Actas

14º Congreso Mundial
de Semiótica: Trayectorias

Buenos Aires

Septiembre 2019

International Association for Semiotic Studies (IASS/AIS)

Tomo 8

Conferencias plenarias

Coordinadores
Oscar Steimberg,
Oscar Traversa y
Gastón Cingolani

IASS-AIS
International Association for Semiotic Studies
Association Internationale de Sémiotique
Asociación Internacional de Semiótica
Internationale Vereinigung für Semiotik

ASOCIACIÓN ARGENTINA DE SEMIÓTICA

UNIVERSIDAD NACIONAL DE LAS ARTES

CRÍTICA DE ARTES

Proceedings of the 14th World Congress of the International Association for Semiotic Studies (IASS/AIS)

Área Transdepartamental de Crítica de Artes
Actas Buenos Aires. 14º Congreso Mundial de Semiótica : trayectorias : Proceedings of the 14th World Congress of the International Association for Semiotic Studies-IASS/AIS : tomo 8 : conferencias plenarias / editado por Rolando Martínez Mendoza ; José Luis Petris ; prólogo de Gastón Cingolani ; Oscar Steimberg ; Oscar Traversa. - 1a ed edición multilingüe. - Ciudad Autónoma de Buenos Aires : Libros de Crítica. Área Transdepartamental de Crítica de Artes, 2020.
Libro digital, PDF

Edición multilingüe: Alemán ; Español ; Francés ; Inglés.
Archivo Digital: descarga y online
ISBN 978-987-47805-7-7

1. Semiología. 2. Semiótica. 3. Epistemología. I. Martínez Mendoza, Rolando, ed. II. Petris, José Luis, ed. III. Cingolani, Gastón, prolog. IV. Steimberg, Oscar, prolog. V. Traversa, Oscar, prolog. VI. Título.
CDD 401.41

Actas Buenos Aires. 14º Congreso Mundial de Semiótica: Trayectorias. Trajectories. Trajectoires. Flugbahnen.

Asociación Argentina de Semiótica y Área Transdepartamental de Crítica de Artes de la Universidad Nacional de las Artes, Buenos Aires, Argentina.

Proceedings of the 14th World Congress of the International Association for Semiotic Studies (IASS/AIS)

Buenos Aires, 9 al 13 de septiembre de 2019.

Tomo 8

ISSN 2414-6862
e-ISBN de la obra completa: 978-987-47805-0-8
e-ISBN del Tomo 8: 978-987-47805-7-7
DOI: 10.24308/IASS-2019-8

Editores Generales *José Luis Petris y Rolando Martínez Mendoza*
Editores *Marina Locatelli y Julián Tonelli*
Diseño *Andrea Moratti*

Imagen utilizada para la tapa: *Sin pan y sin trabajo*, Ernesto de la Cárcova, 1894.

A Gradualist Perspective for the Semiotic Approach to Visual Images

DOI: 10.24308/IASS-2019-8-005

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Introduction

Among other features, the visual world is essentially continuous, without oppositions or abrupt jumps. The basic elements or signs that build it for our cognition have usually gradual variations. Colors admit gradual changes of hue, lightness and saturation, and those variations can be almost unnoticeable. A couple of examples of this are the numberless tonal variations that can be observed in human skins or in a collection of leaves taken from a tree in different seasons. This also applies to spatial shapes, or morphology, in general. Processes of metamorphosis (gradual changes of shape, or transformations) are very common in nature and biology. For instance, there are countless different shapes of human bodies between fat and thin, tall and low, etc. Another example: One can follow, day by day the small and unnoticeable changes suffered by a frog, from eggs to adult, passing through embryo and tadpoles. There are only four or five words to designate the different steps in this metamorphosis, but a photographic series of it may show hundreds of instances.

Visual textures and cesias (transitions between transparency, translucency, opacity and gloss) may also change in a continuous and indistinguishable way. In Figure 1a, three visual states are described by words (transparent, translucent, matte), but among them there is a continuous visual variation, where it is difficult to establish boundaries. Almost nothing is more continuous than the visual perception of movement. Muybridge photographic series, and later the cinematographic process, have been able to simulate motion from a succession of static frames that capture changes in shape, position, lighting,

etc. at small intervals. The result is a fluid continuity (Figure 1b). Visual acuity tests performed by ophthalmologists have characters or shapes with a gradual decrease in size. Tests devised to detect deficiencies in color vision (Ishihara, Munsell-Farnsworth, etc.) use variations with degrees of tonal difference between elements (Figure 1c). Contrast vision tests use linear patterns with slight changes in orientation, size, separation and degree of sharpness or contrast of the lines (Figure 1d). All this accounts for that the sense of vision can essentially detect small modifications of shapes, sizes, colors and textures.

Vision is very effective in detecting small differences. And this is enhanced by the possibility of comparing objects and situations simultaneously. The development in simultaneity is a typical quality of most visual languages, something that auditory and verbal languages do not share, because successivity predominates in them. Sensorial assessment in simultaneity does not require the participation of memory, while in successive events, memory is essential to detect differences. Vision can take advantage of this condition, as long as the visual elements appear close, but occupying a different portion of the space, not in exact overlap.

In the history of visual semiotics, theoretical proposals have generally developed models by projecting categories formulated in verbal language. These developments verbalize the analysis and description of the visual world, and reduce and simplify it in terms of oppositions or tight categories: light-dark, straight-curved, large-small, etc. It is a logic of binary type, which shares the opposing criteria of affirmation-negation, truth-falsehood... But the world is not like that, let alone the visual world. It is certainly useful to verbalize what we see for the purposes of communication, or to modelize a certain understanding —simplified— of what surrounds us.

However, the human brain does not need to verbalize visual situations to understand them and make decisions. When we cross a street, we unconsciously calculate in milliseconds an infinite number of changing data: distances, speeds, sizes, shapes and colors, attitudes and gazes of drivers of nearby vehicles, as well as our own motor skills. And eventually we are able to reach the opposite sidewalk safely. If all this had to be verbalized to be processed by the brain, it would be impossible to perform such action.

Of course one can never dispense with the use of signs, both to model or produce some representation of the world, or for communicative purposes. But sign systems that allow to account for gradual evolutions, changes, cumulative differences and variations would offer a much richer knowledge of the visual world.

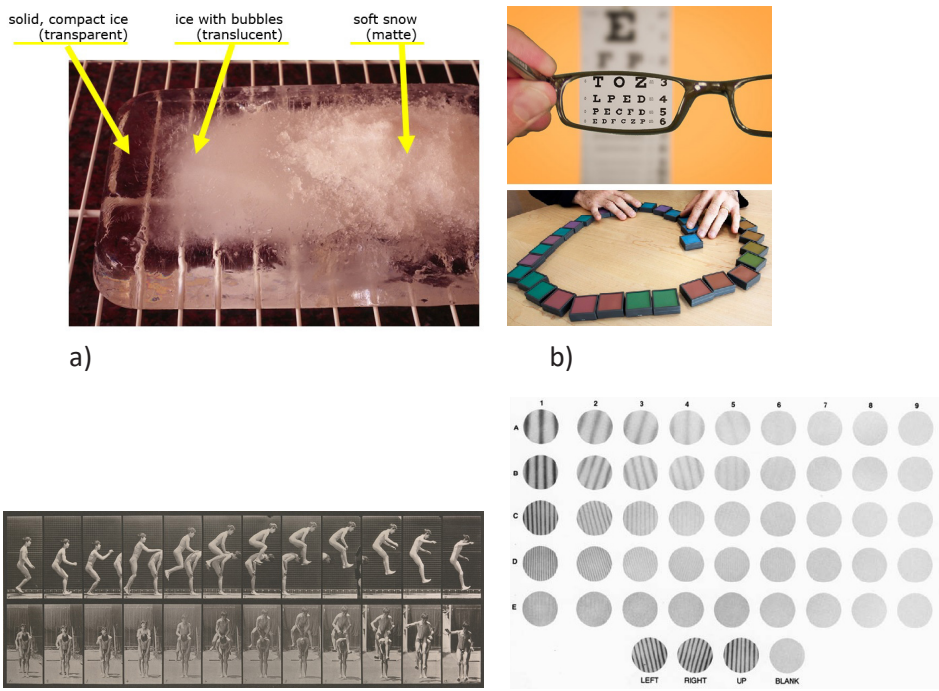


Figure 1: a) Continuous variations of cesia in a fragment of ice, between transparent to matte).
b) One of Muybridge photographic series. c) Ophtalmological test for visual acuity and Munsell-Farnsworth test for color blindness. d) Test to evaluate the vision of contrast.

Grammars of visual language

In 1967, Jacques Bertin develops and systematizes, with the name of graphic semiology, the elements that allow cartography to display its full potential and expand its methods towards other fields and genres of the production, processing and graphic communication of information, with great influence in what has been more recently called infographics or info design, among many other fields of application. Bertin exposes the elementary graphic signs that, with the possibility of a graduated variation, allow to represent and communicate a large number of concepts, data and types of information of diverse complexity and various levels of relationability. Qualitative aspects can be adequately represented by shapes and colors, quantitative data, by means of figure sizes and lightness values, textures are suitable for both, and orientations allows to refer to spatial situations. In turn, each of these graphic variables can be materialized in terms of points, lines or surfaces, with which the repertoire of available combinations increases considerably (Figure 2). If we

also consider that each of these categories admits gradual variations, we have practically a language with almost infinite combinatorial possibilities, which can be semantically associated with a huge number of concepts or classes of information.

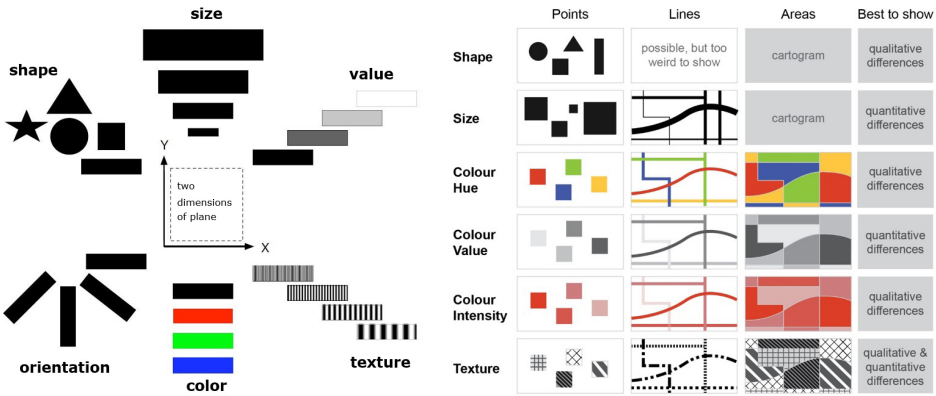


Figure 2: The graphic variables according to Bertin (left), with possible materializations, combinatory and uses (right). From Bertin (1967), and Burkhard & Kruse (2017: 64).

There are models that organize and identify thousands of colors in terms of a gradation of three dimensions, for instance, the Natural Color System, with the variables of hue, blackness, and chromaticness (Figure 3a).

César Jannello (1984) devised a model that organizes the variation of shapes, also in terms of three variables: form-matrix, size, and saturation (Figure 3b). These allow for the gradual transformation of two-dimensional figures (see also Guerri 2012). Other models have been developed or amplified in a similar way, to account for the gradual transformation of three-dimensional shapes, for instance, the one that can be seen on Figure 3c, by Mason Dambrot (2017).

Jannello (1961) also proposed a cubic model to organize visual textures. The variables are: directionality, size, and density (Figure 3d). Using the same variables, I proposed a slightly different way of organizing textures, an example of which can be seen in Figure 3e (Caivano 1990, 1994).

There are also models that organize and identify visual sensations of gloss, transparency, translucency, matte appearance, etc. The name “cesia” was given by Jannello to this kind of visual sensations, and I developed a model with three variables: permeability, darkness, and diffusivity (Caivano 1991). It can account for gradual changes between dark and transparent, between transparent and opaque, and many other situations that we see in daily life (Figure 3f).

Finally, I can mention my proposal to organize a model for the gradual description of movements, in terms of visual signs (Caivano 1999).

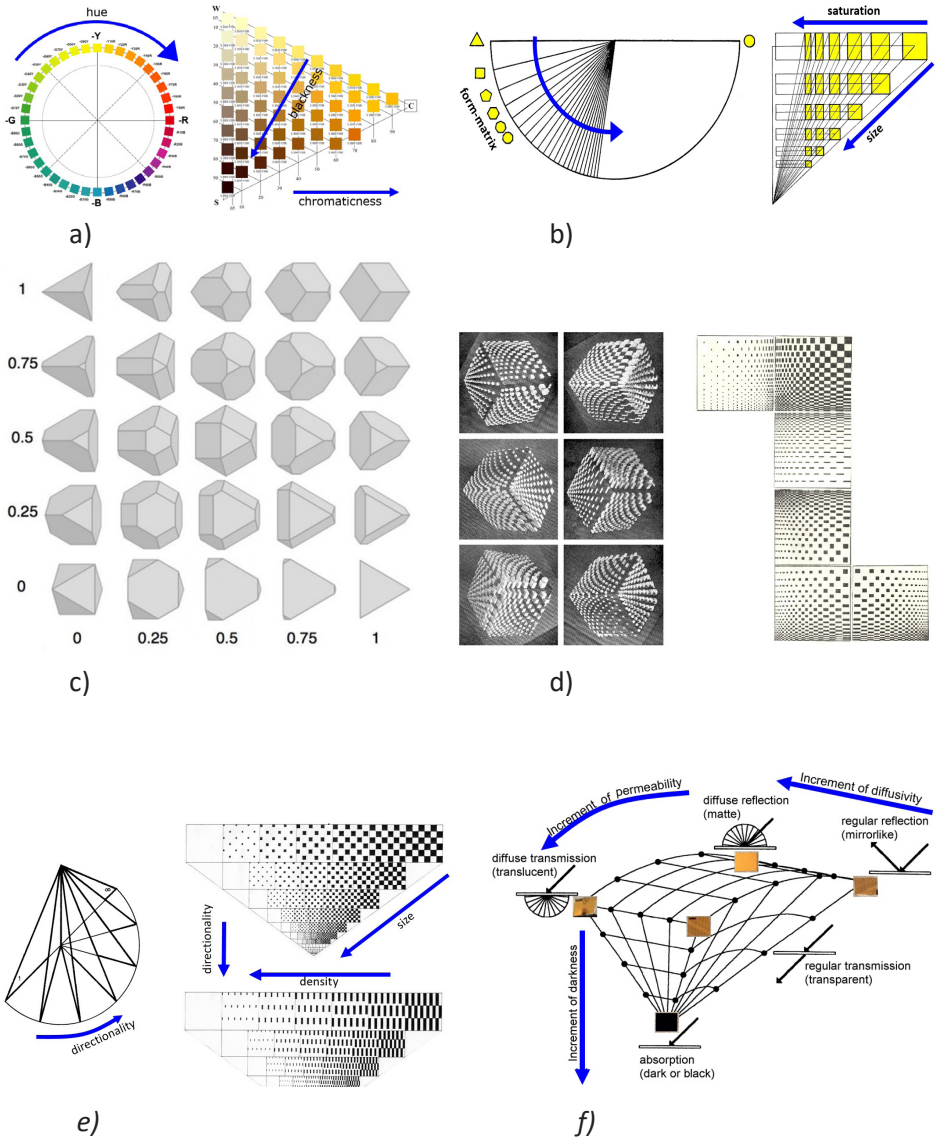


Figure 3: a) Natural Color System. b) Jannello's system for 2D shapes. c) Gradual variation of 3D shapes. d) Jannello's model for visual textures. e) Another model for visual textures by Caivano. f) The system for cesias by Caivano (transparency, translucency, gloss, matte appearance, etc.).

Verbal signs are limited to explain visual variations. The mathematical language allows quantifying gradations and specifying variables, although it only serves for quantifiable aspects, or where quantification is relevant. Each

language has its limitations. A combination of different languages or different kinds of representations can be an overcoming instance to address a more thorough analysis of a certain object.

A gradualist view of semiosis

The argument here is that a semiotic perspective based on a gradualist conception allows to handle adequate complexities for visual studies. There are antecedents in biology, geology and other natural sciences, as well as in human sciences, history, economics, etc. In natural sciences, the gradualist hypothesis may adopt the forms of uniformitarianism (advocated by James Hutton by 1785 and Charles Lyell by 1830, among others) or evolutionism (from Darwin 1859, *The origin of species*), in front of the opposite idea of catastrophism (favored by Georges Cuvier by 1822). In politics and society, we can find processes of sudden change trough revolutions versus processes that evolve through gradual transformations. In economy, shock policies or gradual policies may be applied, for instance.

In addition, I maintain that developments based on Peircean semiotics, are better suited for visual studies than dualistic structures anchored in linguistics. The Greimasian semiotic square, based on the operations of assertion and negation, with the relations of contrariety, contradiction and complementarity, participates in the binarist conception of semiosis (Figure 4a). It is certainly useful for many cases, but proves to be inoperative when it is necessary to account for more complex, non-binary types of semiosis, as is usually the case with visual semiosis. However, if the connections are understood as intermediate cases or transitions, the same binarist model could be transformed in a gradualist one (Figure 4b).

From a Greimasian perspective, Jacques Fontanille (1998) develops a model or tensive space, applied in this example to the semiotics of light, that, even when based upon oppositions, takes into account transitions and intermediate cases (Figure 4c). Note that for the intermediate cases, no names (or just a couple, at most) are available, either in French or any other language. In another diagram, Fontanille shows the way from the semiotic square to the tensive space (Figure 4d).

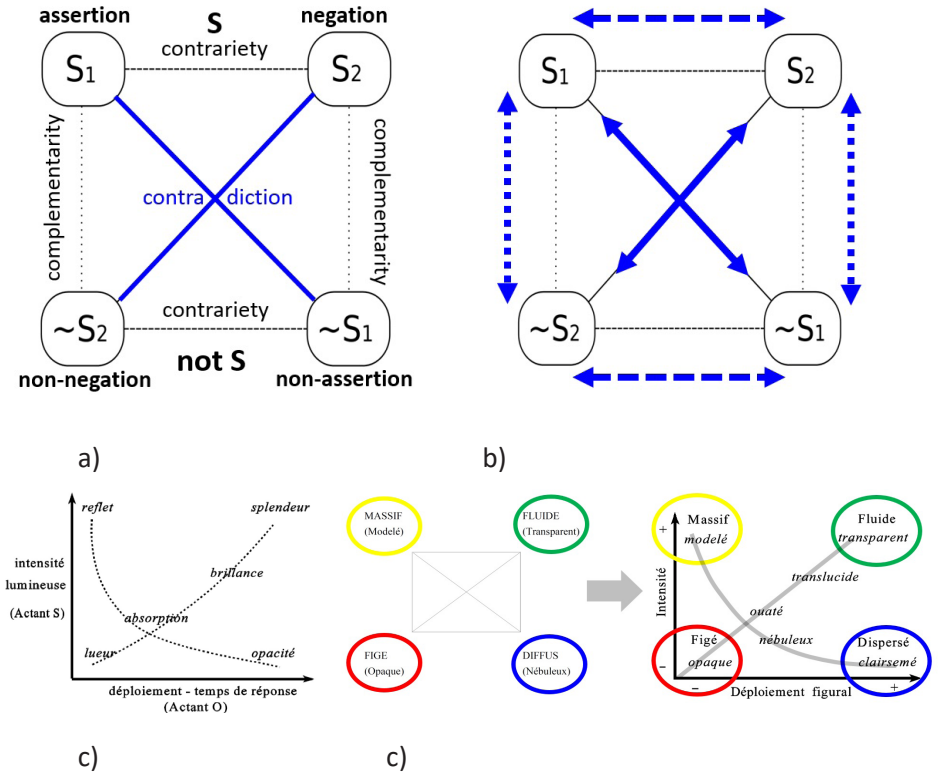


Figure 4: a) Greimas' semiotic square (from Hébert 2006). b) The same square, but with transitions between the binary oppositions. c) Fontanille's model or tensive space applied to the semiotics of light. d) Fontanille: from the semiotic square to the tensive space.

The concept of scale

Scale is one of the attributes of visual images, specifically in the field of spatiality, although languages that do not have visual or spatial development, but temporal, such as sound, admit scalar variations (Figure 5a). And scale is just a category of gradual nature. Images within another image that are repeated to infinity are known as *mise en abyme*. As examples of them, the can of Royal baking powder and the series of images reflected in facing mirrors can be mentioned. They have attributes of self-similarity, homothecy, and a fractal nature, and are gradualist procedures, with jumps of scale with greater or lesser degree of proximity between the steps or intervals. These jumps or intervals can be made as small as desired. What regulates this is the ratio of sizes or the scale between the first and second images, since the other images will repeat that initial interval indefinitely (Figure 5b).

One of the requirements for a scale to be useful is that it has regularity in its units and intervals; i.e. it has to be modulated. Dardo Bardier (2007: 36ff) represents this property comparing two stairs. The one on the left is well modulated: any difference in height between the steps serves as a module. The one on the right, however, is poorly modulated: no difference in height between steps is repeated (Figure 5c).

The feature of continuity would appear to be altered with changes in scale. Bardier points out how an object, phenomenon or event observed on two different scales seems to have dissimilar nature. A pencil stroke looks continuous to the naked eye and appears as a fragmented series of dots when viewed with a magnifying glass (Figure 5d). But between the small and the large scale of observation there are intermediate scales, where that opposition or difference is diluted, clearly becoming a gradation.

We always observe, measure, and represent something on a given scale. "If we were able to describe a fact on all its scales, we would have a full description of the fact" (Bardier 2007: 232, my translation). But describing something on all its scales gives as a result that such object appears different on each scale, even if its transformation from one extreme to the other is gradual. Here, we may refer to the video *Powers of ten*, by Charles and Ray Eames (1977), made at IBM (available on YouTube).

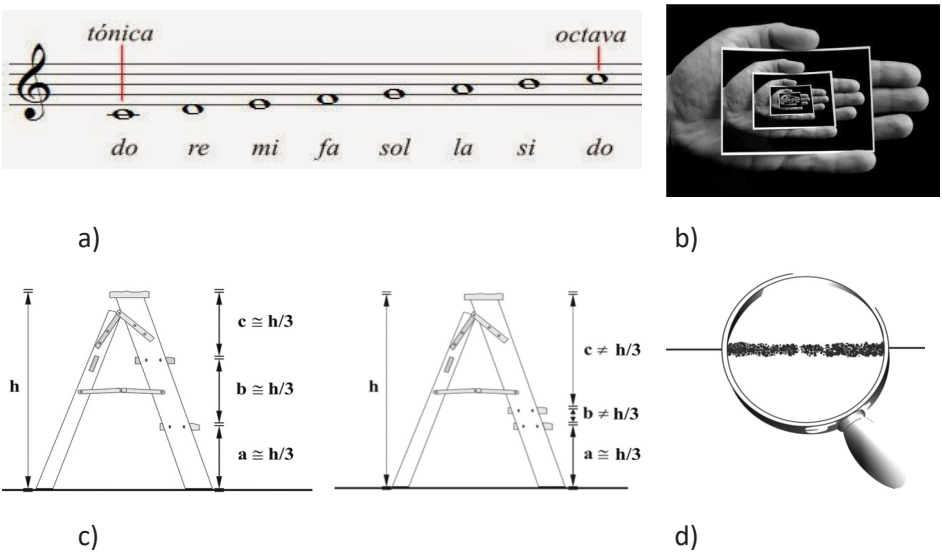


Figure 5: a) A musical scale. b) An image reflected in facing mirrors. c) A well modulated scale (left), and a poorly modulated one (right), from Bardier 2007: 36). d) The same object looks continuous at one scale and discontinuous at another (from Bardier 2007: 70).

The concept of edge is also relevant. Bardier describes two types of edges: net (or sharp) edge, with an abrupt change, and diffuse (or nebulous) edge, with a progressive change (Figure 6, above). But what appears on a scale with a net edge, turns out to have a diffuse edge on another scale. Let's see an example. A city at the sea shore has a limit, represented on a map by a line or an abrupt color change dividing land from water. But when we see the "real" sea shore, such an edge does not exist: waves come and go and the limit is changing continuously (not even mentioning the changes produced by tides). And even if it is possible to eliminate waves and tides, the boundary between wet and dry sand is also quite diffuse. Thus, there are countless intermediate scales, where the edge is not as net or diffuse (Figure 6, below).

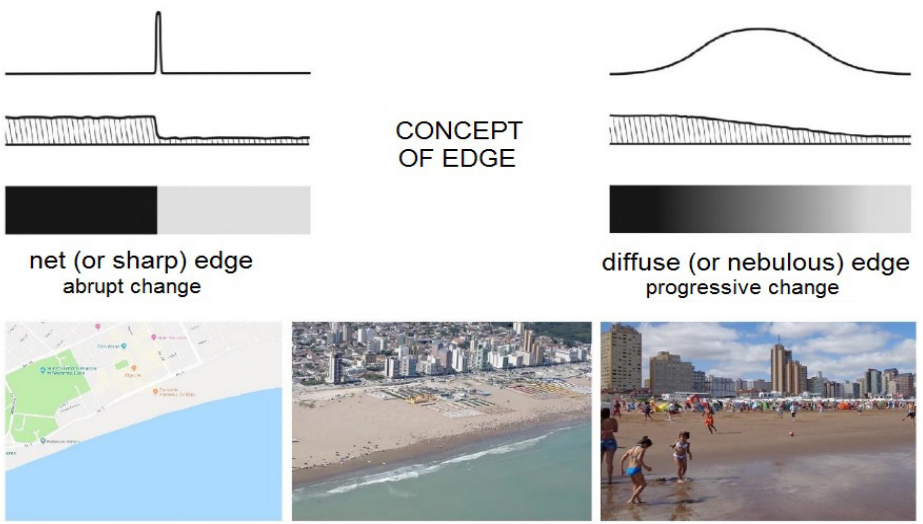


Figure 6:
Sharp and diffuse edges.
The two schemes on top are reproduced from Bardier (2007: 228)

Since visual images are basically composed of shapes, colors, textures, cesias, and eventually movement, they acquire the gradual features of these elementary visual signs. This allows visual images to communicate a type of information or build a particular kind of knowledge, made of continuities, gradual transitions, scales, nuances, transformations, and in this sense, they can share or take advantage of some properties of numerical languages. To study these problems in depth, visual semiotics should build more gradualist models, instead of binary ones.

Transformation of an oppositional scheme into a gradualist one

Is it possible to escape from the dualistic enclosure that verbal language proposes? Let's see a case. Tables or schemas of variables with positive and negative values usually applied in social sciences work in the manner of net edges; i.e., through an abrupt division they make a dualistic simplification that, although useful to classify certain information, in practice hides the more complex nature that the phenomena under study generally have (Figure 7, left). If we want to have more precise and nuanced information at the same time, recording situations that are not simply "white" or "black", the same scheme could be used, but affecting the variables by a gradual scale, even if it is simply adding a single transition. Obviously, between the "precarious" and "non-precarious" opposites there may be intermediate cases, i.e., degrees of precariousness. This allows recording cases that cannot be so easily sort out by means of opposites (Figure 7, right).

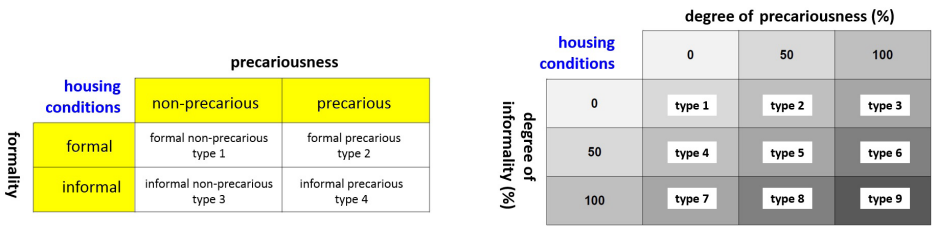
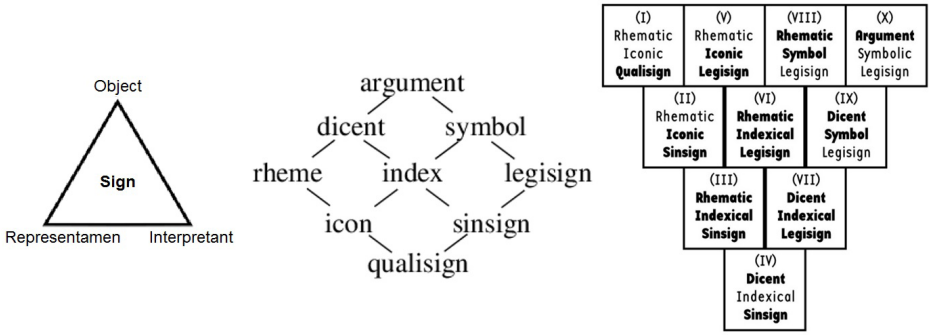


Figure 7: a) A binarist classification (adapted from the doctoral dissertation by Mariela Díaz, Hábitat popular y mercado laboral durante el proceso de urbanización El Alto - La Paz (Bolivia), 1985-201*", Fac. Cs. Sociales, UBA, 2013). b) The same classification, but transformed into a gradualist one.*

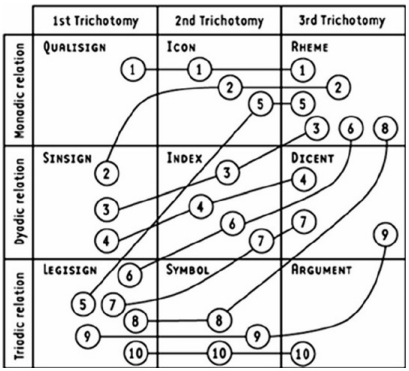
Peirce, linguistic categorization and gradualism

Peircean diagrams of semiosis are dynamic by definition, because semiosis is understood as a relational process that admits many situations. From the triadic sign relationship of representamen, object, and interpretant, nine classes of sign can be derived: qualisign, sinsign, legisign (1st); icon, index, symbol (2nd); rheme, dicising, argument (3rd). And by connecting these signs, it is possible to obtain ten sign relationships (Figure 8a).



a)

ARCHITECTURE	Abduction	Deduction	Induction
Abduction DESIGN	1 F of F Abduction Deduction Induction	2 E of F Abduction Deduction Induction	3 V of F Abduction Deduction Induction
Deduction CONSTRUCTION	4 F of E Abduction Deduction Induction	5 E of E Abduction Deduction Induction	6 V of E Abduction Deduction Induction
Induction HABITABILITY	7 F of V Abduction Deduction Induction	8 E of V Abduction Deduction Induction	9 V of V Abduction Deduction Induction



b)

Figure 8: a) Peirce's triadic model, 9 classes of sign, and 10 classes of sign relationships. b) Guerri's semiotic nonagon, and 10 classes of signs as a cross-relational system, by Queiroz

The relational nature of semiosis is well represented in various interpretations of Peircean schemes, or developments stemming from his conceptions, for instance Claudio Guerri's semiotic nonagon (see Guerri et al. 2014), or the 10 classes of signs as a system of cross-relational classes by Joao Queiroz (2012), after Floyd Merrel (Figure 8b).

> Symbols grow. They come into being by development out of other signs, particularly from icons, or from mixed signs partaking of the nature of icons and symbols. We think only in signs. These mental signs are of mixed nature (...) A symbol, once in being, spreads among the peoples. In use and in experience, its meaning grows. Such words as force, law, wealth, marriage, bear for us very different meanings from those they bore to our barbarous ancestors.
> (Peirce: *Collected Papers* 2.302)

It is clear that in this process there is a gradual transformation, with intermediate stages, i.e. it is a dynamic process. The color purple illustrates a

case of an index transformed into symbol. In the past, when purple was very difficult and expensive to obtain, it was the color of royalty. In the Roman Empire, only senators, victorious generals, and the emperor himself could be able to use purple. Today, this indexical connection has disappeared, but purple still conveys meanings of magnificence, pomp, dignity, nobility, and elevated position. In other words, a sign that in a certain context begins to be taken as an index (because of a physical connection between it and its object), with time and reiterative use becomes a symbol, because habit causes the relationship to be preserved in an arbitrary way, independently of the original connection.

In this transformation, there must be intermediate stages, where sometimes these signs behave in one way, sometimes in another, and sometimes ambiguously. It would be a process similar to Robert McLaury's vantage theory (1997), when a semantic relationship of coextension appears in the process in which a language is making a passage from a semantic relationship of inclusion or quasi-synonymy to one of complementarity.

If using an ordered set of colors, you ask people to mark the colors designated by basic names, for instance in English, you will get something like Figure 9a. If you perform the same survey with speakers of a different language, for instance Spanish, you will realize that they segment the color continuum in a different way (Figure 9b). Note also that the semantic extensions of each term are very well defined and mostly do not overlap (Berlin and Kay 1969: 119, 126).

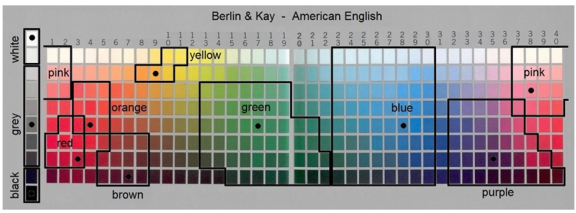
McLaury (1997: 111-115) found some intriguing cases. For instance, in the Uspantec language in Guatemala, speakers designated much of the same samples with two different names (*q'en*, orange, and *kyaq*, red), according to the category from which they started. There was a big semantic overlapping, however the terms were far from being near-synonyms. MacLaury understood that the situation could not be explained by the habitual semantic categories of inclusion, synonymy, or complementation. He named it coextension (Figure 9c).

It is easy to see that among the four categories □inclusion, synonymy, coextension, and complementation□ (Figure 10a) a gradual variation can be established by enlarging or moving the semantic extensions. Figure 10b shows a gradual sequence of this process. This allows to explain the evolution of basic color names and to account for intermediate stages. Coextension (and sometimes also inclusion) act as intermediate stages between near-synonymy and complementation. This accounts for when a language is evolving to produce new separate cognitive categories. Symbols grow! (see Short 1988) This is a dynamic process. Some intermediate signs would appear when a sign is evolving to become a symbol.

Methods that employ a gradualist conception are more suitable for studying visual phenomena than those approaches based on typical binary oppositions or categorial classifications, strongly anchored in verbal language.

Gradualist methods have a greater affinity with visual phenomena, which are intrinsically continuous.

a)



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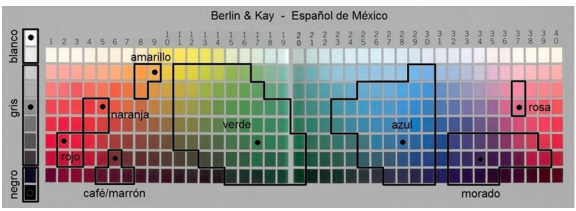

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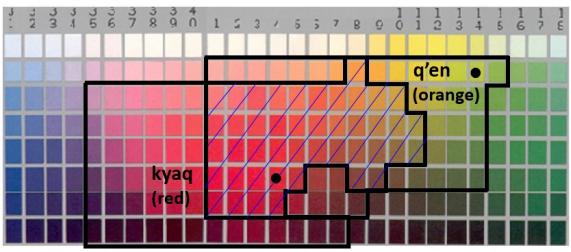
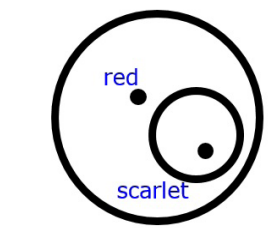
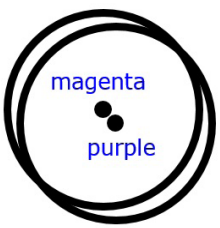
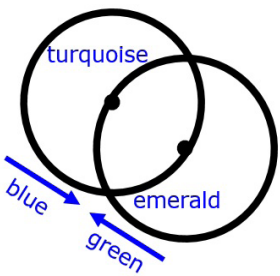


Figure 9: a) Linguistic color categorization by American English speakers. b) The same survey performed with Mexican Spanish speakers (adapted from Berlin and Kay 1969: 119, 126). c) McLaury finding of a new semantic category: coextension (adapted from McLaury 1997: 114).







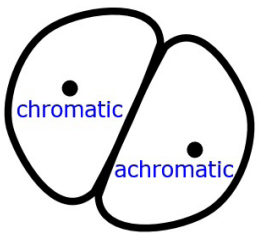


Figure 10: a) An example of four semantic relationships: inclusion, synonymy, coextension, and complementation. b) Among them, a gradual sequence can be established that accounts for when a semantic relationship is being transformed into another.

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