

Colour Report

F50

COLOUR AND PSYCHOLOGY

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Semiotics and cesia: Meanings of the spatial distribution of light

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Cesia is the name adopted to designate the aspect of vision that has to do with the perception of different spatial distributions of light. Light interacts with objects and it can be absorbed, reflected or transmitted; in turn, reflection and transmission may occur regularly or diffusely. These are physical matters. Now on, the human visual system perceives this decoding and interpreting it as visual signs that carry information about certain qualities of the objects around: level of lightness or darkness, degree of opacity, glossiness, transparency, translucency, matt quality, etc. This kind of visual percepts are the ones just covered by the generic name cesia.

Semiotics is the study of semiosis, that is, the processes of signification. We talk of semiosis when we are in front of situations where a transmission or exchange of information, a physical reaction, or an effect of meaning is produced by means of signs that act as agent between an object and a subject, serving to that subject as a representation of the object. Visual semiotics is the study of those processes where signs working in the visual channel are at play. Here, we are concerned with a certain kind of visual semiosis, the one where signs are given exclusively by different spatial distributions of light, cesias. Cesias are, thus, a special type of visual signs, other than color, visual texture, shape, or any other quality of the objects seized by the visual sense.

We can distinguish two aspects of cesia. On one hand we have a physical phenomenon: visible radiation and the way it interacts with objects producing diffuse or regular, reflected, transmitted or absorbed radiation. On the other hand we have a perceptual phenomenon: a visual sensation produced by that physical stimulus, and a cognitive inference, which generates the perception of translucency, transparency, matt opacity, mirror-like appearance, and blackness, with all the intermediate situations.

Color and cesia are the primary categories for visual perception because they produce some kind of contrast that makes the differentiation of areas in the visual field possible, and this is the first step in the recognition of objects. Traditionally, the research on light and color has been based on three fields: 1) optics, as the study of the physical processes of light and color, 2) physiology and neurophysiology, as the study of the mechanisms for vision, and 3) psychology and psychophysics, as the study of the sensorial and perceptual representations of the phenomena of light and color. Besides these disciplines, the doctrine of *semiotics* can provide another focus, a different, new, and encompassing one, considering the objects under study as signs by which somebody can make representations of certain aspects of the world.

Usually, it is practical to divide the study of any system of signs into syntactics, semantics, and pragmatics. The syntactic aspects of cesia, those that refer to the relations of signs to one another, have already been developed in previous research, where the sensations of cesia were organized in a three-dimensional model (in the fashion of color order systems), and procedures for the production of harmonies of cesia and the construction of scales of cesia were indicated (Caivano 1991, 1994, 1996). I want to address now some semantic and pragmatic implications of cesia, that is, referred to the relation of the signs of cesia to the objects they can represent, as regards semantics, and the relation of cesias to the interpreters of these signs, to whom they bring some kind of information, as regards pragmatics.

Within the semantic function, cesia is a sign capable of indicating certain physical properties or characteristics of materials. The most obvious and immediate fact, because the sensations of cesia are induced by physical properties, is that cesia works as a sign for these physical attributes. Thus, a

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matt sheet of paper indicates an object that, because of its physical conformation, is capable of reflecting light in all directions, while if we are in front of a glossy paper we know that there is something different in the physical conformation of it that makes light to be reflected more directionally. We can detect scratches on a polished surface because diffuse reflection is produced within them, that is different from the specular reflection of the adjacent surface. These are signs of indexical type, where the meaning comes from the relation of physical contiguity between the sign and what it denotes.

There are also another kind of inferences that can be made from indexical signs of *cesia*, but they are a bit less direct. We are able of visually distinguishing ice from snow precisely by means of their *cesia*: ice has glossy highlights and transparency, while snow looks matt and more opaque, but we learn this by experience. In the same way, if we are driving a car and we see a dark spot on the road, by this sign we can deduce that the road is wet, but the kind of gloss can tell us if it is water or oil. The lack of transparency or limpidity in the atmosphere can be a sign of air pollution or simply of presence of fog. A water surface with an unusual gloss may indicate pollution with oil derivatives. Often, in certain materials, the gloss may be a sign of impermeability, while the matt quality a sign of porosity or permeability.

Conventional or social meanings are also ascribed to *cesia*, and in these cases *cesias* are used as symbols. Gloss, for instance, often conveys the meaning of luxury and wealth, because it is generally a kind of visual quality common in precious stones and metals, and it is for this reason used when richness is meant, even if the materials themselves on which gloss appears are valueless.

Another question that has to do with the semantic relations between different sign systems is how sensations of *cesia* that may be termed illusory can be produced by means of systems of representation that employ materials not covering all the spectrum of *cesia*, such as photography, drawing, and traditional painting. With a photograph, for instance, we can produce the sensation of transparency without the substratum (the photographic paper) being transparent in itself: a jar of clear liquid is a physically transparent object (it allows the regular transmission of light) that produces the visual sensation of transparency, but a photo-

graph of this jar, being an opaque object (that may be matt or glossy, according to the finishing of the photographic paper), even conveys the visual sensation of transparency (Fig. 1).



Figure 1. A transparent jar and an opaque photograph of it: both produce the sensation of transparency.

Similar situations occur with the reproduction of other categories of *cesia*: translucency, mirrorlike appearance, glossiness, matt quality, etc. In a slide, which is a transparent object in itself, there may be perfectly represented a mountain, which is an opaque object. In the *Venus* by Velázquez there is a mirror represented, which obviously is not a real mirror. Wittgenstein points out that in order to paint a golden helmet or armour it is not necessary to use golden paint (1950 [1977: par. 79]), the sensation of metallic gloss can be obtained by non-metallic pigments. Now on, no human observer in a culture accustomed to see photographs, drawings, or paintings confuses these representations with the visual sensations of *cesia* obtained directly from the corresponding physical properties of the objects. This is a phenomenon that does not occur with color, or that occurs at a lesser extent. A pigmented object produces a certain spectral distribution of light as a consequence of a selective absorption of the visible spectrum. And a representation of that object (a photograph, a colored drawing)

produces approximately the same spectral distribution.

Apart from this difference between color and cesia, we can define cesia in the same way as color is defined, that is, as a psychophysical phenomenon. A physical side is also required in cesia (visible radiation and objects that modify its spatial distribution) and also a psychological one (the sensation produced in an observer and the interpretation of such a sensation). Between these two aspects there is a kind of interface that is physiological and neurological, that allows the passage and transformation of one thing into another. Thus, as colors "seen" in dreams or present in memory cannot be considered colors in the psychophysical sense (because the physical aspect is lacking), and as the radiation reflected by an object in a uninhabited planet cannot be considered as psychophysical color either (because the psychological aspect is lacking now, for there is no observer sensing the physical event as color), also visual illusions of cesia such as those mentioned before cannot be considered as cesias in the psychophysical sense (because in those examples the physical aspect of the representation has no correlation with the physical aspect of the represented thing).

With regard to the pragmatic dimension of semiosis, it is interesting to observe how different animal species build and use signs of cesia. Research has been carried out on color vision in species other than the human one. It is well known that some animals sense light beyond the range visible for human beings (for instance in the ultraviolet zone), that some do possess trichromatic vision and others do not. In the same way, it can be studied how different animals sense the different spatial distributions of light and what purposes these kind of visual signs serve to. There are animals that use cesia instead of color as a means to pass unnoticed to their possible predators. Thus, certain fishes are transparent, with a refraction index similar to that of the water in which they live (Fig. 2).

Many species have the perception of cesias far less developed than the perception of color, or have it developed only in a primary stage as compared with the human species. David Katz (1911 [1935: 11]) takes up again the hypothesis that the periphery of the retina, which has a more imprecise and gross kind of vision than the central fovea, keeps features of what had been relatively primary

stages in the evolution process of a particular vision system, and for this reason allows us to make an idea about how was that kind of vision. Katz points out the fact that transparency and gloss are not perceptible in peripheral vision. From this, we can deduce that a primitive vision system, which one hand may actually sense color, cannot differentiate qualities of cesia on the other hand. This can be seen in various animals, such as insects and birds, that are unable to perceive semi-transparencies or highlights on windows, and make vain efforts to pass through them.

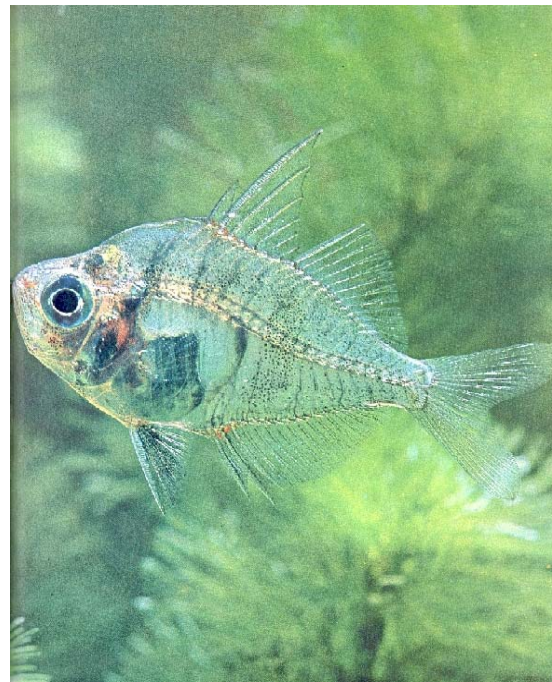


Figure 2. This fish uses cesia (transparency), instead of color, for concealment.

Jack Hailman divides the visual stimuli into two kinds (1977: 103): 1) spatially unpatterned light, where the codification of the information is given mainly by intensity and spectral distribution, and 2) spatially patterned light. This last type is just the one that originates the sensations of cesia. Hailman points out that spatially patterned light is very important for animal communication, "and requires more sophisticated photoreceptors such as the compound eyes of arthropods or the image-forming, camera-like eyes of vertebrates". This assertion agrees with our previous observations.

Cesia plays a very important role in vision in general and in the perception of space in particular. As an example of the first fact it can be mentioned that paintings of matt

finishing are used in military camouflage in order to avoid glitter that make visible the object to be hidden, and this aspect is perhaps more important than using a color that imitates the color of the surroundings. As an

example for the second assertion we have the fact that gloss helps us in the perception of the three-dimensionality of objects. Objects with glossy highlights seem to have more relief than matt ones (Fig. 3).



Figure 3. Wet pebbles and dry ones (glossy and matt appearance). The glossy appearance enhances the relief. (Reproduced from P. Brodatz, Textures, New York, Dover, 1966).

The degree of distinctness of image of objects that are in a relatively turbid or translucent medium is one of the keys (besides the size, perspective, texture gradient, and others) that allows us to ascertain the distance at which those objects stand. In a foggy day, a child standing at ten meters distance may appear of the same size, shape and aspect than an adult at fifteen meters, but we can know that the child is closer by the more distinct image of his general contour.

In architecture, it is interesting to note how different cesias in the materials that define spaces can alter the characteristics of those spaces by modifying the visual perception of the physical limits, making the sensations of privacy, protection, comfort, repulse, etc. produced by a room to change. The sensation of privacy, for instance, can be modelled by moving the appearance of the physical boundaries along the scale transparent-translucent, without losing natural illumination (Fig. 4).

Cesia serves as a parameter to evaluate the quality of certain materials. The paper for printing, to take an example, is not only

judged by its whiteness, the degree of opacity and gloss is also important. In paper for technical drawing, instead, another quality has priority: transparency. Often, we get help from cesia, besides color, smell, and other sensorial aspects, to recognize the food and chose that of better quality: pure milk looks white and opaque, milk adulterated with water looks more translucent. Apples are not only chosen for their color but also for their gloss.

It is true that we are not so conscious of the function of cesias as signs, as we are of the function of color. Perhaps it is for this reason that examples of symbolic use of cesias do not appear in great quantity as it happens with color. Being signs that emerge as such from conventions, symbols are cultural constructs, and hence they need a certain history in the conscious use to become developed. In spite that in the case of cesias such a history is somehow scanty, the fact is, as demonstrated by the examples we have seen, that the visual signs of cesia play an important role in vision, at the cognitive, communicational, and aesthetic levels.



Figure 4. Translucent and transparent walls in an interior of P. Chareau's "Maison de verre". (Reproduced from GA No. 46, photograph by Y. Futagawa).

References

- Caivano, J. 1991. "Cesia: A system of visual signs complementing color", *Color Research and Application* 16 (4), 258-268.
- . 1994. "Appearance (cesia): Construction of scales by means of spinning disks", *Color Research and Application* 19 (5), 351-362.
- . 1996. "Cesia: Its relation to color in terms of the trichromatic theory", *Die Farbe* 42 (1/3).
- Hailman, J. 1977. *Optical signals. Animal communication and light* (Bloomington: Indiana University Press).
- Katz, D. 1911. *Der Aufbau Der Farbwelt* (Leipzig: Verlag von Johann Ambrosius Barth). English transl. by R. B. MacLeod and C. W. Fox, *The world of colour* (London: Keagan Paul, Trench, Trubner, 1935).
- Wittgenstein, L. 1950. *Bemerkungen über die Farben*. English transl. by L. McAlister and M. Schättle, *Remarks on colour*, ed. G. E. M. Anscombe (Berkeley: University of California Press, 1977).

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