Application of numerical evaluation of colour in harmonious relations definition among colours in textile design

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*Colour has the important role in creating the observer's opinion about observed object or scene. Certain colours emits certain signals so it is very important to determine proper colour palette. In design, the key element is choice of colour which will assure achieving contrasts and harmony of composition elements, which will assure observer's positive reaction and acceptance. When the right balance of shapes and colours is achieved, it can be said that the harmony is achieved. Scenes in which the colours and shapes are positioned in harmonious relations induce the sense of inner peace and balance. In paper, based on analyses performed as part of the graduate thesis of undergraduate student Antonija Laštro, the possibility of applying the methods of computer colour evaluation in purpose of colour relations evaluations and placing colours in harmonious relations, was investigated. Using the objective colour parameter values according to CIELab system and analysing the position of colour in L*a*b* colour space, the possibility of assuring the objective harmonious matching of colours was analysed. The analysis performed in paper is based on two methodology of Johannes Itten, for colour coordination regarding their contrast characteristics, and these are the methodology of placing colours in proper complementary relations (contrast) and methodology of triad.*
Key words: *colour objective evaluation, colour harmony, colour relations in textile design, L*a*b* values, colour space*

1. Introduction

In ones everyday life, colour has a significant role in creating the observer's decision about observed object or colour scene and colour relations in it. Certain colours emit certain signals, so the choice of right colour palette is crucial. Besides the right choice of colour palette, it is also important to define the colour contrasts and the content of colours in dependence of composition elements of colour scene or colour object. The observer's experience will not depend only on colour palette and harmony in observed scene, but also on background and surrounding colours, which will all together influence on preserving the multicoloured composition permanently in observer's memory, Fig.1 [1-5].

1.1. Theory of harmonious and contrast relations among colours

The choice of colours which will assure the positive contrast and harmony of composition elements, which will influence the positive reaction and acceptance of an observer, is the key element in design. When the balance and accordance of col-

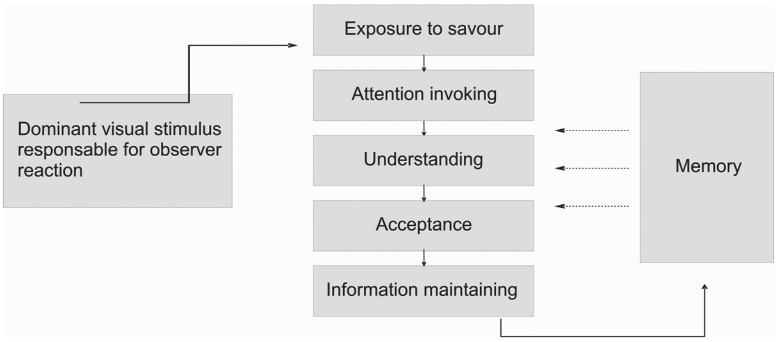


Fig.1 Schematic presentation of basic phases of observer's acceptance process of visual information

ours is achieved, it can be said that the colour harmony is achieved. The colour scene in which the colours and shapes are composed in harmony, stimulate the sense of inner peace and balance [3, 5-11].

Non harmonious scenes, the observer will experience or boring or chaotic, in every sense the psychophysical reaction of an observer will be negative, rejecting. Through the history, numerous scientists and artists, were occupied by harmonious relations among colours attempting to define the theoretical laws of harmony, developing also the interests of colour theory and colour science in the scopus of their scientific and artistic work [11]. In the ancient Greece, with problems of colour harmony, Pitagora and Aristotel were occupied. Goethe (1749.-1832.) also worked on theory of harmony laws, exploring the psychological effect of colours on observer and exploring the visual phenomena in general [11-13].

Philipp Otto Runge (1777.-1810.) also believed that, from the painters and visual artists aspects, certain theories must be set, since, according to his believes, scientists of hat time that worked in the field of colour theory, sort of neglected the visual and artistic aspect of colours. Michel Eugene Chevreul (1786.-1889.) explored the law of complementarity and was the first who defined the theory of simultaneous contrast. George Field (1777.-1854.) was among first who defined theory of cold and warm colours.

Wilhelm von Bezold (1837.-1907.) tried to define the harmonious triads of colours. Albert Henry Munsell (1858.-1918.), also defines his concept of colour harmony and balanced relations among colours [11-13].

Wilhelm Ostwald (1853.-1932.), confirmed that human eye, definitely certain colours combinations experience as agreeable and acceptable (harmonious), while some definitely not. So, in his reserach he was trying to find the answer on question „why is that so?", and how the harmonious relations among colours can be defined with certain laws and rules [8, 9]. Faber Birren (1900.-1988.) was also occupied with relations of „cold" and „warm" colours. Also, Birren tries to show and define the laws of harmonious colour relations [11-13].

All this thesis and theories of harmonious and contrasts relations among colours, will be integrated in unique theory of basic rules of harmony and contrasts, by the Swiss Johannes Itten (1888.-1967.), visual artist and one of the grates colour theorists. According to Ittenu, intuition led by the pure talent must be supplemented with theories and doctrines, in order to achieving the balanced, harmonious, artistic peace created from coloured elements. Johannes Itten, cit.: „*In the area of colur as creative elements, artist cannot explore and create only based on subjective experience, but also based on objective principles and rules. Basing the creative work on pure subjective perception, means being inhibited and limited on a way of creating the balanced and harmonious peace of work*" [11].

Itten bases his theory on artists who, through history, were not underestimated the possibility of intellectual research of their basic artistic media, the colour. Johannes Itten defined the strategy for successful colour combining, and through his research he set the five basic principles of creating the harmonious colour elations: dyad, triad, tetrad, hexad and analogues. He also established seven methodologies for colour coordination based on their contrast characteristics: contrast of saturation, contrast of hue, light – dark contrast, warm – cold contrast, complementary contrast, simultaneous contrast and contrast of extension [11].

But, although Itten sets certain rules and concrete strategy for successful colour combining defining it as objective approach, still, the composition created based on Itten's rules and strategies is result of subjective colour harmony and contrast experience [11].

1.1.1. Theory of complementary relations

Complementary (lat. *complementarius* – complete, fulfil) means supplementing, completing. It can be said that every coloured surface acts like filter that transmits or reflects the light of its own colour, while absorbing the light of complementary colour. One colour is complementary to another when their lights, while added to each other, produce white light, and their pigments mixed produce grey colour [11-15].

According to Itten, complementary colours are placed in 12 parted colour circle, diametrically opposite to each other, Fig.2. Placed one next to other, complementary colours reinforcing each other, while mixed together nullify each other producing the neutral, grey hue. All chromatic colours have only one complementary colour [11-15].

Each complementary pair consists one "warm" and one "cold" colour,

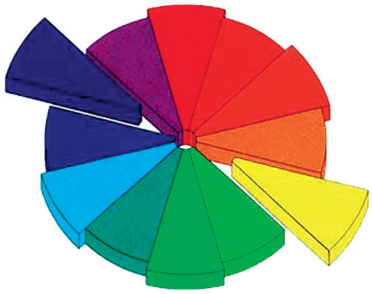


Fig.2 Complementary relationship of colours in 12 parted colour circle

of which one I primary colour and the other is secondary, and, as it was already said, they are placed right opposite to each other in colour spectra.

Also, each complementary pair has its own special characteristics. Yellow and violet-blue, for example, represent not only complementary contrast, but also the maximal contrast of light and dark among chromatic colours. Red-orange and blue-green are complementary pair while in the same time create the maximal degree of cold – warm contrast. Red and green are also complementary colours, but in their full chroma they are placed on the same lightness level [11-15].

Principle of complementarity is a base of harmonious relations among colours, creating the balance in the eye of an observer, as an essential precondition of visualiztaion process. Human sense of balanced relations among colours is related to complementary contrast. In multi coloured scene which contains complementary pairs, he human eye will, primary, notices this complementarity. Also, because of the indigenous need for complementary balance, the observer will, if the scene does not contains the complementary balance, creates the illusion of such balance. These phenomena is called simultaneous contrast. For example, yellow, combined with its complementary violet-blue, will be visually experienced in its full hue brilliance. But placed next to green, in order to satisfy the need for complementarity, the green will apparently achieve the sort of bluish violet shade. The reason is exactly this indigenous need of human visual system to observe violet-blue next to yellow and not green [11-15]. When the complementary colours are combined in proper extension, the result will be visually static, stable scene.

In multi coloured scenes which are based on complementary contrasts, harmonious balance can be achieved also using combinations of, not only colours of full chroma, but with hues which represent gradation of chromatic hue in chroma and lightness (meaning achieving lighter and darker shades of equal hue, with gradation in chroma).

1.1.2. Triad theory

According to Itten's triad theory, three hues chosen from 12 parted colour circle, which position creates triangle formation, define the group of triads.

Harmony of triads can be created with colours from the colour circle whose position creates the form of equilateral triangle (Fig.3) or isosceles triangle (Fig.4) [11].

Triads from the form of equilateral triangle are: yellow/red/blue; yellow-orange/red-violet/blue-green; red-orange/blue-violet/yellow-green. Combination yellow/red/blue, is classical combination of three painting primary and it is considered of most common and visually the strongest triad. Harmony of painting primaries has a stimulating effect on visual stimulus of an observer, while psychophysical reaction on harmonious triad is positive and acceptable [11].

Other from of triad is combination of colours which in colour circle are positioned in a way to create a form of isosceles triangle. Such form of triad create the effect of so called „split complementarity“. Meaning, if one choose from the 12 parted colour circle the pair of colours which are placed on opposite (complementary) positions, and if one colour from the complementary pair are replaced with its first left and first right neighbour from the circle, the triad in a form of isosceles triangle is achieved, respectively he effect of a „split complementarity“, which assure the harmony of three colours in complementary relationship [11].

Forms of triangles described above, can be rotated through the whole colour circle, so with any three colours from the 12 parted colour circle, the harmonious triads can be achieved. For successful combination of colours in form of triads, one colour should be dominant, while the other two should only accented the dominant colour. Harmonious triads can be achieved also with combinations of two chromatic colours with third achromatic colour (greys from white to black) [11].

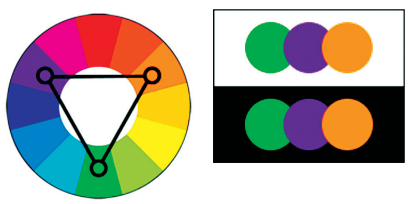


Fig.3 Equilateral triad

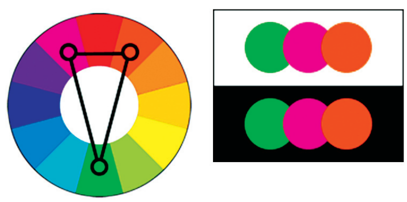


Fig.4 Isosceles triangle – „split complementarity“

1.2. Basic characteristics of numerical evaluation of colour

Considering increasing usage of digital devices in textile designing, but also in producing the patterned textiles, knowledge and successful usage of systems for objective, numerical evaluation and colour parameter defining, (lightness, chroma and hue), become inevitable.

Modern system for patterned textile producing are computerized, and colour in such system is defined based on precise, numerical values. Also, graphical computer programs which are used in patterning and textile designing, base its colour management on objective colour values and enable creating a colour based on colour parameter according to CIELAB system. Such approach enables detailed study of each colour parameter in designing process and also achieving unexpected shades palettes which are produced with aimed changing of exact one colour parameter [16-21].

Development of objective CIELAB system starts at 1931., with acceptance and standardization of CIE system (Commission internationale de l'eclairage). CIELAB colour space is most agreeable with human visual perception of colour, and is defined as system of ***opposite coordinates of colours***. Spatial view of a system is defined with *a, b* coordinates placet in rectangular coordinate system, coordinate ***a*** defines red – green axis, while coordinate ***b*** yellow – blue axis. Colour hue in CIELAB space is defined with angle between a* and b* coordinate, in values from 0° to 360°. Evaluation of hues starts from +a* coordinate with hue value h* - 0°, the value of +b* coordinate is 90°, of –a* coordinate is 180°, and –b* coordinate is 270°. System defines the lightness value ***L*** with numerical scale from 0 = black to 100 = white. For neutral (achromatic) colours (white, grey, black) a = 0, b = 0. In a*/b* coordinate system, every colour can be defined by its position regarding the hue and chroma, for each lightness level [16-21].

Chroma is defined by the distance of colour from the central point defined by intersection of a* and b* coordinates. This point represent the point of achromatic hues, meaning that in centre of diagram the neutral (achromatic) hues – black, white and greys are positioned. With increased distance of colour from the central point the colour is more saturated and purer.

In paper, the possibility of numerical (computer) colour evaluation in aim of colour consistence assessment and their placement in harmonious relations is analysed. Using the objective evaluation of colour parameter according to CIELAB system and analyzing the position of colour in L*a*b* space, the possibility of objective colour consistence was investigated. Analysis performed in the paper are based on two methodologies of Johannes Itten for colour coordination according to their contrast relations, a methodology of placing colours in proper complementary relations (contrast) and methodology of triads.

2. Experimental

In the process of designing the samples showed in this paper, the computer data base was used, that contains the objective numerical information of colour parameter based on CIELAB system of precise, numerical colour evaluation. Computer base of objective colour values was created based on spectrophotometrical measurement of textile samples, performed by remission spectrophotometer DataColor, SPF 600+CV. From this data base which contains information of several thousands colours of different colour parameters values – lightness, chroma and hue, the 594 different colour samples were chosen. Chosen colours are placed through the whole colour space, through each of four basic quadrants, on different lightness levels. Chosen group of hues is showed in CIELAB colour space, regarding their lightness, chroma and hue, on Fig.5.

Principle of colour samples selection which are in complementary relations is showed on Fig.5. According to example showed on Figure, the hues which are placed on diagonals of colour space showed, are in complementary relations.

Chosen colour hues which are, according to heir L*a*b* values, in complementary relations, are used in further work for samples of patterned textile design and designed textile collection creation. Samples were made in technique of computer patterning and designing. Computer programs used were „Deluxe_Paint II Enhanced 3.0", „Jasc Paint Shop Pro" and „Adobe Photoshop CS3". Program „Adobe Photoshop CS3" enables the input of L*, a*, b* coordinate values according to CIELAB system of numerical colour evaluation, which assures precise reproduction of exact colours of defined characteristics.

3. Results and discussion

Designing, either is it textile and fashion design, or other branch of designing, means usage of artistic elements of lines, surfaces and colours in aim of creating the composition that would observer experience as harmonious and appealing. Among

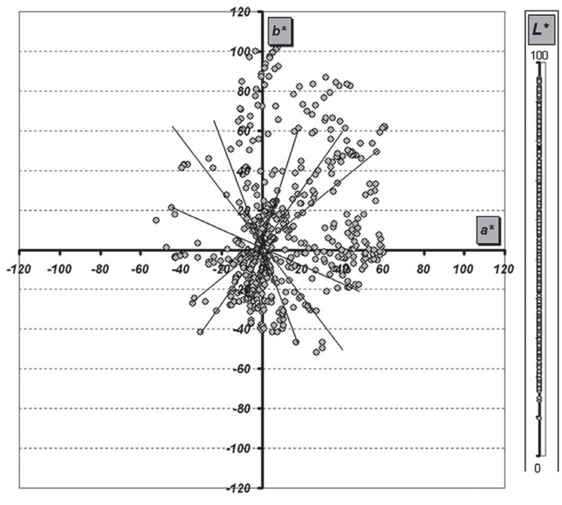


Fig.5 CIELab three dimensional coordinate colour space

the elements of creation mentioned, the colour could be defined as one of the dominant characteristics of human senses which is the base on which the observer defines the surrounding scenes and makes certain decisions. So, achieving the positive relations among colours is the key elements in fashion brands development and in designing in general.

The aim was to show that considering the colour in its precise, objective parameters, could assure achieving the exact wanted contrasts and relations among colours, which would be much more complicated and non precise if it would be performed based on pure subjective experience and intuitive reaction. The computer base was used that contains objective numerical information of colour parameters based on CIELAB system of precise, numerical colour evaluation and position of chosen colour hues in CIELAB space (L*a*b* diagram) obtained by instrumental measurement.

Analysis of hues used for creation of samples of patterned textile presented in this work, was based on two methodologies for colour coordination created by Johannes Itten: a methodology of placing colours in proper complementary relations (contrast) and methodology of triads [11].

In L*a*b* diagram complementary hues are placed diametrically opposite to each other considering the diagonal axis through the centre of the colour space (Fig.5). This is the ay that enables precise definition of complementary pairs for each colour hue in colour space.

During such analyse it is important to consider also the parameter of lightness. For achieving a complementary relation between chromatic colour and achromatic shade of lighter or darker grey, it is recommended hat, for achieving a harmonious relation, to create a combination of given chromatic hue with achromatic version of hue that would be in complementary relation to chosen chromatic hue. For example, if certain elements of design in chromatic red colour should be applied on grey, neutral background, it is recommended that the chosen grey hue would be produced as achromatic version of green, which is complementary to red.

Results obtained in this paper are showed in tables and graphically in a*/b* colour space.

Tab.1 Colour coordinate values of chosen yellow and blue colour

	L*	a*	b*	C*	h*
Blue	51,95	0,33	-40,76	40,76	270,46
Yellow	88,77	-3,15	77,55	77,61	92,32

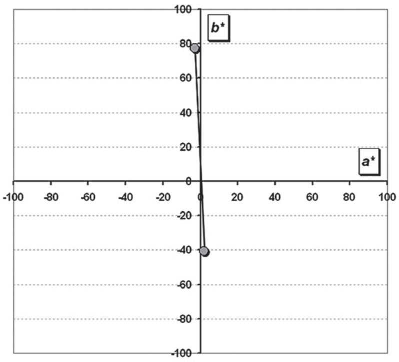


Fig.6 Position of chosen hues from Table 1 in a*/b* diagram

3.1. Complementary relations of chromatic hues

Example 1: complementary relation of chromatic hues – yellow and blue hue

It can be seen that chosen hues are exactly diametrical to each other, so it can be said that they are complementary to each other.

To assure greater preciseness of hues that would be exactly in opposite – complementary relations, the principle of determination was performed as follows: in a first step the yellow hue of following objective value was chosen: h* = 92,32° (Tab.2), which is for 2,32° moved away from the main yellow axis +b*=90° into upper left quadrant of a*/b* diagram (Fig.6).

So, the blue hue complementary to chosen yellow one was defined as blue hue which is for he same angle value, 2,32°, moved from the main blue axis -b*=270° towards lower right quadrant of a*/b* diagram. Considering the procedure described, the exact hue value of the defined blue hue was h* = 272,32. In that way the exact, precisely defined blue hue, opposite – complementary to chosen yellow hue was defined. Based on the hue value obtained the matching colour sample was found in a computer data base, so the sample of blue colour of L*a*b* values was chosen (Tab.1). Relation of chosen yellow and blue is demonstrated through the design of patterned textile showed on Fig.7.

As it was already said, he samples showed are designed using two colours in complementary relations, which in a*/b* colour space are placed opposite to each other along the axis *b*.

Yellow is the colour of high self lightness, characterized with exceptional colour energy. Each colour in visible part of the spectrum that human eye

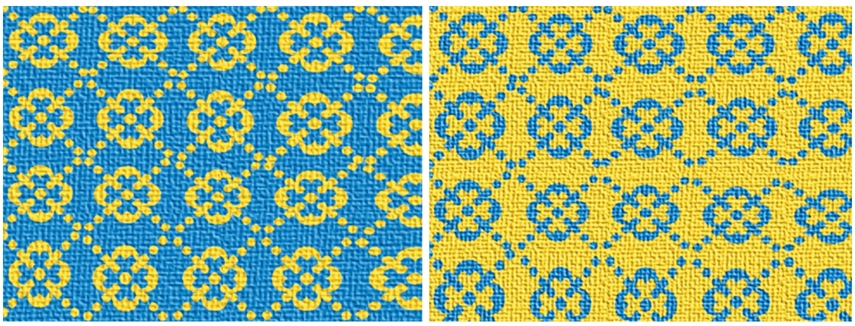


Fig.7 Design of patterned textile based on complementary relations of chosen yellow and blue hue

is able to percept, is characterized with its specific energy regarding the frequency of adjacent wavelength. This energy is exactly the main property that defines entire observer's psychophysical experience, on which the observer defines the observed colour relation as harmonious, agreeable and acceptable, or not [3, 4, 11].

So the knowledge about how to act with colour, how to direct the specific energy of colour and contrasts that arises from the relationship of specific energies in creating the presentable environment in fashion presentation and expression, are essential in creation of a designer. Considering the property of yellow being colour of exceptional high colour energy, it will affect stimulating on an observer, and the elements presented in yellow colour will be first noticed. So the elements of yellow must be fitted into entire colour scene in a way of highlighting certain element, while in the same time the harmony of the whole colour scene must not be disturbed [3, 4, 11].

Also, besides the satisfactory complementary relation, in combinations with yellow and some other colour characterized with high colour energy and self lightness, it is necessary to consider the portions of each colour hue, in order to maintain the satisfactory harmony. At the contrary the effect of "Visual competition" can appeared. The effect of "Visual competition" occurs when two or more objects, with approximately same chroma characteristics and emphasised reflection (emphasised lightness and energy), with the same intensity draw the observer's attention. Such phenomena resulting in confused observer's visual reaction, when observer is disabled to completely visualize neither of the perceived elements. So, for achieving the harmonious relations among colours of different energetic levels, one of the key elements is portion of each colour in a complete scene [3, 4, 11].

Combination 2, Fig.7, is an example of to big portion of yellow colour, where the yellow becomes dominant due to its emphasised energy, while the elements in blue colour become insufficiently prominent. Satisfactory balanced relation of those two complementary colours is achieved in Combination 1. In their complementary relation, yellow and blue are also the colours of emphasised light – dark contrast. So, in such combinations special attention must be paid to portions of each colour.

Example 2: complementary relation of chromatic hues – yellow-orange and green-blue hue

Complementary hues of sample showed on Fig.8, were defined at the dame principle as it was performed for the example 1. First, the yellow-orange hue was chosen h* = 79,23, so the difference of hue value in relation to main yellow axis +b*=90°, was defined as 10,77° with movement towards upper right quadrant of a*/b* colour space.

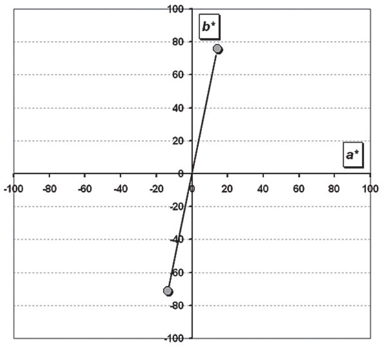
As it was done for the example one, here also the value of blue-green hue, complementary to yellow-orange, was defined as colour that is for the same angle value 10,77°, moved away from the main blue axis - b*=270° towards lower left quadrant of */b* diagram.

In such way the value of blue-green hue was defined as h* = 259,32, which represent he exact, precisely defined, diametricaly opposite – complementary hue to yellow-orange. Based on hue value achieved, the matching colour sample from the computer database was found, so the colour of the L*a*b* characteristics showed in Tab.2, was chosen.

Design showed on Fig.8 is also interesting as an example of special design element usage with purpose of achieving the visual balance regarding the portion and energetic domination of certain colours. As it was already established, yellow as well as yellow-orange, are the colours of emphasised energy and regarding their energetic domination, their portion in combinations with their complementary pairs should be, according to Itten, 1/4 to 3/4 in relation with their complementary pair [11]. In design showed, the portion of yellow-orange

Tab.2 Colour coordinate values of yellow-orange and green-blue hue

	L*	a*	b*	C*	h*
Green-blue	47,1	-13,6	-71,4	72,7	259,23
Yellow-orange	82,6	14,4	75,7	77,05	79,23



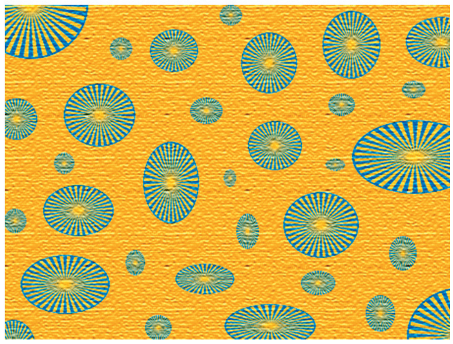


Fig.8 Position of chosen hues from Table 2 in a*/b* diagram and realized design

Tab.3 Colour coordinate values of blue-green and orange hue

	L*	a*	b*	C*	h*
Blue-green	72,1	-9,06	-9,32	13	225,8
Orange	57,26	58,32	59,13	83,05	45,4

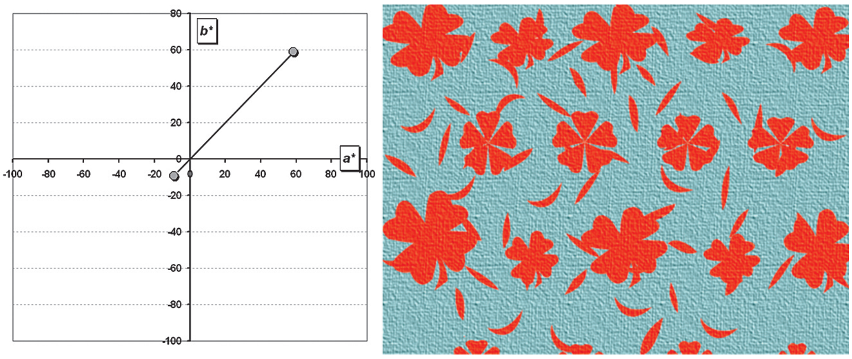


Fig.9 Position of chosen hues from table 3 in a*/b* diagram and realized design

is significantly bigger, but with usage of striped elements in blue-green colour, certain dynamic is achieved which additionally stimulate the perception of blue-green colour. In hat way the domination of yellow-orange is decreased and two complementaries in such combination is balanced and harmonious.

Example 3: complmentary relation of chromatic hue with chromatic-achromatic – green-blue with yellow-orange

Sample showed is and example of complementary relation between chromatic and chromatic-achromatic hue.

Colour hues used in design showed, were also defined by the principles showed on previous examples. Objective hue value of orange colour, according to CIELAB is h* = 45,4.

In relation to the main yellow axis +b*=90° of a*/b* diagram, the difference in angles is defined as 44,6° with movement in upper right quadrant of a*/b* colour space. So, the value of the blue-green hue which would be complementary to chosen orange was defined in a way that was found blue-green hue which is for the same angle value, 44,6°, moved away from the main blue axis -b*=270° towards lower left quadrant of a*/b* diagram, so its exact hue value would be h* = 225,4. This hue value represent the exact, precisely defined, diametrically opposite – complementary hue to chosen orange. Based on this theoretical hue value, the matching sample of adequate hue value but with low chroma value was found in computer data base, with L*a*b* values showed in Tab.3.

Usually, the chromatic hues are combined in their complementary relations, but it is also of great significance to achieve balance and matching relation between achromatic shades.

It has been proved that the phenomena of simultaneous effect and contrast appears due to the indigenous need of a human eye for complementary balance, so if the colours are not properly balanced in their complementary relations, the human eye will spontaneously create the illusion of complementary relations although it is not present in the observed scene. So, when certain chromatic colour is placed on neutral, achromatic background, the human eye will, because of this need for complementary balance, create an illusion of complementarity and the neutral, grey colour will assumed certain shade which will be complementary to chromatic hue presented on such background. So the grey presented next to yellow will appear bluish to human eye, while the grey presented next to red will appear greenish to human eye [3, 4, 11].

Knowledge of theory of contrast relations among colours and understanding the phenomena of simultaneous contrast, will enable the visual artists and designers in recognizing the situations in which such effect will appear, so they will be able to make the decision is such effect positive phenomenon or it should be restrained with certain methods. Also, everyone who poses theoretical knowledge will also have knowledge about the methods of bypassing and restraining the effect of simultaneous contrast in situations where such phenomenon is unwanted [3, 4, 11].

According to methods of Johannes Itten of bypassing the effect of simultaneous contrast, if the achromatic, grey surface is presented in mild chromatic-achromatic version with barely noticeable hue which is in complementary relation to chromatic hue presented on such surface, the relation that the human eye will spontaneously created will already be present in real and not as an visual illusion [3, 4, 11]. With this method, the appearance of illusive shade and the effect of simultaneous contrast which means the visual illusion of unreal shade, will be bypassed [3, 4, 11].

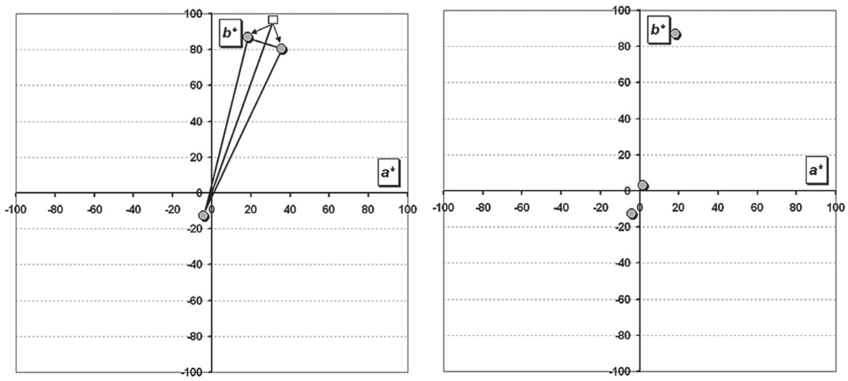
So, also in a process of creating the presented sample (Fig.9), the chromatic – achromatic grey wit mild, barely noticeable blue-green shade was used as background which is in complementary relation with chromatic orange.

3.2. Hue relations on triad principle

While combining the third colour with two colours in complementary relation, it must be considered that such combining could easily led to

Tab.4 Colour coordinate values of grey, green-blue and yellow-orange

	L*	a*	b*	C*	h*
Grey	84	1,43	3,22	3,52	66,05
Green-blue	78,68	-4,54	-12,56	13,35	250,13
Yellow-orange	71,85	21,47	86,8	89,4	76,10



a) b)

Fig.10 Principle of a) defining the triad based on objective CIELAB values and b) placement in a*/b* diagram

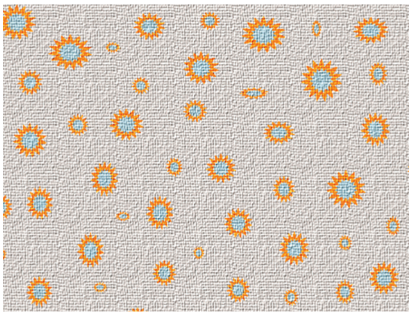


Fig.11 Designed sample on triad principle

disharmony. According to theoretician Johannes Itten, in such combining harmony could be achieved if the rule of, so called, triad is followed. The rule of triad says that, if one colour from the complementary pair is replaced with its first left and first right neighbour colour from the 12 parted colour circle, the harmony of three colours in complementary relation will be assured. This effect is called the effect of "split complementarity" [3, 4, 11, 14, 15].

Example 4: Complementary relations of two colours wit addition of third colour in combination

Sample showed on Fig.11is created on the principle of triad. On Fig.10 a and b, the principle of defining hues in triad relations according to Johaness Itten's rules is presented. The hues from yellow-orange/blue-green parts of the colour space, was chosen (Fig.10a). First, the position of chosen blue-green hue is defined in L*a*b* diagram, with hue value h* = 250°. Then, the complementary hue to blue-green with this specific hue value was defined which is placed precisely on hue value h*= 72,12° (diametric axis assigned with white square – Fig.10a).

In the next step, following the principle of triad, in order to define the two colours that would be in harmonious relation with chosen blue-green, the yellow-orange hues were defined, which are in a*/b* colour space, according to their hue value h*, placed at the left and right position in relation to the exact complementary hue to chosen blue-green, which would be the orange with hue value h*= 72,12°. In order of precise definition of these left and right neighbour, arbitrarily difference from the exact axis of precise complementary hue to blue-green was defined in angles, and its value is 17,88°. The value of "left neighbour" was obtained through the following principle: 72,12° - 17,88° = 54,24°; for „right neighbour": 72,12° + 17,88° = 90,00°. The position of obtained hues is showed on Fig.10a.

As it is showed, all three hues are, according t their a*/b* coordinates, chromatic (saturated), with small exception of blue-green hue which have a bit lower chroma but it is still in a group of chromatic colours with prominent, dominant hue. But, the aim was to show the combination of triads with one achromatic (grey) colour.

So, in next step the „right neighbour" of yellow-orange hue was moved towards achromatic point (the centre of the a*/b* diagram), preserving the same hue value but with lower chroma (Fig.10b).

In such way, the precise achromatic shade of chromatic „right neighbour" was defined. These, theoretically defined parameter values of colours that will be combined as triads, has been imported in graphical computer program for designing, Crated sample is showed on Fig.11. In a presented way, the precise choice of colour based on the analyse of objective colour parameters was performed, which assured the balanced relation of chosen hues and harmony of split complementarity.

4. Conclusion

Knowledge of objective, computer principles of colour parameter evaluation, could be crucial in designers work, in achieving the accordance and harmony of coloured artistic elements and motives, so the positive observer's reaction and sense of balance and acceptance would be achieved.

The aesthetic balance is more important for an designer, than the possibility of precise determination of small colour difference. For an designer, it is not so important to determine real, precise colour difference, as it is importance to achieve harmonious relation among colours, and the approach presented in this paper offers exactly the possibility of defining the precise harmonious relations among colours.

Also, graphical computer programs which is used in designing and patterning of textile base their colour management on objective colour values, and provide the possibility of creating the precise colour based on objective parameters according to CIELAB system. Such approach gives possibility of each colour parameter study in a process of designing, as achieving the unexpected shades palettes which can be created with aimed changing of certain colour parameters.

It has been showed that the CIELAB objective system for precise, numerical evaluation of colour parameters and positioning of colours in a*/b* coordinate space, can be used as exceptional tool in searching and confirming the relations among colours through whole colour space, in their chromatic or achromatic variations.

It has been confirmed that, the matching relations of chromatic and achromatic hues and their setting in harmonious and contrast relations, can be performed with greater preciseness if it is based on objective colour values.

On example 3, the principle of usage of computer colour parameter values according to CIELAB system was showed, in process of matching he chromatic and achromatic hues in complementary relations. Also, the method of bypassing the effect of illusive appearance of modified shades and simultaneous contrast appearance which imply the visual illusion of unreal shade, was demonstrated. In fact, when the certain chromatic colour is placed on neutral, grey surface, the human eye will, because of indigenous need for complementary relations, create the illusion of complementarity and the neutral grey surface will achieve illusive shade which will be complementary to chromatic hue presented on this certain neutral surface. On example presented, the possibility of applying the Itten' method of bypassing the effect of simultaneous contrast, was showed. The method is based on knowledge of theory of contrast relations among colours, understanding the phenomena of simultaneous contrast and knowledge of possibility of applying the computer evaluation of colour parameters in presented situations.

On example 4, it was showed that the approach to analyse of hue relations on the basis of computer, objective colour parameter values according to CIELAB system, enables precise definition of hues in triad relations.

Basing the creative work on pure, subjective experiences, means being inhibited and limited on a creative way towards balanced and harmonious work of art. To get yourself free from limitations of creation and designing basically on pure intuition, means possessing knowledge and awareness about objective principles and laws on the area of creative work with colours.

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