

# Geometrical qualities in the harmony of colours – the colour harmony system “Immocolour”

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## Abstract

*A report on the development of the "Immanent colour harmony system" modelling optical effects perceptible in nature outlining number and saturation of the different hues applied, functioning mainly by intermingling the colours.*

## Keywords

*colour harmony system*

## 1 The origin of the problem

Below are the ideas of a colourist, lecturer at the university, teaching at the Institute of Drawing of the Building Engineering Faculty, about results gained in the research of questions in the theory of colour harmony arising during his creative activity as a painter and during the training of architects.

Some 20 years has passed since – at the College – I quit my studies to paint according to sight and when I started to struggle with my own image idol, the question arose; what colours would I use when I cannot rely on the information gained from the scene? Colours have been liberated long ago from the detention of representation during the history of art, so I did not intend to be satisfied with the descriptive use of colours. Strenuous years followed, as I painted stereoscopic forms without models (my themes were rather surrealistic, they could not be posed). I was tempted by expressionism, the vehement use of colours like Fauve and Matisse, on the other hand I also needed the type of atmospheric offered by monochromity, by the fine transitions of moderate colours offered by expressing the depth of space.

I heard several times the opinion, that strong colours are rather applicable to planar ornamentals, meanwhile transitions of tone and saturation are more favourable to express spatiality, plasticity, and that these two methods cannot be combined. I could not accept it!

As in the last century the painters “went out into free space” from the nearly constant illumination of the studio, they had to sense such phenomena, that led more and more to their own colour harmony of the picture, abandoning step by step the world of colours describing reality. Such phenomena are for example, a reflection from a strong coloured surface, or a shadow being colourfully brightened, or the staining percolation of light through certain umbrella-like medium, e.g. on the leaves of blossoming trees. But it is enough only to think of the warm radiation of the sunset and of the graduated cooling towards the blue effect of air. Or it is enough to observe how certain peculiar mediums, (that continue to be the favoured topics of the painters) e.g. brilliant water surfaces, clouds, foliage of trees, disintegrate the uniform surface into more colour components. It is interesting, that these phenomena of nature generated the

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liberation of colours through their own reproduction.

Nature even helps the painter to establish his own “supernatural” world of colours, however, only if he can get away from the swarming of the material-natural colours of forms, observing rather the influences of a colour that can be seen in Nature.

To discover these phenomena again, I also had to become acquainted with the abstract rules of colours and the scientific theories analysing the psychological and biological effects on humans that were offered to me by “colour dynamics”.

I think it is important to note that a painter must not give up the momentary or characteristic suggestivity being in the personally translated character of the colours of the picture, although this problem is almost fully abandoned by the newly returning conceptual and photo-naturalistic painting trends. In my opinion we must fight for the personally translated characteristics of the language of the painter, it does not come through automatically, and colour is an important part of it . . .

A painter can be recognized, of course metaphorically, that he always does “ a kind of something” just as I can recognize my limping neighbour from the end of the street, but it is also possible, that he had established a visual language of his own – of course this is valid in the transposition of reality, or in the modelled characteristic of the abstract forms . . .

For me it is not a visual language if someone repeats a topic *ad nauseam* , the same stands if he also schematically simplifies reality, although rather few people recognize the difference between highly reduced transpositions and impersonal unintelligent topics.

## 2 My connection with the scientific approach to colours

I was appointed in 1989 to the Institute of Drawing and Forms Mastery Department of the Budapest Technical University, where Dr. Antal Nemcsics had been involved for many years with the systematization of colours, with the research of the relations between colour and humans, and of colour and the built environment. Titled Colour Dynamics, there is a two-semester topic helping the studies of architect undergraduates. As by that time I already joined the Institute, I also showed interest in deliberating the utilization of colours in my colourist work and from the very beginning I participated in the teaching of this subject. After Professor Nemcsics retired I became the representative of the topic at the Faculty, and also directed the postgraduate topic “Colour Dynamics” over 4 semesters. Several students that had attended the Academy of Fine Arts have attended since then. I think it is necessary to mention that the precondition for ordering colours into harmony (which is also the main topic of my paper ) is the definition of relations between and an accurate description of colours, which has been solved successfully by the Colouroid Colour System developed at the University.

## 3 Archetypes in the research of colour harmony

Several theories have been developed about the harmony of colours. Goethe (1810) already mentioned characteristic, less characteristic and characterless colour pairs. Itten (1961) defines certain ratios for a mutually balancing degree of cool-warm complementary pairs. The explanation of the various quantities lays in the uneven maximum saturation of colours.

Chevreul (1871) elaborated the theoretical background of Divisionism, which means, that broken colours can also be produced by the raster-like decomposition of intensive opposing colour pairs. Regarding the colours seen as the psychological inducement of composition rules the conclusions of Klee (1961) and Albers (1963) are considerable. The Institute of Drawing is in possession of a Joseph Albers type folder; its pages demonstrate the interference of colours up to the point of being misleading, each a modifying phenomena of the other. It is fascinating to the audience that certain colours for example can appear significantly different in certain different environments and different colours can be made similar within certain limitations.

In the course of the lectures of Dr Antal Nemcsics I became well acquainted with the rather manifoldly mapped system of conditions of colour harmony and I would also like to define my own research direction in reference to that.

According to Nemcsics, the colour harmony experience, briefly summed up, contains three main active components:

- Psychological (colour and humans)
- Functional (colour and object, and / or environment)
- Aesthetical (colour and colour)

Whether we feel for example one certain colour in a certain space to be architecturally harmonic or not, we can be influenced by psychological aspects, by what emotional association is dominantly joined to the colour, and whether the function of the building (e.g. school, church, or place of entertainment) is in harmony with it. From functional aspects it is possible, that a colour inside the building has a different role as a wall, a corridor, a ceiling, furniture, or whether we observe the painted object if it is important to be observed. The aesthetic aspects refer mainly to whether the colour is in harmony with the other colours of the composition. The colour preference is also an important question; which colours we like and which we don't, although it is possible, that in the case of proper expression of the content it is all right in its place even if it does not belong to our most favoured colours.

In the case of a picture, all of these three main approaches are true. For the sake of certain emotional influence we can establish one fully supernatural, reigning colour tone with one or more dominant colours. This is certain! We may also say this is the psycho-associative condition. But besides this, the objects are to be put into a space, with light/shadow effects, and additionally we also need the colours, although not as determinants, but to accompany items. The biggest problems of the

painters may be in this area. This is the very aesthetic condition, of which I will speak in detail later. In case of a painting it can also be important, that the colours are light-permanent, will not fade or peel off. With a mural composition, the problem may also be the possibility of it needing cleaning, if it is placed in an outdoor place.

Thus for me, the system of aesthetic conditions has posed the unsolved question. Nemcsics explains that the scale-like luminance and saturation is rather important. The geometric characteristics appear here as colour planes laid onto certain straight lines being at equal distance, or on equally distributed colour planes. Often even the monochromic painters do not know this and do not utilize colour consciously in this sense. The effects of shadow and light respectively on the increase of brilliance have also a saturation logic and scale-likeness. But the big problem comes after monochromy, if I wish to have polychromic tonality. How many different colours would I use (beyond the dominant weighting that is emotionally determined) and with what degrees of saturation?

In my experiences in pedagogy the difficulties arise here. Some people solve monochromic compositions well, however, few can manipulate more colours. And in teaching we cannot build exclusively on born congenital talents.

Generally in the colour hues ( yellow, orange, red, purple, blue, green) besides the monochrome the dyadic, triadic, quadratic and polychromic harmonies as main harmony types are mentioned. According to my visual pedagogic, respectively professional view, however, a colour set can be rather dissonant and incoherent, although it is adjusted only to the above particular limitations. For instance two, equally fully saturated inter-related colours can be totally independent of each other, dissonant, lacking of graded meaning, and more equally unsaturated colours can also be disturbing, meaningless and expressionless.

Until now, I could not find any definite reference, that between the number of colour sets and their bright, vivid, respectively mellower variations (that is the saturation) any type of regularity exists. As a type of geometric regularity, the saturation and / or luminance scales materialize the harmonic impression of sight, as according to a certain distinguishing possibility, with compositions having a larger number of colours there is a need for all of the raster points of the monochromic colour plane to be at equal “distances” from each other. But some geometric regularity must also exist in connection with the various colour shades. In the course of my experiences, geometry and the research work of the creative artist (the contributor) resting on many years of painter instincts, it showed astonishing inter-connections.

The slowly outlining building logic of the colour system can be named “Immanently coupled hexamerous colour harmony, initiated from one colour hue advancing to cool-warm respectively complementary directions”, (“IMMCOLOUR”), that can be built up onto any saturated or not sufficiently saturated colour.

In the following, the procedure of system elaboration will be introduced.

## 4 The phenomena founding the development of and proving the colour harmony system “Immocolour”

### 4.1 Nature

I came to the conclusion that in connection with colour harmony we must not take from Nature so that we stare at the unlimited wealth of colours. Although certain colour constellations of elements of Nature can seize us, I feel to have a more effective weapon in the hands of the painter that for the sake of expression and the internal colour system of the picture, real colours can be transposed. This was one of the most influenced innovative changes of the Avant-garde. The phenomena of Nature can be very important for us even beyond the perception of an unlimited wealth of colours. I think mostly of the sensing of space and of the various light and shadow effects. I came to the conclusion that it should be examined, i.e. what happens with one colour in Nature?

- a In the case when the illumination increases, then the colour will be lighter, its saturation decreases and still, we do not feel it more mellow, rather it becomes more sparkling.
- b If the illumination or the angle of incidence decreases, shadow grades are sensed,
- c When the colour mellows, it becomes less saturated.  
In a darker environment in less light the illuminated colours of the form are more broken.
- d The colour surface receives a coloured illumination that can be reflected from a strong coloured surface, but the most frequent effect is the golden light of the setting or rising Sun. In this case the radiating light is mingled with the surface’s own colour.
- e The colour is seen through the colour media. The most typical one is the air perspective effect, as the forms with respect to distance contain more dark tones and the bluish colour effect increases. Similar effect is sensed with underwater positions, where the colour of the water and the colour of the form are mixed at the rate of distance and thickness of the water mass. A similar phenomenon is the reflected image reflected from the colour surface. In this case the colours of the object and of the reflecting surface are mingled; the contour of the circumference becomes more undefined, more dimming.
- f Under certain conditions we can observe that the colour surface fully changes transitionally (e.g. the sky after sunset), or is optically distributed into more colour components (e.g. the light radiating through the foliage of trees, the glittering water surface, or any larger form made up of any number of minor elements).

The most characteristic coloured light effect occurring most often is when the Sun warms the colour and on the other side the

clear blue sky gives a cool reflection, maybe the cooling effect of the air perspective prevails. Such phenomenon can be observed in high mountains when in the evening the low moving sun turns the green of the hilltop into orange, however, further down, in the shadow of another mountain, the same green becomes already bluish. At a nearby bush the original green is seen.

Similar to this, a frequent topic of painters is when from the early evening landscape bluish light trickles in through the window, while in the room the glare of the fire or the lamp gleams.

In my opinion these colour relations of Nature have permeated into us so much during our lives, that this abstract colour harmony also determines our colour harmony judgement.

#### 4.2 Determination of the human colour perception

An interesting phenomenon is that there is a mechanism to compensate the contrasts in the biology of our sight, just as we see the dominance of cool-warm reflections in Nature.

This is called adaptation.

If we stay long enough in a room illuminated with a red colour, then the natural light appears bluish green, and the red appears the complementary of red. The behaviour of a black object is similar in red light. If we look into the Sun, we sense violet circles later. In case of pigments, if we put e.g. orange next to gray, this gray will create a bluish impression, if blue, then orange. This is the phenomenon of complementary contrast.

Thus the human eye endeavours to see the contrasts and tries to balance them.

#### 4.3 Determination of the behaviour of colour pigments

It is a well known phenomenon, that lemon yellow, carmine red and manganese blue constitute the set of three colours that cannot be mixed in its total saturation from anything, but from them, all other limiting colours, the colour cycle can be mixed in almost total intensity. If I turn this triplet into certain positions, I can get all other hues, although with less saturation.

If we wish to let the students mix over a short time a nice colour harmony, the right formula is that they only get three tubes of paint, and in this case the mixes will not “become dirty”. They only have to put the maximum saturation of the three colours into a hierarchy and almost all shades can be built in.

Another rather interesting experience of mine is that I mentioned already in connection with Diversionism, that a broken colour can be established by decomposition into two complementary or related colours, and this “granulated” surface gives rather a fascinating effect near to homogenous spots, in the form of textures. When observed from a greater distance, it melts into the original colour. By cutting giant posters, such raster surfaces can be produced. The monochromic elements of a certain composition can be multiplied by using only fully homogenous

colours, of which there is almost no effective difference in numerosity.

These natural, biological and chemical pigmented phenomena helped me to create my colour harmony system.

### 5 The Immocolour

The main point of Immocolour is, that a full colour tonality – built up on all six basic colours – can be tuned for each clear colour of the colour cycle, so that the other five colourations, showing up the most possible interrelations to each other, the main and the ancillary colouration are in intermixed connection.

All of the six generated colourations – cool and warm as they are separated – are of modified maximum saturation, and the most saturated of the bordering colour cycles is the initial colour randomly separated.

Each of all the harmony systems at the same time also has both monochrome and polychrome characters. The six colourations can only be established from three colourations defined one after the other. Clearer colour members can explode the atmospheric unity, as the system can be perceived as the determined strength combination of three colours arriving from three different directions, however, in a way that one painted surface takes cool and warm reflections on the basis of the example of nature described above and the shadow effects happen always with complementary refraction.

The cool-side reflecting colour is the complementary of the warmer reflected tone, and the warm-side reflecting colour belongs always to the cool reflected colour version. The complementary of the initial colour is a mixture of cool and warm reflecting ones.

This system can be established by gradual addition, shown by the Fig. 1.

Let us take for instance one originally yellow colour; this will be the most saturated colouration. Now define at an approximately 140° direction a blue (there is some freedom to choose the determination of the blues) of which, with the help of a proper red the complementary of the yellow can be mixed, this is the purple, with moderately low saturation, plus the cool reflection of the yellow with mediocre saturation. This will be the green that is to be mixed, so that it would be placed on the colour cycle just opposite. Finally, from the clear red and the basic yellow an orange can be mixed, and this is to be in complementary relation with the blue defined above. If we started with any secondary colour, e.g. orange, it is rather important to define the cool respectively warm modifying colour so, that all generated colouration would remain characteristically different, thus no confusion would occur with them. Note that the colours are at the same distance to each other on the generated ellipse (!!!) and to the point representing the black-and-white axis.

When, with the help of a very good technical quality Swedish colour atlas, the NCS (Natural Colour System) I instinctively tried to determine what saturation has to be put, beyond the initial yellow to the five colourations mixed with two clear

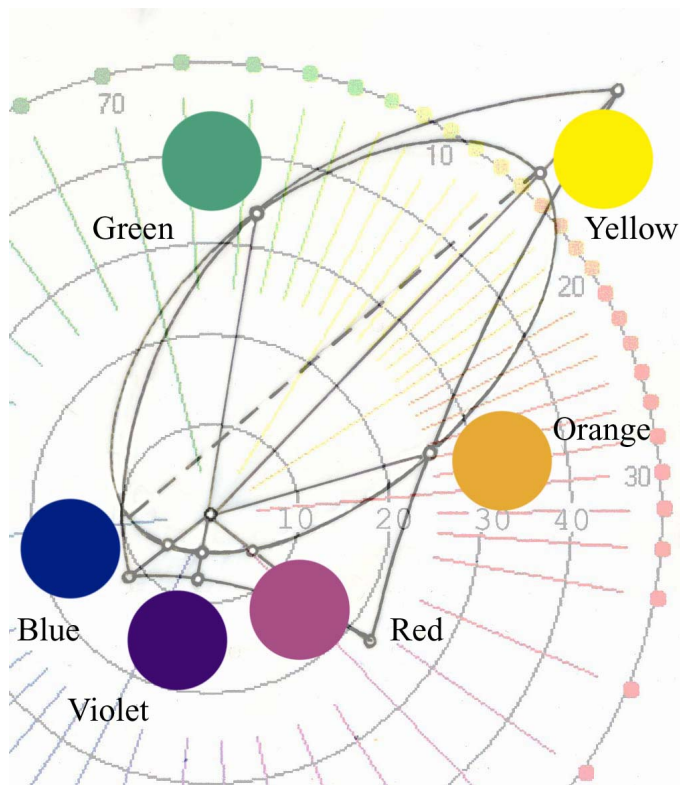


Fig. 1. The construction of a harmony ellipse

colour components, a relatively graded hierarchy has been generated separately for the saturation of both cool and warm hemispheres. And when I placed the intuitively set values on the scaled colouration plane, I got a normal ellipse! This means, that as the luminosity and saturation both have linear harmony characteristics that can be described by geometry in the plane, the same is valid for the colouration as well, the harmony experience of colouration-saturation relationship is realized for us in an affinitive relation of the full clear colour cycle, in an ellipse.

Of course, this ellipse can also be smaller in the colour space, when the origination is not from the fully clear colour, but the colouration points laying on it will have the same saturation differences through editing. I recognized, however, that in the yellowish green, the yellow, the orange and the full red pigmental colouration  $T = 85$ , it is rather difficult to arrange them into harmony. I found that these almost luminous colours in my system reflected by coloured lights represent the light source itself, thus the illuminated elements seem mellower than this. Generally the light source is not part of the composition. No such strong saturation exists from purple, blue and green colours, thus these do not create the impression of strange, even with clear colours “from the tube”, on the picture. It is important to note, that the most saturated initial colours match rather as background form than as form into their places, because they rather recall the radiating light as the setting sun makes the firmament red.

You can detect, that the complementary, respectively monochrome harmonies are after all those protracted fully into a line, respectively protracted and shortened distortions of the six member elliptic system. The triadic and quadratic harmonies

are placed also on the ellipse, but they leave some utilizable harmony situations empty.

In addition I have demonstrated the harmony ellipses built up on the three main colours (yellow, red, blue), and the constructivist style artistic view compositions built up on these initial colours made by the author.

### Summary

If I intend to briefly summarize in some thesis the characteristics of colour harmony discovered (perceived) by me, I can state:

- 1 Among more colourations, the strongest organizing element of colour compositions is the mutually mixed characteristics.
- 2 Harmonizing colours are placed on the colour cycle on an elliptical orbit at a proportionally changing distance to each other and to the neutral point (the axis).

### 6 Colour and texture

The textural representation of colours still have to be mentioned: with what means, in what consistency and with homogenous or optically mixed surface do I work? My perception is that homogenous surfaces emphasize more those that are indented by any painting means and vice versa. Surfaces that are homogenous to the human eye appear exclusively stiff, dead, in the vicinity of near identical denseness, but those that are diversely indented seem oppressively disorderly, chaotic.

My experience is, that we can define an

- articulation quality (blowing, rolling, depiction, hatching, etc.)
- articulation size (how large?)
- articulation density.

We feel pleasant if of these, the articulation quality is relatively constant, but the size and the density change at the borders of the two forms. The homogenous surface can be taken for one infinitely tiny and dense articulation (e.g. the tissue of the canvas), but the changing of the glazing (light-dark) and of the coating paint, also gives a rather fine contrast. You must know if the colours of various saturations have the role of illuminated surface colour or shadow colour on the picture.

Among the colour pairs representing the complementary or highly different saturation light-shadow contrasts, one initial colour has, immanently, to recognize its related element of greater brightness or even of more shadow versions, so that the homogenous and the optically mixed versions would be linked to each other as a chain.

The initial colours (of which I generated various harmony ellipses) can be thought of as moderate illuminated surface colours, and 3-4 pcs of them can be established per colouration so, that their further illuminated and shaded versions would fill up the colour plane with equal density. The shadow colour

versions may be tied over to the complementary colour plane as well, in this case this is named as reflected shadow.

The same shadow colour function cannot belong to different light colour environments. (Apple never has the same shadow colour, as the lemon, this would lead to schematizing.)

The Fig. 2 below illustrates this light-shadow triple interconnecting system, as a complementary colour plane pair is filled up with approximately proportional density. The shadow-mediocre light-bright colour roles are linked together into chains of 3, or even 4, 5 member chains, and in the meantime they are intermingled and make homogenous and optically mixed versions, they originate from each other. This is the “IMMANENT” characteristics.

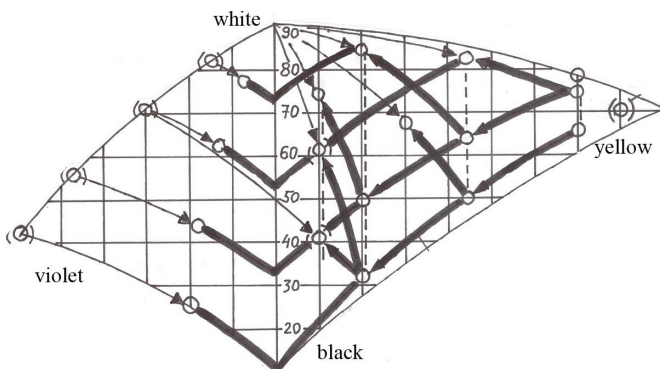


Fig. 2. The thick black lines show the connections of the colour-chains

### 7 Who is the beneficiary of such a personal colour harmony system?

Independent from that these are planar works; this type of colour handling formulates, strictly speaking, the colour harmony rules of spatiality. Therefore it also contains elements of general validity. For a painter, who uses an organic form of expression, this can be useful. Although in constructivism, painters often and by choice show up modelled or even aggressive compositions embracing the full clear colour cycle (see Lohse and mostly the contemporary artists of the Northern countries), I see the further continuation of this tendency instead of the unanimity similar to the “traffic signals” rather than turning to the structures of fine, modelled light-shadow spatiality of Nature.

Many colourations in full saturation also neglect the associative contents, in addition to it, all works of the artist will be almost identical.

In my system, shadow colours include the illuminated surface colour, homogeneously or optically mixed, and the illuminated surface colour can take other reflections at other points of the space. This multi-directional immanence, the intermingling of the colours, richly articulates the space and also establishes the graduated component of harmony in the colouration. But it is also capable of strong contrasts, as during my experiments over the long years, I also sensed such interesting colour connections that had not been consciously established. E.g. yellowish

green and red make orange, and / or yellow, from red and green blue can be mixed, or from purple and orange red, etc.

Thus, in my opinion, this harmony system is useful not only to its creator, but to all such painters, designers, or architectural students, that strive to bring colours into interconnection. You can see, the “blood relation” connection is here, the strongest relationship, the derivation from each other. It is worth another paper to recognize the principles described here in the works of recognized artists. People, for whom establishing of a personal visual language of space and form is important, will hopefully utilize this system that is also proven by the attached harmony drawings. To whom only the conceptual character of art is important and visibility is a dry “instruction for use” or descriptive drawing of the idea, will not of course be able to use these principles. I think now again of the excessive movement of the contemporary fine arts into a theoretical direction.

In the program of our Department colour appears in all years, I have been trying to help the designing, descriptive works of my students according to the above principles for years, which is also verified by several successful exhibitions. I think first of all of the exhibitions of the Department in the assembly hall of the BME and in the Kós Károly house in City Miskolc this year, that attracted lots of visitors to our Department.

Attached are the harmony ellipses built on various colours and the compositions belonging to them, plus the figures attached to the article.