AIC 2004 Color and Paints

Interim Meeting of the International Color Association
Porto Alegre, Brazil, November 3-5, 2004

Proceedings

edited by José Luis Caivano

2005

AIC 2004 "Color and Paints" was organized by the
Brazilian Color Association
(ABCor, Associação Brasileira da Cor)
on behalf of the
International Color Association
(AIC, Association Internationale de la Couleur)

AIC 2004 Color and Paints, Proceedings of the Interim Meeting of the International Color Association, Porto Alegre, Brazil, 3-5 November 2004

The proceedings include: invited lectures, oral papers, posters.

Reference to papers in this book should be made as follows:

For the electronic version on the Internet:
Author(s). 2005. "Title of the paper". In *AIC 2004 Color and Paints, Proceedings of the Interim Meeting of the International Color Association*, Porto Alegre, Brazil, 3-5 November 2004, ed. by José Luis Caivano. In www.fadu.uba.ar/sicyt/color/aic2004.htm, pp. X-X [first and last page of the article].

For the printed version:
Author(s). 2005. "Title of the paper". In *AIC 2004 Color and Paints, Proceedings of the Interim Meeting of the International Color Association*, Porto Alegre, Brazil, 3-5 November 2004, ed. by José Luis Caivano and Hanns-Peter Struck. Porto Alegre, Brazil: Associação Brasileira da Cor, pp. X-X [first and last page of the article].

Chromatic strategies: Decisions around artificial coloration of natural materials at product's design process

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ABSTRACT

When natural materials are chosen to work on the dilemma will fluctuate between keeping the natural colors of materials and changing them. This work explores the possible variations of natural-material's color and cesia through the application of artificial covers, arranging the variables of both spatial and spectral light distribution, in such a way that they work as a reference tool to make further decisions around the use of color in product's design processes.

1. NATURALLY ARTIFICIAL OR ARTIFICIALLY NATURAL?

Product design, as all human activities, is a *cultural process* that generates new objects as an answer to people's needs or desires, creating at the same time an *artificial environment* for men to live in. This process is based on a *central strategy* that leads the professional by organizing the variables of the project (morphology, production, communication, function, etc.) for the product to be the result of certain aim and fulfilling user's requirements.

In product's design, the materiality becomes one of the main defining characteristics because it sets the physical and technological possibilities, and through them, product's morphology as the result of form, texture, color and cesia[1] of the material chosen. This materiality may vary according to the functional or aesthetical needs of the project, but the choice will be fundamentally restricted to the use whether natural or artificial materials.

Artificial materials are those made by the combination of elements through chemical processes, transforming natural or synthetic elements in raw materials such as plastics, metals, ceramics, etc. In these transformation processes the chromatic properties of the materials will be defined by the elements included in the combination as well as by the proportion of the quantities used.

On the other hand, *natural materials* are those who could be found on nature and need only physical transformations to be used in production, such as wood, cane, stones and fibers (silk, cotton, rattan, etc.). In these cases the chromatic properties are naturally produced and only could be modified in different proportions by artificial methods.

The reasons to introduce color into materials are variable, but most commonly the purpose is to enhance the appearance and attractiveness of a product and improve its market appeal. Indeed it is often color what first attracts the attention to a particular object. Paints, coats and stains are the most common ways to artificially change the color of materials, and could be applied by several methods, according to the production scale and the aesthetic wanted, in almost every material. However, artificial coloration is used more frequently on natural materials, precisely because its color could not be modified before it is used in production.

[1] Jannello (1984) sets this four variables as fundamental to define our visual world, introducing the term *cesia* to define spatial distribution of light. This concept was developed in Caivano (1991, 1996).

2. MAN MADE SURFACES

Of the many ways in which light can interact with objects, Caivano (1991) name three that enclose, from the physical point of view, any processes produced by light when reaching an object: absorption, permeability and diffusivity. These three could be arranged in complementary scales, measuring different aspects of the phenomena.

Absorption refers to the variation of the quantity of radiation reflected or transmitted by the surface, being on one end of the scale *darkness*, as total absorption, and on the other end *lightness*, as total re-emission.

Permeability measures the percentage of light that is seen to pass through the surface. This scale goes from *transparency*, when surface appears absolutely permeable, to *opacity*, when it is completely reflective.

Diffusivity defines different degrees of re-direction of light, having on one end *diffusivity*, with infinite re-directions, and on the other *regularity*, with only one direction of re-emission.

Then, it is possible to organize these three scales on a conceptual model, which could work as an operative tool in design processes, including all ranges of every variable, and also its multiples combinations.

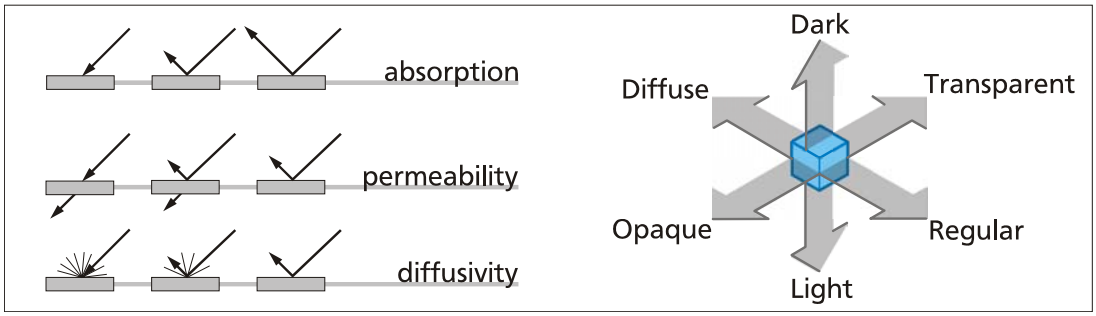

Figure 1. Variable scales.

But what happens when an artificial cover is applied on an object? Any kind of cover will modify, even slightly, the perception of a material, because it creates an additional surface over the original one. These changes occur whether by the way cover reflects, transmits or absorbs light, or by the modifications that the pigmentation causes on color and texture. In every case, all decisions should consider the available coloring possibilities from the technological, communicational and functional aspects of the project.

Artificial covers are commonly used to protect materials against external agents that could damage it. Nowadays, the technological development expands these possibilities, allowing the designer to decide product's aesthetic without loosing quality performances.

Coloring processes for different materials bases on attaching color elements to the surface, in a way that surfaces are totally or partially covered with paints, dyes or coats by means of several techniques, which depend on the material. Then, the color of material is modified by the effect of pigments and dyes due to the modification of the spectral distribution of re-directed radiation, but it is also changed by the variation of its spatial distribution, the cesia.

Beside the chromatic characteristic, paints, dyes and covers have what is commercially called *finish type*, that define how is going to behave light when it gets to the surfaces. Popular cover finishes are named with terms like matte, eggshell, pearl, satin, semi-gloss and gloss to accurately differentiate these effects, depending mostly on the vehicle characteristics.

With an opaque paint, the color of the material is hidden, because the finish layer blocks light, leaving on surface only the pigment color. On the contrary, translucent or transparent covers produce a mixture between the material's color and the dye's color, leaving the light

pass through, and acting like a sort of filter. With a translucent or mostly transparent finish the tone of the material itself becomes an important part in the final color result.

In terms of diffusivity, matte paints scatter light rather than reflect it regularly, creating flat, opaque color, and glossy paints reflect light mostly in a specular or regular way. In general, the higher the gloss the more intense or saturated the color.

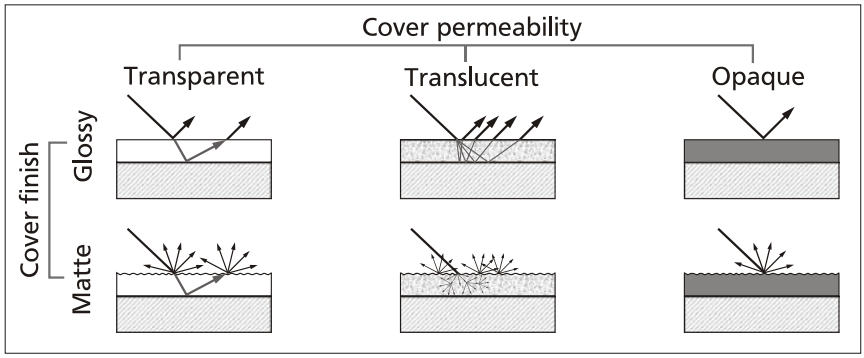

Figure 2. Cesia effects.

The final color is, then, the result of the modification of the incident radiation as a combination of both effects, one produced by the variation of the spectral distribution, and the other one by the change in the spatial distribution. Additional effects take place when the finish layer is permeable, because not only covering surface is reached by light but also fall on material surface beneath it, affecting also the perception of original texture. The tones and colors of all layers are combined and reflected to the observer's eyes as the finish color.

3. THE FINAL CHOICE

Natural materials could be recognized not only by its color, but especially by its texture, which could be either visual or tactile. These two aspects, allow people to *learn* a material through the construction of a symbolic whole, and to *recognize* it later by the sedimentation of this learning in memory. This mechanism makes possible, on one hand, *imitation*, through artificial reproduction of natural characteristics, and on the other hand, *re-signification*, through the, also artificial, transformation of the originally natural conditions of a material.

Color and texture, as signs of materiality, are visual variables that may represent either naturalness or artificiality, according to its relation with the original characteristics of material memorized before. In that way, these visual variables could be arranged in complementary scales that conceptually organize all possible combinations.

Therefore, artificial covers could be strategically used to create different sensations, when the surface of a natural material is covered with any kind of paint or dye.

Many products could be quoted to exemplify these intentions, but in this case it would be much easy to compare if products of the same category are chosen. Furniture design is one of the areas that use natural materials more frequently than others in product design. Then, here are just a few significant cases, among all other possible, to show how the use of artificial covers follows the central strategy.

Exalt: Gaudi's furniture (Figure 3a) expresses and exalts materials through the visual work on natural textures and the use of transparent varnish covers with extremely high levels of glossiness. This cover changes the tactile texture, making it completely different from natural wood. Then, he uses gloss as a tool to delimit form, and texture as a way to communicate that structural characteristics of material could be, also, elements with aesthetic value.

Abstract: De Stijl movement's intentions were to reduce sensations and impressions to the most basics aspects, rescuing the possibility of making individual interpretations. Rietveld's chromatic scheme (Figure 3b) responds to a desire to hide materiality through the use of a completely opaque cover. The color choice matches the aesthetical values of the movement, using particular colors as conceptual symbols.

Figure 3. Relations between color and texture in furniture design.

Proclaim: The Arts & Crafts movement tries to rescue craftsmanship values, following the functional and aesthetical rules of middle age guilds. In furniture design, Stickley (Figure 3c) used natural materials with hand finishes, keeping original color and texture, visual and tactile, to make a statement on the ethics values of production. The finishing is matte, alluding to a subtle and naturalistic aesthetics.

Diversify: Salix value-chain operation was developed to generate products with high added value based on inexpensive native materials (CEMA 2003). This way it could demonstrate the power of design as a competitive tool. In Estudio Blanco furniture (Figure 3d), the original texture is kept on sight, as a sign of material, but re-signifying through the modification of color.

ACKNOWLEDGMENTS

I wish to thank Ingrid Menghi (Sherwin Williams) for her collaboration, by lending material samples and by providing additional information. But specially, I want to recognize José Luis Caivano for his endless patience and generous support.

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