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# The semiotics of color in intelligence model

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## Abstract

Color is an essential category of culture. Following Goethe, it has been shown that color as "unconscious" information represents an ideal image of the material world, with the character of the ideal fundamentally an essential predicate of information. The ideal's specific character should not be viewed as an isomorphism of heterogeneous systems, given the phenomenon of information adequate to a message's semantics (e.g., to image) but not always to form (stimulus pattern, signal). Chromatism theory allows consideration of the predicates of being in the form of the following ontological "chroma" plans: color as the signified (color perception), the ideal — Id-; pigment as denotation (environmental self-coloration), the material — Ma-; skin color as a basic organic factor (color sensation), sensus — S-; color name as signifier — the non-objective and ideal with respect to the S-plan, but in the Id-plan, objectified and materialized in a thesaurus — Mt- (thesaurus of color designations); emotions, feelings, idioms, canons as embodiments of information-energy relations among relevant "chroma" plans. These definitions make it possible to glimpse the actual differences between Frege's concept and the reality of color objectivism.

## 1. Introduction

Color, as an essential category of culture, is subject to intensive application in myth, ritual, folklore, plastic arts, literature, brought into use as a powerful factor in emotional and aesthetic impact. This practice is based on a concept of color traditional for works closely related to myth, ritual and religion, in which color semantics and symbology play an enormous role, expressing key ideas, concepts, images, tradition factors, etc. The researcher, of course, faces multiple questions: what is the basis for a significant choice of color? What is the meaning of the subject-object relations of color images? Are their connotations arbitrary or legitimate?

In fact, these topics have already been spoken of by Goethe: "Symbolism transforms the phenomenon into an idea, the idea into an image, and in such a way that the idea in the image always remains infinitely effective and unattainable, and though expressed in all languages would remain inexpressible. <...> Now whoever has this living grasp of the particular is at the same time in possession of the general, without realizing it, or else only realizing it later on." Interestingly, namely color images possess these properties.

Accordingly, works on informatics have shown that color as "unconscious" information provides an ideal image of the material world, with the essential

predicate of information embodied in its fundamentally ideal character. Yet a purely ontological question arises: how does the ideal correlate with the material in a color image, if the image itself cannot be adequately materialized? We may find a response to this hardly trivial question in the basic thesis of chromatism: the ideal's specific character should not be viewed as an isomorphism of heterogeneous systems, given the phenomenon of information adequate to a message's semantics (e.g., to image) but not always to form (stimulus pattern, signal).

## 2. The Ontological Definition of Color

In chromatism, the ontological definition of color includes all the specified concepts, spread among the components of the intellect. Thus within the concept of "chroma" the ancient authors already discerned a great variety of objects, which chromatism's standpoints saw presented in the form of definite chromatic plans — that is, plans of the semantic unit "chroma":

COLOR as the signified (intensional, the semantic core of meaning, significatum, percept, i.e. the image-concept which as formed in the intellect gives rise to color perception) — non-objective, mental, ideal — Id-plan; for color, unlike paint, exists only in the form of percept;

PIGMENT as denotation (extensional, stimulus, object of an external environment — objectified, physical, material — Ma-plan (auto-pigmentation of the external environment);

SKIN COLOR and/or parameters of the retina as a denotation of intellect — a basic organic, physiological factor syntonically combining information on object and subject, sensus — S-plan (color sensation);

COLOR NAME as signifier (word, lexeme, proposition)

— non-objective and ideal with respect to the S-plan, but in the Id-plan, objectified and materialized in a thesaurus — Mt- (thesaurus of color designations);

EMOTIONS, FEELINGS, IDIOMS, CANONS — heterogeneous generalities as embodiments of information-energy relations beyond relevant "chroma" plans, abstractly establishing certain patterns of existence in culture and human life. Objectively these relations emerge in such idioms — often international — as "purple with rage," "black with grief," "white with fear," "red with shame," "yellow with envy," "green with longing," etc. etc., which reveal the meaning of relations between the mental (color) and physiological or physical (skin pigment or external environment) as ideal and material: S/Mt - "red with shame"; Id/S - "red with passion"; Ma/S - "red with heat."

Because some emotion constantly characterizes the human intellect, an emotion or combination of emotions can be said to precede the perception of objects falling within the scope of awareness, to influence the processes of perception and as a result to filter or otherwise alter the sensory data transmitted by the receptors. As an illustration of the latter thesis, in chromatism, the traditional picture of creative "transition from sensation to thought" is modeled by a process of "idealization" of information: from the material (*Ma*) through the stage of color sensation *S*- to the resulting color perception *Id-plan* and finally to its verbalization in the *Mt-plan* of the "atomic" model of intellect (AMI).

For clarity, we map the data in Table 1, where information processing is denoted by the symbols and , linking the relevant plans for AMI. In that the principles of perception, use and storage of information suggest its generalization, from the position of chromatism one can conclude that the intellect features at least three levels of its processing, which we have identified in Table 1.

Table 1. Relationship between formal and dialectical logic

Plans of open system AMI	Logic of AMI	Dialectical logic	Model of thought in AMI	
			Creative	Ordinary
<b>Mt-</b> consciousness	Social environment — verbal, objectified features <i>in suspended form</i> formal	<i>Objectification of negation</i>	synthesis	thesis
<b>Id-</b> subconscious	Cultural environment — image-concepts, psychological characteristics of <i>sublimates</i> image-based	<i>Negation of negation</i>	antithesis	antithesis
<b>S-</b> unconscious	Religious environment — genetic and/or metaphysical characteristics of <i>metameres</i> genetic	<i>Negation of individual subjectivity</i>	thesis	synthesis
<b>Ma-</b>	Natural environment — subjective, objective, private (spectral) characteristics			

Any system is characterized by the relationships among its components and, in particular, by information as an ideal. Therefore, color proves to be the most reliable toolkit for the creation of information models. All this leads us to a definition of color that serves as a context-sensitive meta-language for the study of objects and relations of any kind. Therefore, "color" is an ideal (cultural, mental), tied with the relatively material (physical, physiological and/or

linguistic) through emotions (feelings) as their information-energy relation. One can suppose that Wittgenstein mentions in the "ideal" in namely an ontological sense, saying of Lichtenberg, "He constructed an ideal use from the actual one... 'Ideal' does not mean something especially good, but only something carried to extremes... And of course such a construct may in turn teach us something about the actual use." And of course — most importantly

for us — the given definition of color allows us to suppose we have found something that unifies entirely heterogeneous things, as we spoke of in the introduction.

Relative to the pigmentation of the external environment, verbal color designations exhibit properties of the ideal, but relative to non-verbalized, non-objectified percepts (images) of color, they prove ontologically material given their objectification in a particular concept, that is, combine both material and ideal predicates, but in different systems of analysis. Perhaps Wittgenstein has this in mind when he states, "The logic of the concept of 'color' is just much more complicated than it might seem." Namely a tetrad definition of "chroma" has allowed us to move away from the concept of "color" in order to operate based on now "colorless" chromatic plans as criteria for the adequacy of constructions and research involving the interrelations of any heterogeneous objects.

Generally speaking, the chromatic definition of color includes all the specified concepts, spread among the components of the intellect: color is the ideal (mental) tied with the material (physical, physiological, psycholinguistic, social) through feelings (as their information-energy relation). Thus, the methodology of chromatism is based on a thesis stemming from the history of world culture and particularly the history of psychology: color as an ideal image of the material world serves as an information model for understanding the complex self-developing systems of this (material) world.

### 3. The Intelligence Model

The archetypal model of intelligence (AMI) is based on an ontological concept of the relativity of the ideal and the material (C.G. Jung). For example, the material plan of the above definition would seem to feature an eclectic blend of the social and the physical. However, comparison of their predicates indicates that the physical is material in the external environment, while in the intellect the social exhibits material properties with respect to the mental, and at the same time, ideal properties with respect to the physical and physiological.

The following comparison serves as a good example of the psycholinguistic correspondence of color (as the ideal) and verbal color designations (as the ontologically material). A much smaller number of colors (hundreds) are verbalized than the human eye can discern in their shadings (more than a million). An analogous comparison holds true regarding feelings. About a hundred of their manifestations are verbalized, while the subject experiences them in an infinite number, exceeding the millions.

Strictly speaking, a characteristic property of color modality lies in the opponential character of the processing of precepts as ideal non-objectified images — a character that does not exist for other modalities as functions of response to stimuli, that is, relative to material objectified images. Certainly, this gives grounds to suggest that color may serve as an ideal tool indispensable to the study of

intellect and particularly of personality.

The question is, why introduce these chroma-plans to describe the information attributes of the components of intellect, if such concepts as "ideal" and "material" exist? Since the intellect operates based on information as ideal, but not at all based on its material carriers, it proves necessary to introduce adequate "substitutes" for both the "material" and the "ideal." If the color names combine material and ideal predicates (in different systems of analysis), knowledge of the historical development of ideas about color will allow our further comparative analysis of color attributes and/or documents reproduced from the history of world culture.

In many ways, this also explains the complexity of cultural research studies of the semantics of color, and concurrently raises the question of the adequacy of the conditions for a relevant description of its color predicates. The problem's complexity is great indeed. We might recall Darwin's characterization of man in relation to the *phenomenon of blushing under the influence of the emotion of shame — varying, for some reason, by age and gender*. Why? How are women different than men? How are old men different than children? Why is modern science unable to answer even this simple question, as it instead becomes ever more entangled in an endless number of contradictory "psychological theories"?

In the best case, age is indicated (sometimes the gender of the test subject), and then what begins is literally mysticism. Studies concern a kind of unimaginable, that is, genderless, "person," in a kind of colorless space, outside society, outside culture, outside time (cycle, day and/or night). Moreover — forgive me, ladies — this "person" is apparently also naked, as there is for all purposes no indication of the color of his clothing, which — as colored light-filters — serves to organize his emotions. But since not one psychologist has ever noted the blushing of this "naked test subject" due to "emotions of shame," it's hard to understand those specialists who for half a century have called psychology "fiction" — after all, fiction is more realistic and believable.

An information model transforms a complex system into its "atomic" components, whose superposed information conveys the essential sense of the exchange of information throughout the system. Such a model eliminates the system's nonessential features, functions and manifestations. For example, which essential properties of a formed system influence the changes of the intellects of each of the members of a potential family, if an ideal case involves interrelated selection taking place on the basis of their perceptual information? It seems that in order to answer these questions, all levels of information processing should be subject to analysis, including the unconscious.

Therefore, in chromatism the concept of "intellect" includes not only cognitivist but also the classical understanding (intellectus = mind, including sensations, feelings, reason), divided into three components: consciousness — social regulations, formal logic, verbal

color designations and so on; subconscious — the unconscious, which includes metacognitive functions and in particular bodily sensations, "gene" logic, color sensations and so on.

Color is an ideal "tool" without which study of the ideal (psyche) is impossible. At the same time, the well-known correlation of feelings with certain colors in chromatism was axiomatically accepted as the possibility of modeling functions of living (complex information) systems with the aid of color. In fact, religion, the soul and color are all ontologically ideal information correlates of each other, and namely this creates adequate opportunities for the indicated type of modeling.

For the modeling and corresponding coding of the information circulating in the intellect, we will thus compare the properties of the external and internal color spaces on the basis of an object studied in detail (which thus facilitates the citation of reproducible measurements), such as the color body. The characteristics of all (achromatic and quasimonochromatic) colors are conventionally depicted using the example of a color body containing the color wheel with maximally intense ("bright") colors along the perimeter and medium-gray in the center. The color body includes a vertically situated achromatic axis and a color wheel lying orthogonally at its center.

As Goethe periodically called red purple, while in Russian culture light blue is added (Berlin-Kay), for adequate communication of color in chromatism, a wheel of eight rather than six colors is used, with contrasting colors harmoniously blending with complementary colors. In this case, on M. Chavelli, triangles of "male" additive light (Red-Green-Blue) and "female" subtractive colors (Emerald-Yellow-Violet) complement each other on the basis of the color canon observable in world culture for thousands of years; orange and blue combine warm and cool tones, modeling the physical and spiritual needs of different "genders," respectively. Additive blending of colors is obtained when light of different colors is filtered and/or reflected from two or more closely spaced small zones of different colors, as in mosaics and stained glass.

Knowing the diameter of the color wheel, it's also possible to obtain the actual volume of this sphere for its practical use in the algorithms of information models. The relevant *formalization* of functional chroma-plans as the information predicates of complex systems, firstly, solely indicates the chromatic, that is, the information-modeling level of the semantic aspect of the analysis. Secondly, the given formalization expresses the ontological character of the complex system. Finally, thirdly, the use of formalized chroma-plans makes it possible to conduct their dimensional analysis in the context of the theory of information to identify the essential meaning of the modeled concepts in ontologically heterogeneous systems.

Colors opposite each other in Newton's color circle are termed complementary because in the ideal case, blending together in rays of light, they yield white light. The

dominant color of an object as discerned by the eye is approximately diametrically opposed to the dominant color absorbed by the object. For example, an object whose color is perceived as violet will absorb yellow-green light.

Contrasting colors are close to complementary colors but differ from them. A very significant difference of contrasting colors from complementary colors arises in that complementary colors are reciprocal, while contrasting colors are not reciprocal: for example, the contrasting color for yellow is violet, while the contrasting color for violet is not yellow but green-yellow. Contrasting colors may appear on any background, so in their projection on a colored surface, there arise the overlay of the given contrasting color with the color of the surface on which the contrasting color is projected.

Usually, contrasting colors are slightly offset from "grounded" green toward "heavenly" purple, which — in the formation of "focal nominations" (on Berlin-Kay) — provides the basis for the construction of a chroma-wheel, with which it becomes possible to easily carry out subject-object modeling and/or to depict complex systems.

Because both complementary and contrasting colors possess opposing properties, their harmonic combinations are characterized by maximal activeness, tension and dynamism. According to Goethe's experiments, the most harmonious colors are situated opposite each other (at the ends of the diameters of the color wheel) and together form a kind of integrity.

Any color of paint placed adjacent to any other is perceived in accordance with the laws of color perception. Any paint, so to speak, has its own sound. Yet in painting, not every pigment placed on a canvas is transformed into color; not every paint "sounds." For paint to become "color" on canvas, an essential role is played by its proximity to other shades, as well as the size of the swatch, its placement, the character of the layer of paint, and the unity of the image. For this reason, artists frequently contrast paint and color, speaking of *overcoming the paint, translating it into color*; that is, they identify color as a particularly expressive means of harmony in art — as opposed to color in general, as opposed to color as a natural phenomenon of pigmentation.

As the psychic references of color universals have also proven characteristic in gender relations, given the magnitude of exceptions, it can be assumed that over the millennia these references have played a represented role in the history of world culture, objectifying the subjective components of the process of cognition.

#### 4. Chromatic Model of Intellect in Semiotic

The three-dimensional structure of the functions in AMI in Figure 1 suggests a concurrent factor of space-time in AMI and of gender characteristics in AMI with gender opponency (AMIGO, see Figure 2). From this it

automatically follows that the intersection of all opposing axes yields the relevant concept of creative (innovative) activity. For true creativity is formed only at the intersections, so to speak, of "trans-value" contradictions and through their elimination in the creative work itself. Accordingly, given that chromatic models of intellect have been tested over thousands of years in their reproduction by humanity, it is possibility that AMI/AMIGO will prove adequate for a valid systematization and classification of many concepts of "values," including the universals of Schwartz. It would seem much easier for an expert to avoid wandering in the philosophical-psychological shadows of a "single consciousness," and instead to represent an information model of the latter on a reproducible level in AMI/AMIGO with sufficiently well-founded theoretical assumptions about the dynamic localization of their functions, values, motivations and other attributes of the intellect.

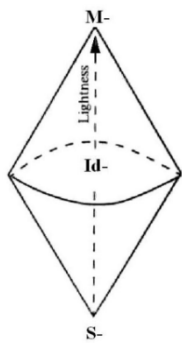


Fig.1. AMI by Serov

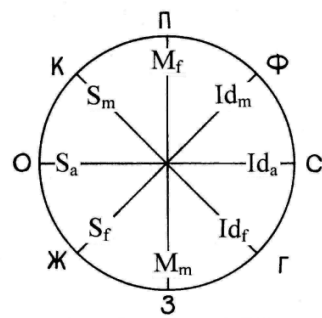


Fig.2. AMIGO by Serov

For our intellect has certainly for many millennia included at least two logics — namely, formal logic, appealing to the rational consciousness (to the brain's left hemisphere) and/or the image-based logic of creativity, which is based on the irrational sub- and un-conscious. Doubtless in different historical periods one logic or the other dominates, setting bounds to one another through

creativity of both consciousness and the unconscious in the intellectual dialogue of times and cultures. It currently appear most relevant to study the "second" logic and then, if possible, the convergences of two logics in a single view of the external world in its inner reflection, as we saw above, in the history of the development of color representations.

In fact, if we begin to consider color as a phenomenon carrying no information, then we will have to forget the question of why women throughout all of human history in all cultures have so carefully chosen the colors of their wardrobes depending on situation, mood and so on, and why the theory of color associations is useless, and why — independently of any migration influences over thousands of kilometers and thousands of years — in completely different cultures very similar color canons have arisen, and finally, why the scientific status of color signifiers in psycholinguistics proved consistent only with the status of terms of kinship, which has allowed me to assume a systemic-functional reciprocal tie between kinship (procreation) and the concepts of color, with their equivalent canonization by all traditional cultures.

## 5. Semiotic and Thinking

This has also provided an answer to the topic, controversial among ethnographers, of why and for what reason long before the appearance of clothing archaic people painted their bodies in different colors. Clearly, the difference in color could bear relation to gender. This likely explains why our perception accords color a meaning that, on Jung, is phylogenetically incorporated in the collective unconscious of humanity, also including meanings dependent on systems of cultural values, experience and so on, that is, on historical context.

For clarity, we'll compare the above results with G. Frege's "semiotic triangle" (see Table 2).

Table 2. Ontological aspects of the analysis of the "ideal"

Mind being	Surrounding world	Body	Spirit	Soul
Intellect	External environment	Subconscious	Unconscious	Conscious (ratio)
Plans of ontology	Ma	S-	Id-	Mt
Predicates of plans	nature	brain, body	image-concept	concept, social mind
Semiotics, on G. Frege	Object (denotation)	-	Meaning (concept)	Name (lexeme)

It is noteworthy that this model of intellect — dividing the philosophical concept of consciousness into "spirit, soul

and body" — directly follows from the so-called dynamic structure of personality, as may be compared in Table 3.

Table 3. Relationship between AMI and AMIGO

Dynamic structure of personality	AMI	AMIGO	Gender dominants	Modeling colors
Socially conditioned traits	Consciousness <sup>*)</sup>	M(f)	f>m	Purple
Level of preparedness (personal experience)		M(m)	m>f	Green
Particularities of mental processes	Subconscious	Id-	m>f	Cool tones
Biologically conditioned particularities	Unconscious	S-	f>m	Warm tones

<sup>\*)</sup> The consciousness is subdivided into feminine (f) consciousness of justice and masculine (m) consciousness of self (see Table 4).

To determine the functional relationship between the components of the intellect and the symbolic structure of the plan of their expression, we express AMI with gender opponency (AMIGO) in the process of the recipient's most

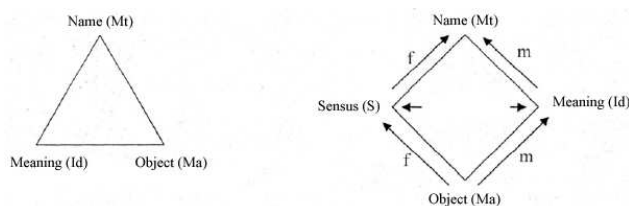
typical perception of color spots on an artist's painting and/or of a literary text with a color-specific description of any given objects/relationships (see Table 4).

**Table 4.** Correlation between plans of AMIGO

Object/Plans	S-	Id-	M(m)	M(f)
Predicates of plans	Unconscious	Subconscious	Self-consciousness	Legal consciousness
Functions of plans	color sensation	color perception	color representation	color designation
Chromolinguistics	Environment - Stimulus	Percept of stimulus	Image-concept	Concept "name"
Logic type	Genetic	Imaginative	Imaginative-formal	Formal
Semiotics, on N. Serov	Sensus (Ma+S)	Meaning (Ma+Id)	Name (Id+Mt)	Name (S+Mt)

The difference between the constructions of G. Frege and N. Serov is represented in Figure 3, where true creativity arises in the creative combination of S- and Id-plans of AMI, which confirms the known position on the masculinity of creative women and the femininity of creative men.

Thus a comparison of the data in Table 4 with Figures 2 and 3 clearly demonstrates the fact that the functions of intellect and the structure of signs (in terms of content) evidently correlates with the semiotic concept of classical "transition from sensation to thought." It is therefore possible draw a fairly reasonable conclusion regarding the tenability and/or relevance of information models proposed for anthropological semiotics.



**Fig. 3.** G. Frege's semiotic triangle and N. Serov's chromatic diamond

Because chromatism is based on reproduction of documents of world culture over thousands of years, it always tells us, as a scientific theory (in Popper's sense), that ignorance/confusion of the boundary conditions of gender could well lead to its falsification. If we follow Habermas in beginning to perceive chromatism not as a natural science pertaining to existence, but as a kind of "hermeneutics," we might recall such criteria of generally significant (valid) interpretation of chroma-plans as an ontological dimension (space  $L$ , information  $I$ , time  $T$ ).

## 6. Conclusion

In other words, use of the color wheel has given researchers an entirely new toolkit, compatible with the human intellect's development over millennia. For psychology, use of the color wheel is additionally valuable in that scientific idealisation is an important property, which —unlike statistical interpretation— characterizes all branches of science without exception, proceeding from

facts to theory. That is, through color and particularly the color wheel and/or body, we have realized an opportunity for classification of heterogeneous functions and relationships, which are naturally associated on the scale of equal relationship with the information-space-time continuum of the external environment, that is, with objective units of dimension as both objective and subjective functions of expression. Color is an ideal means and/or methodological toolkit enabling the classification of properties, objects and their relationships, accounting for heterogeneous ontological predicates. The applied meaning of color (as an element of automatic identification on the level of semantic perception and processing of information pertaining to the external environment) enabled the development of an information model of intellect as a system open for the external environment.

Accordingly, the accents indicated above have shown that many problems of color semiotics may be quite reasonably resolved through the use of chromatism as an interdisciplinary theory and methodology for modeling complex self-developing systems.

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