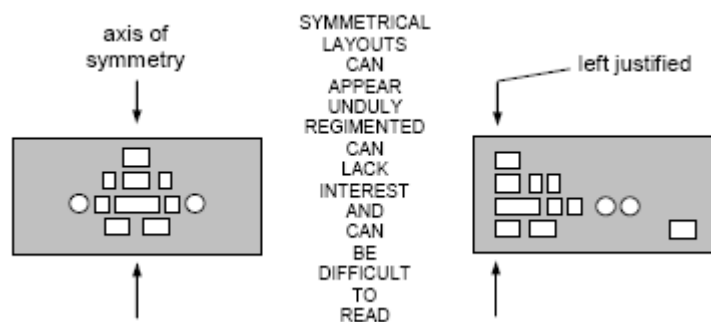
A telephone body is shown below. The superimposed red lines indicate the principal visual alignments, including edge alignments and centre alignments. Note that the edges of some elements are aligned with the centers of other elements, and that printed text and logos are treated as if they were physical elements, to be aligned like any other element. Note the careful use of 'white space' around each element. The temptation to make all elements exactly the same shape (and to align them all by extending the grid of the keypad) has been resisted, allowing functions to be differentiated by shape and color, relieving an otherwise monotonous presentation.



Also note that curves of similar radius are repeated in several positions to improve the visual coherence of the whole product. This effect is often seen on large metal castings that seem to have 'accidental visual coherence' as a result of using a consistent fillet radius throughout.

SYMMETRY AND ASYMMETRY

Elements arranged symmetrically about a centre line appear balanced. Many plants and animals, including humans, are arranged symmetrically about a vertical centre line, because this arrangement requires least structural bracing against gravity, and because mirror images are easily accomplished by biological systems. It also works well for objects in motion, balancing viscous drag forces in birds, fish, vehicles, ships and aircraft as they move through air or water.

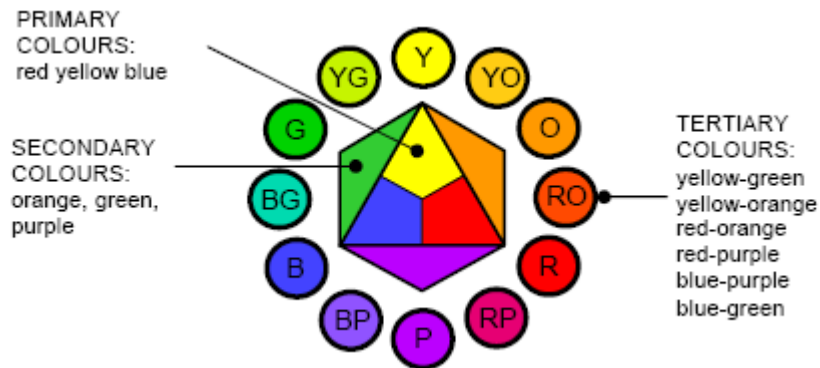


The diagrams above show symmetrical (left) and asymmetric layouts for an instrument control panel. The strong diagonal in the asymmetric arrangement keeps the eye moving from top left to bottom right, providing interest, but the symmetrical arrangement holds the eye static.

COLOR

The color wheel (below) shows the basic arrangement of colors for paints and pigments.

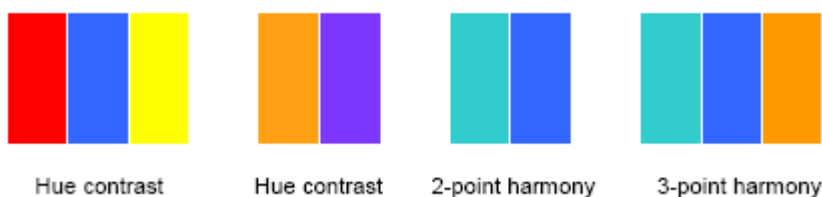
Note that all of the colors in this wheel are fully saturated



Itten identified seven distinct kinds of contrast between adjacent colors on a product, page or canvas:

1) Hue Contrast: (e.g. red, blue, yellow appearing together)

Colors widely spaced from each other on the color wheel are said to show high hue contrast. Colors adjacent to each other (such as green and yellow) are said to be in close harmony. Close-harmonized colors present a lower risk of clash than colors having a high hue contrast. A pleasing 3-point harmony occurs when two of the hues are close, with the third diametrically opposite. Brown or beige wood, gold, copper and brass finishes can all be regarded as shades of yellow or orange; steel, silver, aluminum, chromium and zinc finishes as grays or blue-grays.



2) Value Contrast: (tints and shades of single hue, appearing together)

Since the hues are identical, colors will not clash. Dark shades will appear large and heavy, but pale tints will appear lightweight and 'atmospheric'.



3) Saturation Contrast:

A single hue and value but contrasting between high saturation (high chroma), grey (no chroma), and anything between. No risk of clash. Saturated colors tend to ‘shout’, and will appear to ‘step forward’ (advance) towards the viewer. Low saturation colors are described as ‘subdued’ and will appear to recede from the viewer.



Saturation contrast
in green



Saturation contrast
in orange

4) Cold-Warm Contrast: (e.g. shades of red adjacent to shades of blue)

This is a specific instance of hue contrast. It relies on the psychological association between color and temperature. Blue and blue-green are cold. Red, orange and yellow are warm.



Cold-warm contrast



Cold-warm contrast

5) Complementary Contrast:

Occurs between two colors that are diametrically opposite on the color wheel. Each color appears more saturated when placed next to its complement. Stare at the striped rectangle – the color saturation of both green and red stripes seems to increase over the first 10 seconds of viewing.



Complementary contrast in red and green

6) Simultaneous Contrast:

When a saturated color appears next to grey, the grey appears to take on tints of the complementary color. Stare at the grey square – after 10 seconds the grey will start to change to lavender blue.



7) Contrast of Extension:

This relates to the area of color. Saturated colors (high chroma) require smaller areas than their equivalent tints or shades to create the same chromatic effect. A paint color that appears quite neutral in the can will gain in intensity when applied to a large area such as a wall.

Color Systems

A common obstacle in understanding color theory is the great variety of names given to colors. Names like Olive, Beige, Tan, Ruby and Maroon are imprecise, and as a general rule the names of colors such as those appearing on paint cans should be treated with caution. A further point of confusion is that the rules for mixing pure colored light do not carry over to the world of paints and pigments. Mixing green and red light will produce yellow light, but mixing green and red paint will produce a muddy brown, because the pigments used are never 'pure' colors.

Certain national standards organizations produce charts of 'standard' colors, usually associated with a specific industry or used by government departments such as health, transport, defense, telecommunications or postal services.

Proprietary color systems such as those produced by paint manufacturers usually take the form of color charts, and they can be used to specify color so long as all parties have access to the same charts and materials, but they tend to change annually to reflect changing fashions. One proprietary system, the Pantone color system, has become the *de facto* standard in the graphic arts, printing and model making professions.

The Pantone System

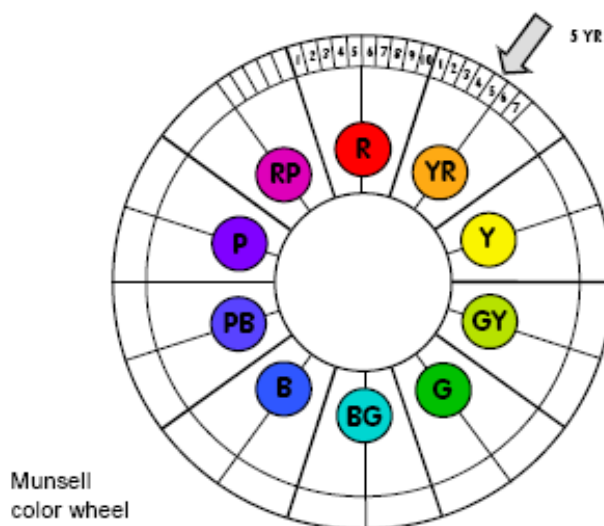
A proprietary system, the Pantone system offers a means of managing color through all the stages of design and production, the principal tool being a set of color charts covering an extensive range of finishes including solid colors, grays, pearlescent finishes, metallics, foils, plastic materials, fluorescents and process colors. Each color is identified by number, and will match across media and products within the Pantone range. The color content of any surface can be measured using Pantone's hand-held instrument, which will display the measured color in a variety of formats including the technical formats mentioned above, and will also identify the nearest Pantone color.

The Munsell System

One of the most straightforward systems for color identification is the Munsell System (after Albert H. Munsell, 1905). In the Munsell system, any color can be defined using only three attributes, these being **hue**, **value** and **chroma**.

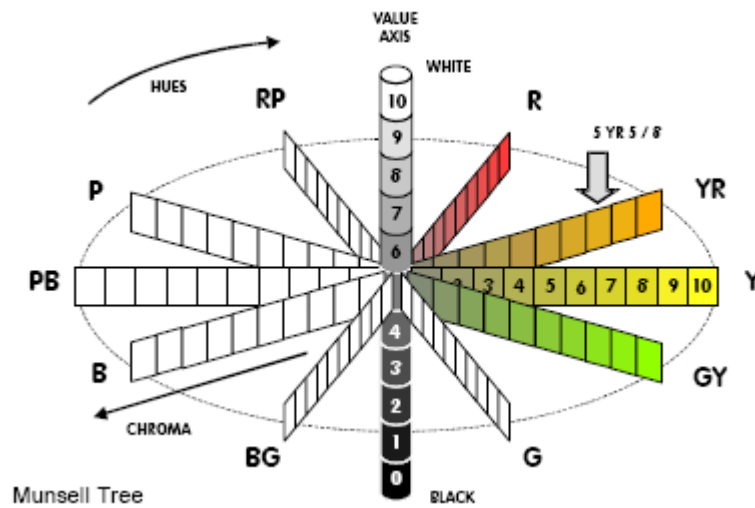
Hue: The basic spectral color (red, blue, green-yellow, etc) defined by its position on the color wheel. Only 10 color names are recognized, a number being used to define the precise hue. For example, a particular yellow-red (orange) hue could be described as **5 YR**. See Munsell wheel, below.

Value: The lightness or darkness. Values range from 0 (black) to 10 (white) with grays between. Light colors are called tints, and dark colors are called shades. Pure colors have values of around 5, and can be tinted or shaded by adding white or black. In the Munsell Tree below, the value scale is represented by the column running up the axis of the diagram.



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Chroma: Sometimes called saturation, it is an indication of the purity of color in the sample, or the departure from grey. High chroma (deep saturation) is pure color; low chroma is grey. In the Munsell Tree below, the chroma scale (for any chosen combination of hue and value) runs radially from the axis (grey) to the outer edge (maximum chroma). The chroma scale runs from 0 (grey, no discernible color content) to 10 (pure color). Super-chromas are possible, such as vermilion or fluorescent orange, where the chroma number can rise to as much as 15. The chroma is expressed by adding this number after the value number.



So from the Munsell model above, a particular orange could be described as **5 YR 5 / 8** where 5 YR is the hue (yellow-red), 5 is the value, and 8 is the chroma.

Links and Resources:

- 1) Itten J., Design and Form, The Basic Course at the Bauhaus and Later, Wiley, 1975
- 2) Itten J., The Elements of Color, (Translated by Ernst van Hagen from the original Kunst der Farbe, Johannes Itten),
- 3) Symbol Sourcebook, Van Nostrand Reinhold, 1972. Ashby M and Johnson K,
- 4) Materials and Design, Elsevier, 2002. Donald A Norman, Emotional Design (Why we love or hate everyday things), Basic books New York, 2004
- 5) John Berger, Ways of Seeing, Penguin, 1972. (An examination of the meaning of visual images). Faber Birren, The Elements of Color – A treatise on the color system of Johannes Itten
- 6) Faber Birren, Creative Color – A dynamic approach for artists and designers, Van Nostrand Reinhold, 1961. For a history of color measurement theory and a comparison of the different color systems.

Web Links:

- www.colorsystem.com/ and www.handprint.com/HP/WCL/color6.html
- For BS and RAL charts see: (UK): www.indfinspec.demon.co.uk/colour_charts.htm and (Eur): www.farbensoftware.de/ral-designsystem_e.htm
- For Pantone color products go to: www.pantone.com
- For Munsell charts and tools, see: www.munsell.com