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# The Concept of Cesia (Visual Appearance other than color): Antecedents, Development, and Applications

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## Abstract

Cesia is the name given to the visual perception of different spatial distributions of light. It encompasses sensations of transparency, opaque appearance, translucency, matte appearance, gloss, mirrorlike appearance, etc., in addition to sensations of lightness and darkness (which are the direct link between cesia and color). Cesia and color are complementary to each other. In short terms, we could define color as the visual perception of the different spectral distributions of light. A parallelism can be noted in both definitions: spectral properties of light, in one case, spatial distribution of light, in the other.

While color sensations span from red/green and blue/yellow oppositions (in terms of hue), from grays to vivid or saturated colors (in terms of chromaticity or saturation), and from light to dark (in terms of lightness), cesia sensations span from transparent to opaque (in terms of the perceived permeability to light), from diffuse to regular or clear (in terms of perceived diffusivity), and also from light to dark (in terms of darkness, as we call the variable that cesia shares with color). Hence, all the appearances included in color and cesia combined can be defined by five dimensions: the classical three color variables plus permeability and diffusivity. There are, thus, five kind of scales that can be developed. We may think in the CIELAB color space (or any other 3D color space) being expanded with the additional dimensions of permeability and diffusivity; or either in the CIE chromaticity diagram (or any color circle) being expanded with the dimensions of lightness, permeability and diffusivity. Any color may appear as a transparent layer or volume, which can vary between crystal clear and translucent or turbid media. Colors may also appear as opaque surfaces, either with matte or glossy finish, which can even reach a mirrorlike appearance (with maximum gloss). And all these appearances may occur at different levels of darkness.

The presentation will make a basic chronological survey of antecedents of the concept, with bibliographical references to authors who have dealt with these aspects of visual appearance before the name “cesia” was proposed to designate them. After that, a brief review of the developments that started after the adoption of that term will follow. Here, a recent proposal for the amplification of the concept of cesia will be explained, which is intended to include also primary sources of light. We originally considered that cesia was only applied to secondary sources of light, those that absorb, reflect or transmit light coming from primary sources. But a recent doctoral thesis by an author who have greatly contributed to the development of cesia, has made the point that some primary sources (extended ones) can also be perceived in particular cesias. And finally, some applications or uses of the concept by different authors will be shown in different fields: visual arts, architecture, design (graphics, textiles, fashion), sensory evaluation of food, etc.



## Biography

Dr. Jose Luis Caivano is a research fellow at the National Council for Research, Argentina, and professor at Buenos Aires University, in the School of Architecture, where he also leads the Color Research Program. He holds a degree in architecture, a PhD in theory and history of art, and the highest category in the national research system of Argentina. He was a research associate at the Center for Language and Semiotic Studies, Indiana University, United States, president of the International Color Association (AIC), the International Association for Visual Semiotics (IASV), and the Argentine Color Group (GAC). Caivano has been appointed as honorary member of Ad Chroma (France), the Portuguese, and Mexican Color Societies. He serves in the editorial board of various international journals and is a senior editor of Color Research and Application. He has more than 190 publications, most of which are freely available at <https://colorysemiotica.wordpress.com/publicaciones/>



# THE CONCEPT OF CESIA (VISUAL APPEARANCE OTHER THAN COLOR): ANTECEDENTS, DEVELOPMENT AND APPLICATIONS

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## ABSTRACT

Cesia is the name given to the visual perception of different spatial distributions of light. It encompasses sensations of transparency, translucency, opaque and matte appearance, gloss, mirrorlike appearance, etc., in addition to sensations of lightness or darkness. Cesia and color are complementary to each other. We could define color as the visual perception of the different spectral distributions of light. A parallelism can be noted in both definitions: spectral properties of light, in one case, spatial distribution of light, in the other. While color sensations span from red/green and blue/yellow oppositions (in terms of *hue*), from grays to vivid or saturated colors (in terms of chromaticity or *saturation*), and from dark to light (in terms of *lightness*), cesia sensations span from opaque to transparent (in terms of the perceived *permeability* to light), from regular or clear to diffuse (in terms of perceived *diffusivity*), and from light to dark (in terms of *darkness*, as we call the variable that cesia shares with color). Hence, all the appearances included in color and cesia combined can be defined by five dimensions: the classical three color variables plus permeability and diffusivity. We may think in any 3D color space being expanded with the additional dimensions of permeability and diffusivity. Any color may appear as a transparent layer or volume, which can vary between crystal clear and translucent or turbid media. Colors may also appear as opaque surfaces, either with matte or glossy finish, which can even reach a mirrorlike appearance (with maximum gloss). And all these appearances may occur at different levels of darkness. This paper presents a basic chronological survey of antecedents of the concept, with bibliographical references to authors who have dealt with these aspects of visual appearance before the name *cesia* was proposed. Then, a review of developments after the adoption of that term follows, including a recent proposal for the amplification of the concept of cesia, which is intended to include primary sources of light. Also, some applications or uses of the concept by different authors are mentioned in various fields: visual arts, architecture, graphic, textile and fashion design, sensory evaluation of food, etc.

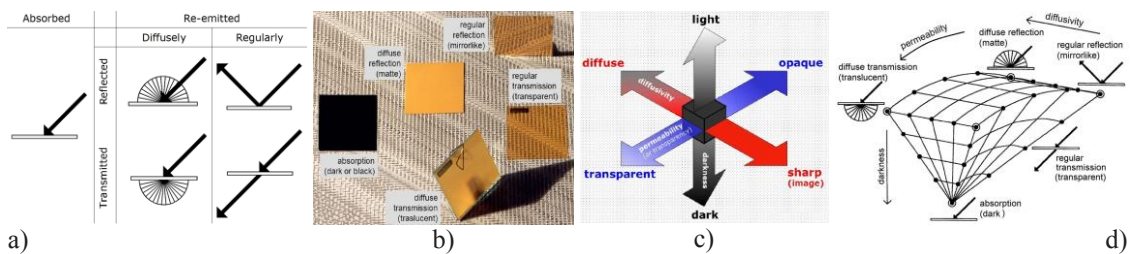
**Keywords:** visual appearance, cesia, transparency & opacity, gloss, darkness

## INTRODUCTION: DEFINITION OF CESIA

The name *cesia* has been proposed to account for the aspect of visual appearance that is related to the perception of different spatial distributions of light. Light that is not absorbed by an object may be reflected or transmitted either regularly or diffusely. These interactions of light with matter are perceived as more or less glossy (from a mirror to a matte surface as the two extremes), more or less transparent, translucent or opalescent, in different levels of darkness (according to the light-dark axis). It is the same kind of phenomena that other authors have called “geometric attributes of appearance” or “quality of surfaces”, with attributes such as transparency, translucency, turbidity, gloss, matte appearance, mirrorlike appearance, etc. The advantage is that the concept of cesia encompasses all the involved aspects in a single word, and that all cesias have been arranged in a 3D order system according to three axes of variation: transparent-opaque, diffuse-regular (or sharp), and light-dark (Figure 1).



Cesia can also be understood as different modalities of color appearance, in the sense that any color can be seen on an opaque surface (which is usually the most common situation) with a greater or lesser degree of gloss, but the same color can also appear in a transparent or translucent object. In Figure 1b, a yellow color appears on four types of surfaces: matte, mirrored, translucent and transparent, and all of them are different visual sensations. To account for these variations we can add two dimensions (permeability and diffusivity) to the three classical variables of color (hue, saturation, lightness). For this reason, all the appearances included in color and cesia combined can be defined by five dimensions. There are, thus, five kind of basic scales that can be developed. We may think in the CIELAB color space (or any other 3D color space) being expanded with the additional dimensions of permeability and diffusivity; or either in the CIE chromaticity diagram (or any color circle or triangle) being expanded with the dimensions of lightness, permeability and diffusivity. Any color may appear as a transparent layer or volume, which can vary between crystal clear and translucent or turbid media. Colors may also appear as opaque surfaces, either with matte or glossy finish, which can even reach a mirrorlike appearance (with maximum gloss). And all these appearances may occur at different levels of darkness.



**Figure 1. a) Basic interactions of light with matter. b) Basic visual sensations of cesia. c) Three axes of variation. d) Solid of cesias.**

#### AUTHORS WHO HAVE WRITTEN ABOUT SIMILAR PHENOMENA BEFORE 1990

Before the term *cesia* was invented around the 1980s and an international publication about cesia appeared in 1991, various authors have been concerned with phenomena similar to those included in this concept, at least since the beginnings of the 19th century. Probably we could go earlier in the search of antecedents, but let's take just the last two centuries.

In 1810 Philipp Otto Runge published his color sphere, the first model that can be regarded as a modern 3D color order system. But between 1809 and 1810, he wrote a short essay entitled "On the dual nature of color" (in German, "Von der Doppelheit der Farbe"), not included in his book of the color sphere. In that essay, Runge considers how color is modified by the material in which it appears. The "dual nature of color" means the possibility of being transparent or opaque. He also realizes (as Wittgenstein will do much later) that white cannot be transparent, and differentiates between blackness (a quality of opaque surfaces) and darkness (which can refer also to transparent colors). Runge also conceives the possibility of an order system for transparent colors, besides his color sphere, meant for opaque colors [1]. One century later, in 1911, David Katz published a monograph entitled *The modes of appearance of colors* (in German, *Die Erscheinungsweisen der Farben*), whose second edition of 1930 (*Der Aufbau der Farbwelt*) was translated into English as *The world of color* in 1935. Katz analyzes the various kinds of phenomena that always accompany the perception of color. He describes different modes of color appearance: surface color, which is essentially opaque, film color and volume color, which have the attribute of transparency, specular colors, perception of luster, etc. [2].

By the middle of the 20th century, Arthur Pope realized that in order to define a color with accuracy, i.e., giving account for different modes in which a color may appear, more than the three usual variables (hue, saturation, and lightness) are needed [3]. In his *Remarks on color*, published posthumously in 1951, Ludwig Wittgenstein is concerned, among other aspects, with the different types of white, yellow and golden, gray and silver, "black" mirrors, etc., and affirms that "opaqueness is not a property of the white color; any more than transparency is a property





of the green” [4]. In 1953, the Committee on Colorimetry of the Optical Society of America (OSA) published a book in which visual perception is classified into eleven attributes of modes of appearance: 1) brightness or lightness, 2) hue, 3) saturation, 4) size, 5) shape, 6) location, 7) flicker, 8) sparkle, 9) transparency, 10) glossiness, 11) luster [5]. The last three attributes are included in our concept of *cesia*. In addition to the perception of color, Sven Hesselgren includes the perception of shape, illumination, texture and movement, as other visual categories [6]. He observes that visual sensations such as luster, reflection, and gloss are not perceived as belonging to the color of an object but as something separate from color [7]. Like Arthur Pope, Ralph Evans also realized that the three variables normally used to define color are not enough to characterize color under different modes of appearance. Evans concluded that it would be necessary to define at least five variables [8].

Richard Hunter proposed a classification of the geometric attributes of visual appearance. He defined six different types of gloss and developed instruments for the measurement of some of these phenomena: goniophotometers, diffuse-reflection and specular-reflection meters, glossmeters, diffuse- and specular-transmission meters, etc. [9, 10]. The American Society for Testing and Materials (ASTM) has standardized the measurement of various physical aspects related to visual appearance [11-13]. John Hutchings emphasized the importance of visual appearance in food, and particularly studied the phenomenon of translucency among other visual qualities of food [14-16].

### THE EMERGENCE OF THE CONCEPT OF CESIA

Sometime before 1980, César Jannello, a professor at the University of Buenos Aires, mainly influenced by the publications of Pope, Hesselgren, Evans, and the Optical Society of America, coined the term *cesia* in order to encompass with a single word the visual appearances elicited by different spatial distributions of light [17]. I heard for the first time about this in 1980 and 1981, when I was a student of Jannello at the School of Architecture of Buenos Aires University [18]. A couple of years after my graduation I got a research grant, and between 1987 and 1988 I decided to investigate more about *cesia*, particularly trying to develop an order system for the variation of the involved aspects [19]. After a paper that appeared in Spanish in a journal at my Faculty in 1990, I published the first article on *cesia* in *Color Research and Application* [20].

It was a coincidence that by 1989 Paul Green-Armytage was doing a similar research and proposed a 3D model to organize what he called “qualities of surfaces” [21]. He did not know about me and I was also totally ignorant of his work. After reading my article in *Color Res. Appl.*, Paul wrote me a letter and we started an interchange of ideas on the subject. Our first personal meeting was in 1993 in the AIC congress in Budapest, where I also met John Hutchings and Osvaldo da Pos (who was introduced to me by Paul as “the king of transparency”). In his paper presented to the AIC 1993 conference, Green-Armytage already mentions the term “*cesia*”. Subsequently, he introduced the term “tincture,” borrowed from heraldry, to encompass color, texture, and *cesia* [22, 23].

In 1992, I started to produce scales of variation of *cesia* employing spinning disks and mixing five materials: transparent air, translucent polyester film, opaque polyester film with specular finish, black matte cardboard, and white matte cardboard. My paper presented to the AIC 1993 conference was precisely about this, and in 1994 I published a more detailed article [24].

### DEVELOPMENTS AFTER THE INTRODUCTION OF THE TERM CESIA

In 1996, Leo Oberascher included the concept of *cesia* in his paper on environmental color design presented to the AIC Interim Meeting 1996 in Gothenburg, Sweden [25]. In Argentina, artist and professor Varinnia Jofré, from the University of Córdoba, worked on ceramic tiles with different *cesias* and presented her results in the 3rd Argentine Color Conference [26]. Since 1996, with the help of designer Patricia Doria, we started to produce a prototype of an atlas of *cesia* made with pieces of glass, in the Optics Laboratory of the National Institute of Industrial Technology. This atlas includes 5 plates, each one with a different degree of *permeability* to light, from opaque (0% permeability) to transparent (100% permeability). Within each plate a scale of 5 steps in



*darkness* and 5 steps in *diffusivity* (from matte to specular, in different degrees of gloss) are developed. It was presented in the AIC 1997 conference in Kyoto, Japan [27]. There, Leo Oberascher also spoke about *cesia* in his paper on “The role of color in the 21st century” [28].

Other scholars that started to use the concept of *cesia*, making some developments or applications in their fields of specialty in the 1990s, have been: Fernanda García Gil, Jesús Díaz Bucero and Justo Romero Torres (University of Granada, Fine Arts), Mabel A. López (University of Buenos Aires, Communication in Design), Diana Varela (University of Buenos Aires, Textile Design), María M. Avila (University of Córdoba, Architecture), and Monica Billger (Chalmers University of Technology, Sweden). See their publications in ref. [29], section 1990-1999.

### A chronology of publications

Let's now review what happened after the turn of the millennium:

**2000 to 2009:** In the first decade of the new millennium, we find the concept spread out in different fields, taken and amplified by other authors. At the University of Buenos Aires: Rodrigo Amuchástegui (philosophy), Julieta Garavaglia (graphic design), Paulina Becerra (industrial design). At the University of Litoral, in Santa Fe: Susana Cariola, Luis Curubetto (architecture). The concept of *cesia* is also quoted in the following books or monographic publications: *Modern concepts of color and appearance*, by Asim Choudhury (2000), *Understanding color*, by Giordano Beretta (2003), *A framework for the measurement of visual appearance*, by the CIE Technical Committee 1-65 (2006), *Figures de la figure: semiotics and general rhetoric* (chapter by Tiziana Migliore, 2008), as well as in articles or papers by Lucia Ronchi (2002), Berit Bergström (2004), B. Rouillet et al. (2005). See these publications in ref. [29], section 2000-2009.

Roberto Daniel Lozano, deals extensively with *cesia* in a paper entitled “A new approach to appearance characterization”, published in 2006 in *Color Res. Appl.* [30], and in his paper presented to the CIE Experts Symposium on Visual Appearance [31]. Nuria Acevedo, Pilar Buera and others apply the concept to the analysis of food appearance [32]. With the help of Ingrid Menghi and Nicolás Iadisernia, working at the laboratory of Sherwin Williams paint company in Buenos Aires, we developed a new prototype of atlas of *cesias*, in this case produced with painted samples. By mixing three kinds of paints (white enamel, black enamel and transparent varnish) in three different finishes (matte, satin and glossy), we were able to build scales of *cesia* with five steps each, covering the whole ranges from opaque to transparent, bright to dark, and matte to glossy, making a total of five charts with 25 samples each, i.e., 125 samples. This work was presented to the AIC 2004 Interim Meeting on Color and Paints, in Porto Alegre, Brazil [33].

**2010 to 2019:** In 2010, the AIC Interim Meeting on Color and Food was held in Mar del Plata city, Argentina, and five papers dealing with *cesia* in food or food packaging were presented by Becerra et al., Castillo and Becerra, Giglio, Lozano, Prause and Cariola (see ref. [29], year 2010). Also in 2010, Francis Édeline, one of the three authors of Groupe  $\mu$ , who wrote the famous *Treatise on visual semiotics*, devoted a section of an article of his authorship to explain *cesia*, pointing out its importance for camouflage purposes [34].

In the AIC Meeting 2011 on Color and Light, in Zurich, I presented a paper on color and *cesia*, the interaction of light and color [35], and Green-Armytage described a new model to link different modes and aspects of appearance, which extends the solid of *cesias* towards texture, on one side, and towards the illuminant mode, on the other side [36]. In a similar vein, in 2014 Varinnia Jofré introduced the new hypothesis of *luminous cesia*, the idea that these kinds of visual appearances are not limited to secondary sources of light but can be also produced in primary light sources [37]. Taking examples and applications from the visual arts, she will further develop and amplify this idea in her doctoral dissertation presented to the University of Córdoba in 2017, whose title is *Aspects of cesia in the artistic image* and deals entirely with the concept of *cesia* throughout its six chapters [38]. See Figure 2.

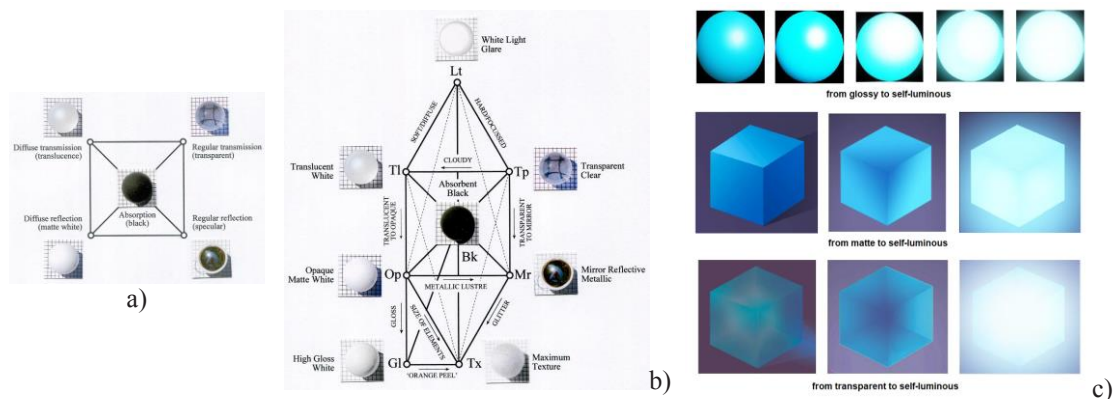
In 2015, 2016 and 2018 Tien-Rein Lee, Vincent Sun and Ming-Kang Lan presented papers dealing extensively with *cesia* in the AIC Meetings 2015 (Tokyo) and 2016 (Santiago, Chile), as well as in the Munsell Centennial Symposium in Boston [39]. In this period, we can also find mentions and citations in doctoral and master thesis in Spain and Argentina by Raúl Parada





(2016), María Lambana (2016), and Carlos Jones (2017). Also, in the book on *Visual appearance and its measurement* by Lozano (Argentina, 2015), in the book on *Color in industrial design* by Gallardo Frade (Mexico, 2016), as well as in the compendium on color words in the English language by John Hutchings et al. (United Kingdom, 2019). See these publications in ref. [29]. The first edition of the *Encyclopedia of Color Science and Technology*, published in 2016 by Springer, includes an entry on “Appearance” by Caivano and Green-Armytage [40].

**2020 to nowadays:** In 2021 I published a new article in *Color Res. Appl.*, dealing with the role of cesia in color mixtures and the consequences on the shape of color order systems [41]. The 2nd edition of Springer’s *Encyclopedia of Color Science and Technology*, published in 2022, includes also a new version of the entry on “Appearance” by Caivano and Green-Armytage. Finally, at the beginning of 2023, with two students of design in Buenos Aires University, we arranged a website entirely devoted to cesia, featuring a homepage with a definition, a short introduction and some graphic and photographic material, a chronology with access to more than 120 publications, references to scientific societies, conferences, programs of seminars, calls for papers in which the concept of cesia is used, videos of recorded lectures, and other materials [42].



**Figure 2. a) Model of cesia in 2D. b) Green-Armytage amplification. c) Jofré: glossy-luminous, matte-luminous, and transparent-luminous scales.**

## CONCLUSION

The notion of cesia has evolved in at least three stages. The initial conception was rather linked to the nature of the physical stimuli, i.e., the interaction of luminous radiation with matter. Later we understood that, without leaving the physical stimulus aside, what is important is the visual sensation produced in the observer, which can vary not only in relation to the materiality of objects but also with the type of light source, the mode and conditions of lighting and observation (visual angle, distance, contextual situation, etc.). Finally, proposals for expanding the model of cesia have appeared with the aim of integrating the different modes of appearance, including not only the surface mode (typical of opaque objects), the volume and film modes (typical of transparent objects) but also the illuminant mode (for primary sources). An additional idea is that, instead of understanding these modes of appearance as situations separate from each other, we can see them related or linked through gradual transitions or intermediate steps.

## REFERENCES

*Note:* References [17] to [41] are available at <https://cesiapage.wordpress.com/chronology>.

1. Runge, P. (1809). Von der Doppelheit der Farbe. In *Hinterlassene Schriften*. Hamburg: Perthes, 1840, 141-146. Transl. R. Kuehni, On the dual nature of color. In *P. O. Runge’s color sphere*, 2008, 72-75.
2. Katz, D. (1911). *Die Erscheinungsweisen der Farben*. 2nd ed. *Der Aufbau der Farbwelt*. Leipzig: J. A. Barth, 1930. Transl., *The world of color*. London: Kegan, Paul, Trench, Trubner & Co., 1935.
3. Pope, A. (1949). *The language of drawing and painting*. Cambridge, MA: Harvard Univ. Press, p. 28.
4. Wittgenstein, L. (1951). *Remarks on colour*. Berkeley: University of California Press, 1977.
5. OSA, Committee on Colorimetry. (1953). *The science of color*. New York: Crowell, ch. 2.



6. Hesselgren, S. (1954). *Arkitekturens uttrycksmedel*. Stockholm: Almqvist & Wiskell. Transl. B. Dahlbäck, revis. C. Jannello, *Los medios de expresión de la arquitectura*. Buenos Aires: Eudeba, 1964, ch. 2.
7. Hesselgren, S. (1967). *The language of architecture*. Lund, Sweden: Studentlitteratur, ch. 3.
8. Evans, R. (1974). *The perception of color*. New York: Wiley.
9. Hunter, R. (1969). Geometric and color attributes of object appearance. In *AIC Color 69, Proceedings*. Göttingen: Muster-Schmidt, 1970, vol. 1, 525-529.
10. Hunter, R. (1975). *The measurement of appearance*. New York: Wiley.
11. ASTM. (1974). Standard recommended practice for selection of geometric conditions for measurement of reflectance and transmittance. Standard E, 179-173.
12. ASTM. (1990). Standard guide for selection of geometric conditions for measurement of reflection and transmission properties of materials. Standard E, 179.
13. ASTM. (1990). Standard test method for visual evaluation of gloss differences between surfaces of similar appearance. Standard D, 4449.
14. Hutchings, J. (1977). The importance of visual appearance of foods to the food processor and the consumer. *Journal of Food Quality* 1, 267-278.
15. Hutchings, J. (1977). Colour and translucency as food attributes. In *AIC Color 77, Proceedings*. Bristol: Adam Hilger, 1978, 467-470.
16. Hutchings, J., & C. Gordon. (1981). Translucency specification and its application to a model food system. In *AIC Color 81, Proceedings*. Berlin: DfG, section C4.
17. Jannello, C. (circa 1980). La cesia como materia conceptual. In G. Carvajal, *Diseño como poética*. Buenos Aires: Acad. Nac. Bellas Artes, 2005, 112-115.  
Unpublished drawings and schemes on cesia. FAU-UBA.
18. Jannello, C. (1980-1981). Handwritten notes on cesia taken by Caivano in two classes. FAU-UBA.
19. Caivano, J. (1988). Cesia. In *Trabajo de investigación*. Buenos Aires: UBA, reports.
20. Caivano, J. (1991). Cesia: a system of visual signs complementing color. *Color Res. Appl.* 16, 258-268.
21. Green-Armytage, P. (1989). Colour and other aspects of appearance. 2nd Confer. Colour Society Australia. In *Spectrum* 6 (3), 1992, 1-11. Available at <https://cesiapage.wordpress.com/antecedents>.
22. Green-Armytage, P. (1993). Beyond colour. In *Color 93, Proceed.* vol. A. Budapest: HNCC, 155-162.
23. Green-Armytage, P. (1993). Tincture – A new/old word for the appearance of things. *Journal of the School of Design (Perth)* 2, 16-23.
24. Caivano, J. (1994). Appearance (cesia): construction of scales by spinning disks. *Color Res. Appl.* 19, 351-362.
25. Oberascher, L. (1996). Environmental colour design. Simulating real world complexity. In *Colour and psychology. From AIC Interim Meeting 96*. Stockholm: SCI, 1997, 49-55.
26. Jofré, V. (1996). El color cerámico y la cesia. In *ArgenColor 1996*. Buenos Aires: GAC, 1998, 92-102.
27. Caivano, J., & P. Doria. (1997). An atlas of cesia with physical samples. In *AIC Color 97*, vol. I. Kyoto: Color Science Association of Japan, 499-502.
28. Oberascher, L. (1997). The role of color in the 21st century. In *AIC Color 97*, vol. I. Kyoto: CSAJ, 83-89.
29. Chronology of the concept of cesia: <https://cesiapage.wordpress.com/chronology>.
30. Lozano, R. (2006). A new approach to appearance characterization. *Color Res. Appl.* 31, 164-167.
31. Lozano, R. (2006). A new look into perception of appearance. In *Proceedings of the CIE Experts Symposium on Visual Appearance*. Paris: CIE, 23-27.
32. Acevedo, N., et al. (2008). Integrating spatial and chromatic properties for a better definition of food appearance, 1st International ISEKI\_Food Conference, Porto, Portugal.
33. Caivano, J., et al. (2004). Cesia and paints: an atlas of cesia with painted samples. In *AIC 2004*, 113-117.
34. Édeline, F. (2010). Énoncés dénoncés. *Visible* 7, 9-33.
35. Caivano, J. (2011). Color and cesia: the interaction of light & color. In *AIC 2011*. Zurich: pro/colore, 225-228.
36. Green-Armytage, P. (2011). A model to link different modes and different aspects of appearance. In *AIC 2011*. Zurich: pro/colore. Further developed in: More than colour – dimensions of light and appearance. *Journal of the AIC* 17, 2017. See also ref. [40].
37. Jofré, V. (2014). La cesia luminosa en el arte. In *ArgenColor 2014*. Buenos Aires: GAC, 2016, 110-119.
38. Jofré, V. (2017). *Aspectos de la cesia en la imagen artística*. Univ. of Córdoba, Artes, PhD thesis.
39. Lan, M. (2015). Influence of surface properties on material appearance. In *AIC 2015*. Tokyo: CSAJ, 1217-1220.
- Lee, T. (2016). Material perception and surface properties. In *AIC 2016*. Santiago, Chile: ACC, 254-257.
- Lee, T., & V. Sun. (2018). An order system based on material perception”, Munsell Color Sympos. Boston.
40. Caivano, J., & P. Green-Armytage. (2016). Appearance. In *Encyclopedia of Color Science and Technology*. New York: Springer.
41. Caivano, J. (2021). Color order systems, color mixtures and the role of cesia. *Color Res. Appl.* 46, 1169-1179.
42. Cesia: <https://cesiapage.wordpress.com>.

