COLOR: ARTE, DISEÑO, TECNOLOGÍA Y ENSEÑANZA

ARGENCOLOR 2002
ACTAS DEL SEXTO CONGRESO ARGENTINO DEL COLOR

(con CD-ROM adjunto)

Compiladas por

José Luis Caivano
Rodrigo Hugo Amuchástegui
Mabel Amanda López

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SICyT-FADU-UBA
Ciudad Universitaria Pab. 3 piso 4
C1428BFA Buenos Aires, Argentina
Tel. (54-11) 4789-6289
E-mail: gac@fadu.uba.ar
Web: www.fadu.uba.ar/sicyt/color/gac.htm

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Buenos Aires
Argentina

E-mail: colmenalibros@yahoo.com

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NAMING THE APPEARANCE OF PATTERNED COMPLEX DISPLAYS

LUCIA ROSITANI RONCHI* AND JOSÉ LUIS CAIVANO†
** Associazione Ottica Italiana*
† Buenos Aires University, and National Council for Research

INTRODUCTION

The classification of materials, and of surface materials in particular, is a problem of great interest from various standpoints, ranging from image reproduction to environmental design. Operationally, it is based on the assessment of appearance. The review of the available literature reveals that passing from the uniform samples currently used in the laboratory to the real world, there is a progressive increase in the number of factors, culminating in the so-called "complexity". However, the (quantitative) delimitation between simple and complex still awaits to be established. In the present paper we are mainly interested in the perceptual aspect of the problem, where several questions are still open. For the sake of available space, we leave aside the solutions offered by computational vision (Rao 1990) as well as various mathematical approaches (e.g. Philips-Invernizzi, Dupont, and Caze 2002). Accordingly, we limit ourselves to quote a paper by Rao and Lohse (1996) who identified the dimensions of the texture in terms of texture naming, to draw a parallel with the colorimetric method and color naming. In fact, their principal component analysis culminated in a three-dimensional space, which, however, has been subsequently regarded as an oversimplification.

From the plethora of classification proposals that appeared in the literature during the past decades, we select three keystones:

- Color appearance through naming and categorization.
- Perceptual organization through its four main steps: discrimination, segregation, segmentation (through the various grouping strategies, including the figure-ground distinction), and representation.
- Cesia, or the ways different spatial distributions of light are perceived.

1. COLOR APPEARANCE

As a starting point, let us refer to Billmeyer's paper (1988) dealing with the instrumental (colorimetric) and visual assessment of color appearance. The official visual method consists in the match with the samples contained in an atlas. However, also a linguistic approach has been developed, based on various modes of operation:
a) Color naming, based on:

the "object files" concerning the basic features of the observed object are processed before the coming into play of attention, by yielding a categorization or grouping of the features, to specify both the shape (globally) and the form (a description based on local attributes), and then, the multidimensional representation of the object.

The role of color in both segregation and segmentation

In a first approach, both segregation and segmentation are investigated for the chromatic structures. However, the color may be of great help. The most obvious example is that where the color of the figure strongly differs from that of the background.

After Grossberg and Pessoa (1998), the (perceived) segregation of achromatic elements may be accounted for in terms of the differences between the output signals of channels tuned on narrow spatial frequency bands, by virtue of early vision mechanisms.

However, higher order effects are necessarily called into play when considering the segregation of chromatic elements. In fact, simple spatial filtering does not account for the segregation of color arrangements. For this, the above said authors propose the FACADE model (F for form, A for and, C for color, D for depth).

Field, Hayes, and Hess (1993) have been developing a particular strategy of grouping, where the relevant parameters are the color, the bandwidth for spatial frequency, the orientation and the relative depth.

Li and Lennie (1997) define the segmentation as the partitioning of a scene in a given number of parts. If the scene is multicolored, various distributions in the color space are to be discriminated, by virtue of the existence of mechanisms tuned on the three cardinal directions of the higher-level perceptual color space.

To conclude this section, let us recall that Wolf and Bennett (1997) propose the so-called object-files, defined as a set of basic features, including color, size and orientation. Such files are mutually interconnected, but not yet related to the properly said representation of form. Before reaching the attentional level, and before entering the general categorization-based representation, the features are heavily processed. In this connection, the participation of color in visual functionality has the same (primary) importance as orientation, texture, movement and depth.

3. CESIA

Finally, it seems to us that it is imperative to include the voice of *cesia*, as an element of primary importance in our proposal of an orienting blank displayed in the next section. The environmental designer is dealing with a real world, where various non-lambertian surfaces are present, with locally to a greater-or-lesser extent disordered surface structures and a variegated (even random distribution of micro-gradients), and where micro- and macro-textures interact with the gross characteristics of texture itself. The effect of all it on visual appearance may be quantified through cesia, but escapes from the traditional treatment of laboratory research on visual

appearance. In this connection it seems of interest to quote Lee and Sato (2001) who propose a classification of textiles to take into account the differences in appearance between the observation of real samples and that of their picture on paper.

The name cesia has been applied to the aspects of vision related to the perception of the different ways of spatial distribution of light, the aspect that Richard Hunter (1975) called "geometric attributes of appearance". Light interacts with materials, and they can absorb, reflect or transmit it in different proportions. In turn, the reflection or transmission may occur regularly (in a predominant direction) or diffusely (scattered in all directions). These are physical facts. But the human visual system perceive and decode them as visual signs that inform about certain qualities of the objects around: level of lightness or darkness, degree or opacity, gloss, transparency, translucency, quality of matt, etc. These kind of visual percepts are precisely the ones enclosed under the concept of cesia.

Taking into account the basic kinds of light transfers and the basic sensations that they arise, an order system of cesia has been developed with the purpose of notation and classification of a wide range of appearances (see, for instance, Caivano 1991, 1994, 1999).

THE BLANK

After these premises, let us try now to suggest a key for taking profit of the above body of knowledge, to compile a list of questions which, arranged in a blank, might provide a condensed classification of a patterned sample. As is made clear in section 2, this special-purpose tool (which may be interactively modified by the user) is based on the selection (among the plethora of descriptive methods proposed by various authors) of three main criteria: color appearance (through categorization and intra-categorical navigation), perceptual organization, and cesia.

A) Questions concerning color appearance

A1) This sample contains: [ ] few colors
or is it [ ] multicolored?

A2) The colors present in the samples are perceived pre-attentionally, or require search or scrutiny. That is:
[ ] are they less than the "magic number seven", or
[ ] do they exceed the magic number seven?

A3) Try to define the global impression about the set of colors present in the considered display:
cold [ ]; warm [ ]; undefined [ ]

A4) Try to classify the importance of various colors present in the sample, provided it is not monochrome:
the prevailing color: indicate its basic category […….]
the secondary color: indicate its basic category […….]

C4) What appearance exhibits the considered sample?
Describe in your own words…….

C5) Localize the considered sample at the due step of these seven point semantic differential scales:

	permeable	[] [] [] [] [] [] [] opaque
If more permeable:	transparent	[] [] [] [] [] [] [] translucent
If more opaque:	matt	[] [] [] [] [] [] [] glossy

C6) Define the cesia of the sample by visually assessing the following three parameters, in a scale of 0 to 100:

Permeability: where 0 means opaque (you cannot see light through it), and 100 means permeable (you can see light passing through it) ……..

Diffusivity: where 0 means non-diffuse (mirror like or crystalline, distinct image), and 100 means diffuse (matt or translucent, blurred image) ……..

Darkness: where 0 means very light, and 100 means very dark ……..

CONCLUSION

The environmental design has been reaching a universally appreciated high level, thanks to the geniality and initiative of serious professionals. The present report simply has aimed at suggesting some considerations based on some recent findings of visual research. We hope that it might be of some usefulness, for instance, from the educational point of view. For the students and the beginners it would be useful to have at hand a comprehensive data set, to be used, for instance, at the site of the design, where surface materials are to be selected, to predict the appearance of the planned environment. It seems to us that, for the time being, it would be useful to have a layout like the one presented here in the form of a blank, to be filled-in by the designer after the proper manipulation according to the particular problem he or she is faced with.

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