WGB New and Occasional Weavers

Meeting #12 Handouts

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FIBER AND LIGHT REFLECTANCE

Gail Glick

Definition Basics:

Hue is another word for color. You would recognize the spectrum of hues on a color wheel.

Value refers to the relative lightness or darkness of a hue.
A gray scale shows the transition from lightest tint to darkest tone.

The study of color in textiles is inextricably linked to the study of fiber structure.

Fiber structure is determined by:

- the molecular arrangement of the particular fiber — be it plant or protein;
- the chemical structure of the color dye;
- the type and characteristics of the yarn;
- the characteristics of the fabric: knitted, woven, crocheted, embroidery.

Certain characteristics — from the molecular level, to the fiber, to the yarn, to the arrangement of that yarn — all affect the value of color in that they determine which surfaces reflect light and which absorb light. The finished fabric then will determine the total amount and direction of light reflectance, which in turn, determines the perceived color of the fabric.

Principle:

The higher the level of light reflectance seen in fabric, the higher the color value (appears lighter). Conversely, the lower the level of light reflectance seen in fabric, the lower the color value (appears darker). That is, depending on the quantity/quality of reflectance, a particular color can look different.

Determinants of amount of reflectance:

-Longer staple fibers reflect more light (e.g., mohair, high twist worsted-spun wool yarns, combed cotton, line linen (longer, stronger lustrous flax fibers used for high quality items like table linens), ramie, and filament yarns like reeled silk and man-made yarns) and thus appear more lustrous and lighter in color value. By contrast, short staple fibers (e.g., lamb's wool, carded cotton, tow linen (short flax fibers often have higher twist and used as weft in towels — more rustic and more absorbent), and low-twist woolen-spun yarns) reflect less light and thus appear darker.

-Longer yarn floats in a woven fabric reflect more light. Thus, satin which has warp floats, sateen which has weft floats, and damask which has a combination of warp and weft floats appear lighter in color. Similarly, a twill fabric will be more reflectant than plain tabby weave.

-Yarn composed of many fine fibers reflects more light and thus appear lighter in color than yarn composed of fewer, coarser fibers. For example, the very fineness of silk filaments in reeled silk contributes to the luster and apparent lightness in color of the silk fabric. It follows that fabric composed of fine yarn appears lighter in color than fabric composed of coarser yarn — even of the same material, as there are more warp and weft yarns per inch.

-The more a given fiber has a rounder or more cylindrical cross-sectional shape, the more uniform the luster. For example, wool fibers have an oval to round cross-sectional shape; on the other hand, the luster of the wool fibers may be offset by the presence of scales on the outside and/or the crimp — both of which break up reflectance.

-The more a given fiber has a straighter longitudinal shape, the higher the luster and lighter the color of the fiber because it creates an uninterrupted reflecting surface. For example, besides the fineness of the fiber, the straight longitudinal shape of silk filament adds to its surface luster. By contrast, fiber that is crimped, twisted or spiraled, has the effect of

darkening the color. Crimp, which appears naturally in wool, is the waviness along the length of the staple. Merino wool — which although is a fine fiber wool (with a low micron count) tends to have a low luster because it has a tight crimp. On the other hand, Romney or Lincoln sheep wool, which have coarse fibers, have a more lustrous, lighter in color yarn because the crimp is broader and more elongated, thus, creating more reflecting surface.

-The degree and direction of twist in spun fiber affects the reflectance factor too. High or tight twist fiber, with its rougher surface texture, has the effect of reducing light reflectance and darkening the color. Changes in the amount of twist in a single strand of yarn can create variations in the reflectance of light and thus the color value.
Yarn, when spun, can be twisted clockwise (S-twist) or counter-clockwise (Z-twist). As long as the twist directions remain consistent, the difference in reflectance between the two is fairly subtle.

-The orientation or arrangement of fibers to each other also affects the degree of reflectance. The more consistent the orientation of fibers composing the yarn strand are, the greater the light reflectance and thus the appearance of a lighter color. Fibers arranged as straight and as parallel to each other as possible — thru combing — will be more reflective (e.g., worsted wool, combed cotton, line linen). By contrast, randomly arranged staple fibers, such as woolen yarns, carded short staple cotton and tow linen will show a lower reflectance and darker color value.

-The more parallel the yarns composing the structure of a fabric are, the brighter the cloth. Generally, yarns interlaced in a woven structure (where warp and weft yarns are parallel to each other) produce more reflectance or brightness than looped fabric structures, such as knitting or crochet.

— The more textured the surface of the fiber, the more diffused the reflected light, which in turn means a fabric surface that appears lighter in color. Even so, a smooth textural surface (such as silk filament) can reflect a high degree of light.

Fiber texture gets interesting when dealing with hair fibers. Hair fibers are covered with scales that catch and reflect light. The size of those scales determines the surface texture and luster. Hair fibers with large, flat outer scales (e.g., mohair, alpaca, Lincoln fleece wool) present a smooth surface

that reflects light, giving the fiber a high luster, and well-defined or intense color. Wools with smaller outer scales (or finer, shorter staple wools) disperse light and appear as dulled, softer colors. The same applies to raw cotton, with its naturally crinkled surface, in contrast to mercerized cotton, with its smooth surface and brighter, more intense colors.

-Oddly, the more textured the surface of the yarn, the more light is absorbed, thus making the color appear darker and more intense. The deeper the texture, the darker and richer the color. This is caused by *interreflection,* which accounts for the changeable appearance of fabrics with naps and piles.

2 Types — Simple and Complex Yarns:
Simple yarns: smooth, even yarn with an equal number of turns per inch spun throughout its length. These can be singles, plies, cables or cords. The key is the uniformity. Alone, they can produce a smooth surface, lustrous reflectance, lighter color value.
Complex yarns: aka novelty yarns or chenille, have textural interest, can be singles, plies, cables or cords. However, they are irregular in size, twist or construction. They can be spun with lumps, loops, flocks, flakes, which tends to absorb light and reduce reflectance, thus appearing darker in color.

- Factors affecting the surface texture of woven fabric and degree of reflectance:

- Yarn twist direction (alternating S-twist and Z-twist) and degree of yarn twist (high or low) can create subtle changes in reflectance.

- Yarn spacing (whether packed tightly or loosely); even or balanced weave vs. unbalanced weaves (weft- or warp-faced fabrics) can change the transparency and/or the angle of reflectance.

Changes in yarn tension (tight and loose) create
textural effects that in turn affect reflectance and color value.

- Weave pattern can affect fabric texture: basketweave creates a more pronounced texture than plain tabby. Basketweave also creates a softer drape, thereby creating softer, graduated shadows.

- Pile techniques (cut loops and knots) can create deep texture on fabric; the more textured the darker, richer and more intense the color. Cut pile fabrics (corduroy, velvet, rug piles) especially show the effects of interreflection and the change in color depending on the viewer's orientation to the fabric. Uncut loops/knots show less color shift due to interreflection, because the uncut loops always present a light-reflecting side of the yarn to the viewer, thus more light is reflected from the surface.

Print Resources:

Hornung, David. Color: *A Workshop for Artists and Designers*. Laurence King Publishing. 2021.

Lambert, Patricia; Staepelaere, Barbara; Fry, Mary G.
Color and Fiber. Schiffer Publishing. 1986.

Selby, Margo. *Color and Texture in Weaving.* Interweave. 2011.

"Color! Everything a Weaver Needs to Know," *Handwoven Magazine,* March/April 2000.

"Compatible Contrasts," *Handwoven Magazine, May/June 2016.*

Video:
Bixler, Sara. *Understanding Color Relationships in Weaving.* Long Thread. (On Demand Seminar)

Essen, Deb. *Color in Weaving: Successful Choices for Handwoven Cloth.* Long Thread. (DVD or video download)

Website Articles:

warpandweave.com: "Are Your Colors Weaving Into Mud?" by Tien Chiu

fibersanddesign.com: "Weaving Color: A Guide to Yarn Colors for Weaving"

Websites with color gamps and kits
Jane Stafford Textiles https://janestaffordtextiles.com/

Lunatic Fringe https://lunaticfringeyarns.com/

For color combinations…Kangaroo Dyer offers Color Grid https://www.kangaroodyer.com/product/color-grids-1/