USE OF COLOR IN ARCHITECTURE –
INDUSTRIAL ARCHITECTURE PERSPECTIVE

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Abstract. *This paper deals with the color theory and the application of this theory in architectural design. Since the modernist architects and modern era in architecture, the colors of the buildings were not in the focus of their authors. On the contrary, the modern movement has taught us that color, and especially artificial one, is almost a crime to use and in a way, it expresses a lack of a style. Through examining universal color harmony principles in this paper the problem and phenomenon of using colors in contemporary architecture was discussed, which had its roots in the modern movement and evolved through technological advance especially in material technology. The industrial architecture is used as an example, to narrow down the research field, but also for the reasons of extensive and creative use of color in this type of buildings. We have examined several industrial buildings that have been systematized into three categories. All three categories are analyzed for the application of general color harmony principles. Then discussion focuses on refining principles of color usage in architecture that appear in contemporary architecture in order to systematize those principles, particularly important for architectural education and new practitioners of architecture. In conclusion, it is stated that universal color harmony principles are applicable in architecture as well, as in other visual arts.*

Key words*: industrial buildings, architectural design, color harmony, architectural analysis, color, façade articulation*

1. INTRODUCTION

There is a theory in design that people respect and care about what they find beautiful and pleasing while they will disclaim and neglect what is unappealing [1]. The pursuit of happiness inevitably includes the pursuit of beauty. Beauty is a quality of an object that

gives pleasure to one or more senses. Delight in the presence of beauty is as natural human condition as breathing [11]. People search beauty in their own environment, in everyday life. The built environment is an important milieu in which people are searching for beauty and satisfaction. [3] An important part of it is surely the environment of the working areas. Pleasantness and satisfaction of the visual experience are usually connected and related to the amount of the stimuli people can get and receive from the object of perception [9, 10]. Since the colors were not popular and welcoming in architecture until recently, our environment lacked the power of the color that consciously and unconsciously it usually has on humans [13]. Color is a deeply emotional subject. For most of us, it is also highly personal, we each have a unique response to color that we develop internally through experience and association [1,9]. The lack of this interaction is definitely one of the reasons why much of the architecture of modern movement and similar has never been substantially appreciated in the wide population. This paper will try to push some boundaries toward the revival of color usage in architecture.

Through selected built project examples, here usage of colors and color schemes on the façade will be discussed. The main answer we are searching for in this paper is what successful color principles used in architecture would be. We used the general color theory as a starting point and general aesthetic principles that are going to be examined through some cases of contemporary industrial architecture as examples. Our working hypothesis is that aesthetic principles are universal and therefore there is a successful way of using a colorful façade in architecture.

If there some deviations from this hypothesis are found, they will be highlighted. Although colors did not have a particularly good reputation in architecture in recent history, the paper sought the answers to the question of what is a good way of using color in the design of building façade. Our discussion is limited to specific building types, industrial buildings, and to usage on building envelope — façades. Narrowing down the scope of our discussion has several justifications. Firstly, this is the way to establish some boundaries; therefore the discussion can be more focused. But also, today in contemporary modern architecture, industrial buildings are conveniently open for using a more colorful façade perhaps more than other types of buildings except for possible buildings for children or similar types.

2. COLOR DILEMMA IN ARCHITECTURE

The roles that different decorative elements play in façade design are gradually changing. In architectural history there are examples of vibrant usage of the colors at building façade, but in theory, may there be a bit of the hostility when it comes to the discussion of colors as a metaphor of a good taste and style. In western thinkers of the late 20th century, color and its potential followers seem to have diminished, become secondary, decorative, and deeming a colorful object or artwork less serious or intellectual than its less chromatic counterpart [11]. Essentially, the discussions of aesthetics in architecture are usually focused on form, material, size, and composition, and there is a common thought that a good architectural design must be monochromatic, maybe even color blind. Architects think in layers. There are so many layers of thoughts in the design process, so the color decision process seemingly comes after all other phases that supposed to ensure good architecture. Although it is not an excuse for non-using coloring in built environment, this is

maybe an act of recent history, fashion or act of engineering influences, through movements that called for honest uses of natural materials and its natural color tones, such as modernism, Brutalism, etc. [4] This rationalism, it may be said, is particularly characteristic of industrial buildings. Color in architecture simply faded in the modern movement. The use of natural, material color found in concrete, glass, and metal, celebrating chromatically devoid minimalism, has dominated architectural thinking since Le Corbusier. White has most often been associated with an elevated intellect and color consequently delegated to the arena of whimsical decoration with but a few notable exceptions. Unfortunately, color has either been used so badly on the outside of buildings, though, that is spawned a great fear of large-scale colorful architecture. Apart from an ill-conceived, short-lived trend in the 1980s, where cladding materials lacked durability and light-fastness, color has been, on the whole, conspicuously absent from our buildings. Since then, we do not have as much color in architecture, as it may be possible and appreciated. Modernists used "the play of light and shadow" together with form play in monochromatic experience, but this is surely not the only way of making successful architectural composition and the only means of expression in architecture. [4,11,13,14] People are not color blind, we see colors, we feel the colors, we do have feelings for them, they have meanings (not always the same) for us, so it is absolutely unjustified to colors be so detached from architecture that makes the humans' natural environment [15].

Recently a visible renaissance has taken place where intelligent, provocative and serious color is being used to serve form and function and take a leading role in architectural environments [11]. We have put aside our chrome-phobia, replacing the achromatic façade of the last several decades with a polychromatic celebration of new technology. What is most intriguing is the diversity of materials and applications. Color has become wholly integrated into the construction process with a vast array of techniques. Rather than a secondary afterthought, chromaticity is considered through material, surface, light and finish at an early stage in the design process [11].

In tandem with the visual qualities of the used façade materials, color is an extraordinary tool for giving a building both identity and presence. Such projects share an immediate recognition and iconic status. Another important element they share is their placement of color. The impact and strength of a color scheme are determined by proportion, shade, saturation, and location. A successful building can expose the intelligent use of one color to great effect and often one color can go a long way. Color must be explored in relation to size and location. Regardless of whether one or many colors are used on the building's façade, the color becomes the most significant and noticeable characteristic of the building.

3. COLOR THEORY

Before the discussion on the particular usage of colors in architecture, specifically on building façade, it is important to make a short journey through a color theory in general. Writing about color is known since the ancient Greeks, but until late XVIII, color theory, in general, was not much in the focus of discussion in the science and art as well. Discussion on color is usually searching for answers to basic questions such as: What is the color? What does it mean? How to organize and display it the best? What makes the color combination harmonious? Putting aside questions of what is color and how to organize a color system, we here focus our discussion on applications of color, and

consequently, questions of meaning and harmonious color combinations are still our places of interest. Color order system or so-called "laws of color harmony" has troubled researchers, scientists and as well as artists for a long. While some of them, like Newton, searched for causes of colors; the others were more focused on the effects of colors, like J.W. Goethe. Since XVIII through the XX century dynamic search for the comprehensive color order system, an umbrella system of laws of color harmony has been visible. Overall color theory, history strives to find the laws of harmony and aesthetics in color schemes, but after decades, even centuries of discussion, agrees and disagrees, we can now agree then there is nothing that can be for sure considered as an absolute law. So we can talk about guidelines and principles, but not the laws [9].

Nevertheless, color harmony is based on the following main focuses. The first focus is definitely the relationship between hues, and the second character has value and saturation of colors. So, there are definitions of the color harmony as a balanced relationship between complementary hues. J. Itten (from Bauhaus) strove to replace subjective principles, and therefore non-scientific, with objective principles of color harmony that can be taken as absolute truth. He stated that the balance between complementary colors is the first principle of color harmony [10]. Furthermore, Schopenhauer was also interested in this topic finding a relationship between color and its light-reflectance. Although he admits, the light-reflectance of colors is not a function of their area, he concludes that it does illustrate the way we sense value differences between pure colors. Josef Albers has also influential thoughts about colors. He stated that true understanding of colors comes from an intuitive approach to studio exercises. He stressed instability, the relativity of perceived colors as well as the power of visual training. But he admits, although his starting point is basically the subjective character of color harmony principles that even in this unstable field there are effects that can be predicted and controlled [1]. The visual experience is not a part of the theory, it is paramount. It determines how we perceive colors. There is an enduring assumption, or a hope, that those elusive, timeless, and absolute laws of pleasing combinations of color really do exist and await discovery.

4. DEFINING COLOR HARMONY

Harmony is a condition that follows when two or more different things are sensed together as a single, pleasing experience. Harmony is complete, continuous, and natural. It is intuitive; everything is in a balance. Consequently, color harmony appears when two or more colors are sensed together as a single. A key characteristic of harmonious coloring is they are effortless, natural. Each color senses naturally in its relationship to the other. No color is out of place. Goethe: "harmonious compositions seem to belong together according to our senses" [8]. A single color is not pleasing on its own, it is the relationship between the colors in composition to each other that creates color harmony, not the colors themselves. J. Itten said that "harmony is the joint effect of two or more colors" [10]. Harmony is more pleasing than chaos, but not necessarily more interesting or exciting.

Design concepts also may exploit (un)beautiful, starching, aggressive, even disturbing color combinations. Dissonant combinations of colors play a significant role in the design. Therefore, the more comprehensive term in design is color effects, instead of harmony. This term also includes color harmony as a traditional idea that represents pleasantness in color combinations. A second way of making color effects in design is the

so-called visual impact [9]. It is affected by color choices and combination of the visual flair of design. A successful color combination is realized in terms of goals, it is not possible to define color combination as harmonious or dissonant, but it is more appropriate to talk about the successful or unsuccessful color combination. The most important questions before making a color combination in the design are what to achieve? Whether it is for shock value or there is a need or an idea of high visibility, or suggestion of luxury, or wish to startle, excite, disturb, or to even evoke association.

The old laws of harmony are antiquated, but still fresh and valid and therefore useful as a starting point. No laws of color harmony are comprehensive, and no single factor determines it. The aspects of color compositions: hue, value, saturation, spacing intervals, completeness; all that contribute to harmonious effects. All this considered, it is possible to generate color harmonies that transcendent historical theory, individual taste, current trends, and cultural bias. In literature about design principles, colors and harmony there are some rules that can be called for design rules for successful color combinations. This is how we have defined them based on previously cited literature [1,9,12]:

1. Creating intervals between apparently incompatible colors run them into pleasing combination. Introducing colors that are a series of intervals between the two creates a visual bridge; a connectedness that responds to the human need for order.

2. Colors in a complementary relationship are physiologically satisfying. Goethe's phrase "completing colors," is a reminder that the eye finds equilibrium in the presence of three primaries. The eye is more comfortable at rest than at work, and comfort is pleasing.

3. Coloring is also harmonious when a single hue is used in a variety of values or saturation, as monochromatic schemes; or as analogous combinations, which contain two primaries but not the third. A range of values does not have to extend from the extremes of light and dark to be pleasing, nor does it have to be arranged in a linear progression.

4. Even intervals of value are harmonious; middle values are harmonious; Equal values in different hues are harmonious. Intervals of value will be seen as harmonious as long as steps are equidistantly spaced (almost invariably chosen as more preferable). It is true that middle values are often selected as preferable over their much darker or lighter variations. First, hues of close or equal value can be pleasing when they are used as carried colors against a contrasting darker or lighter ground. Hues of close or equal value also create elegant harmonies without a contrasting ground when no image is intended.

5. Color compositions tend to be most successful when the overall level of saturation is relatively constant. A relatively constant level of saturation does not mean that all colors are at the same level of brightness. Complex compositions that include different levels of saturation call for a studied balance between vivid and muted elements. Bright and dull elements are composed together to create a single, cumulative effect that is brighter or more muted. When a general level of saturation has been established, any atypical element is disruptive. A single pure color inserted into a muted palette will pop forward.

6. Color compositions in which two or more hue families compete for equal attention are often less successful than those with major-minor hue relationships. The much complex coloring has an additional characteristic. There is a dominant hue family; most often a group of analogous colors; this principal theme is enlivened by smaller areas of complementary or near-complementary colors.

7. Dissonant coloring can be dynamic and exciting — not pleasing perhaps, but certainly, a way to draw attention. When the guidelines of color harmony are deliberately ignored, the result may startle or repel, but it may also be memorable. Unpleasing colorways have their own strengths. — Visual impact

8. High impact color can be used to direct attention. An area of brilliant color set in a more muted palette injects an element of surprise into a composition. The strongest images are created by the high-value contrast alone, a graphic power that requires no hue. The addition (not the substitution) of brilliant color to an already powerful image does not change the strength of the image. Instead, it affects the amount of time it takes to capture the viewer's attention. Colors that are both hue-intense and light-reflecting, like a strong tint of red-violet, or a saturated yellow-green, have an eye-catching immediacy.

9. A textured surface (or the impression of one) engages more of the senses than an area of flat color. Broken color, suggesting texture, invites a tactile response as well as a visual one. Fragmented color responds to the human need for connection to the natural world.

Naturally, it is not possible and therefore not necessary to have all these principles in the same composition in order to achieve a harmonious color combination.

5. COLORS IN USE IN INDUSTRIAL ARCHITECTURE

As we set the basic color theory which is valid in general, here we are going to examine the presence of such cases in architecture.

Firstly the appearance of color effects in architecture is going to be established, specifically on the façade of buildings. Our focus of examination as already has been described are buildings from industrial architecture family. We used for discussion only buildings that have in use clear and visible hues of colors, so that all buildings that use, as dominant and only idea, too dark and too light tones (shades from white via gray to black) as well as all buildings using various tones of nonspecific natural colors of raw materials such as wood, metal, etc. have been excluded from discussion.

Our intent is to discuss buildings that have brave, outstanding usage of colors and therefore color combinations in architecture. The final goal is to find laws, more adequately principles of using colors in industrial architecture.

We started this analysis as an architectural analysis, examining structural elements of architectural composition such as volume, surface (façade) and point (detail). We were able to group all examined buildings in three groups that have specific and mutual different characteristics. The first group of buildings is characterized by color(s) applied on whole volumes in three-dimensional architectural composition. In the second group are buildings that use color(s) on the façade as two-dimensional composition and in the last one are grouped buildings that use color(s) just in architectural detail(s).

5.1. Colored volumes

Figures 1 and 2 represent the first group of buildings. The manner in which authors use colorings in this group as seen from these photos is as follows: most common is the usage of only one hue, which is contrasted with neutral other volumes in a composition that is used as a neutral background such as dark grey, white, etc. Also, there are possible combinations of two combined more or less equally dominating hues (Fig.1a) or a multiple-

Fig. 1 a) KP Alazraki Corporate Building, Mexico (ph. *Mito Covarrubias*); b) Stoby Winery, North Macedonia (ph. credits: *Aleksandar Radevski & Viktorija Stavrik*); c) Wildspace, United Kingdom (ph. *Tim Crocker*)
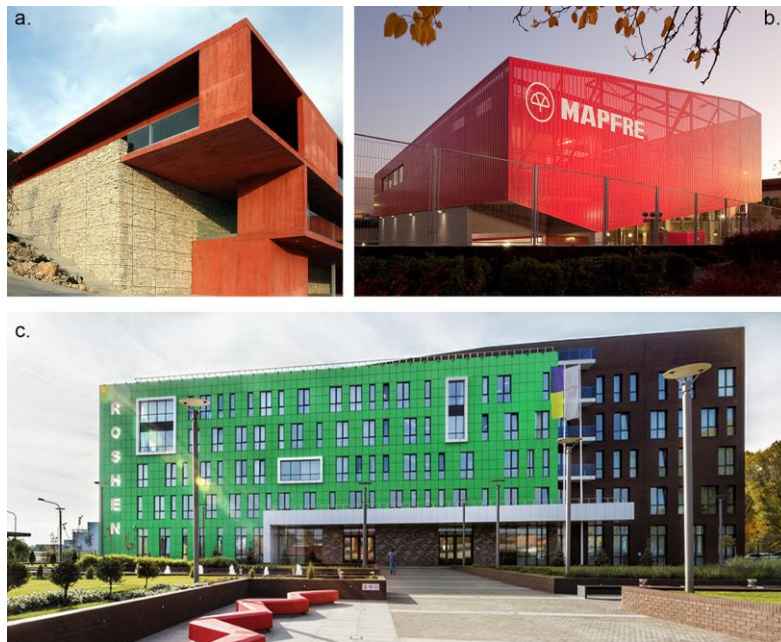

Fig. 2 a) Pago de Carraovejas Winery, Spain (ph. *José María Díez Laplaza*); b) Mapfre Automobile Services, Spain (ph. *Miguel de Guzmán*); c) Confectionery Factory Roshen, Ukraine (ph. *Oleg Stelmah*)

color combination (Fig. 1c). Single hue usage is not necessarily characterized by the monotone surface, but it is possible to use a combination of the several tones of the single hue, that from a distance act as a single color. The color choice is usually outstanding; highly contrasted to other parts of the building and the background. When using colors in this way, the highlighted volume is usually clearly defined and formed so it stands out not only by color but also by form. Color choice: Sometimes architects use corporate colors to strengthen the visual identity of the company (Fig 2a) that is now visualized through the building, but as well it is possible to use colors that are connected to the function (Fig. 2b – color of the wine in the winery), also color code can be used for nonverbal communication (way-finding) to make differences between separate parts of the buildings (Fig 1a and 1c).

Examining the presence of the named principles of color effects in this group of buildings is presented in Table 1.

5.2. Color(s) on façade sequence

Fig. 3 a) Docks in Aviles Port, Spain (ph. credits: *[baragaño]*); b) Fournitures Select, Canada (ph. *Steve Montpetit*); c) Umur Printing, Turkey (ph. credits: *Nevzat Sayin*)

The second group of buildings uses coloring at the level of the surface. Here, the design concept is in a two-dimensional sequence of composition that is applied in the envelope of the building. It cannot be necessarily connected with the size and shape of the volume(s) of the building and other parts of the composition — openings, etc. We found several ways of making composition, using one color with several tones of the same color (Fig. 3b and Fig.4a), or using two or more distinctive colors that are combined

(Fig. 3a, 3c, 4b). It is almost impossible to create a visually pleasing composition, but not using neutral tones that are used to calm down the composition. Sometimes those are panels of light color incorporated into the sequence of facade composition (Fig. 3a, 3c) or areas of window openings are used, or even other material that is contrasted to the vibrant-color surfaces (Fig. 3b, 4a, 4b). Table 1 systematizes the presence of the color harmony principles in this group of buildings.

Fig. 4 a) Urban Solid Waste Collection Central, Spain (ph. credits: *Vaillo + Irigaray*). b) Pcital Gardeny, Spain (ph. *Jordi V. Pou*)
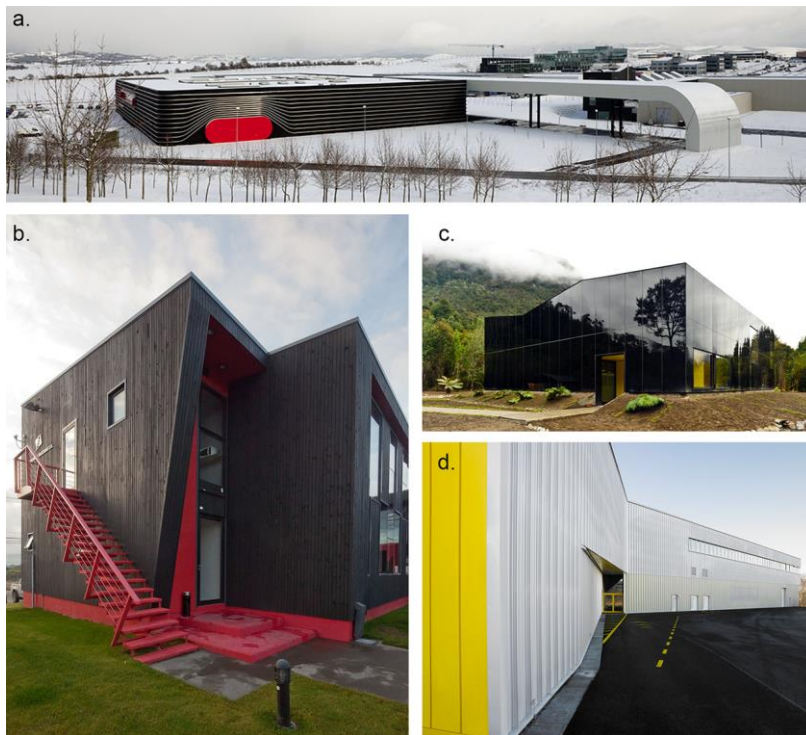

Fig. 5 a) Epsilon Euskadi, Spain (ph. *Francisco Berreteaga*); b) CPT Office, Chile (ph. *Juan Eduardo Sepúlveda Grazioli*); c) Glacial Water Bottling Plant, Chile (ph. *Cristobal Valdes*); d. North Laser Centre, Germany (ph. *Martin Schlüter*)

5.3. Color in detail

In this group are buildings where color is used as a detail, usually to highlight a particular part of the building. Those are most frequently entrances or some other interesting parts of the building. It serves as a focal point of the composition so it is more usual to use saturated high-impact colors that are distinctive even from greater distances despite the size of the colored area (usually not very large) rest of the building is designed as a neutral basis, black and white, as much as shades of gray. Compositions do not use more than one main color. Functionally, this also can be corporate colorized. The usage of color harmony principles in the third group is also systematized in Table 1.

Table 1 Examination of the color harmony principles used in the presented architectural design of the industrial buildings

	Color scheme associated with corporate brand colors	Princ. 1 Intervals & Harmony	Princ. 2 Complementary colorings	Princ. 3 1-2 hue of various values or saturation	Princ. 4 Even interval of values or even values of hues	Princ. 5 Saturation & Harmony	Princ. 6 Major and Minor themes	Princ. 7 Dissonant colorings	Princ. 8 High Impact colors	Princ. 9 Textured surfaces
Colored volumes										
Fig. 1-a	●		●				●		●	
Fig. 1-b				●	●	●			●	
Fig. 1-c								●		
Fig. 2-a	●								●	
Fig. 2-b	●								●	●
Fig. 2-c			●			●	●			
Color(s) on façade sequence										
Fig. 3-a		●		●	●		●			●
Fig. 3-b				●	●					
Fig. 3-c								●		
Fig. 4-a				●					●	
Fig. 4-b		●						●		
Color in detail										
Fig. 5-a	●								●	
Fig. 5-b	●								●	●
Fig. 5-c									●	
Fig. 5-d									●	

6. DISCUSSION

Here all examined buildings will be integrally discussed, irrespective of to which group they belong. This is because there is no clear evidence that way of applying colors on building envelope influences the rules of color harmony. With the exception of the last group that particularly uses a single principle of making color effects successful (so-

called use of high-impact color), the other two groups cover the whole spectra of color harmony principles named above.

It is possible to combine architectural analysis with the analysis of architectural objects as a simple graphical experience, the image, as one of the typical visual art forms, because discussed elements of design are primarily an artistic component of an architectural design. Only on the secondary level, those forms are connected with some logical function. Or not. There are examples of both cases. Firstly, color choice, if it is not chosen as a corporate brand color scheme, which is the case in several examples (see Table 1) or as an association for the function, is a purely artistic decision made by the authors. Architectural design is certainly not pure art, but also a functional form. Although sometimes it seems different, architects are more than usually conditioned in their own decision. Sometimes, it is a matter of investors' affinity, availability of materials for usage, quality of built materials, etc.

Principle 1: Intervals and harmony. - No matter how unlikely a color combination may seem at first, a series of intervals can establish a kind of order that the eye accepts as logical. Creating a series of intervals between unrelated colors is a principal way in which they can be transformed into a harmonious grouping. A series of visually logical steps between any colors are inherently pleasing. In the first case this is present (Figure 3-a), there is a combination of two hues that are not complementary, and the composition is amended with neutral intervals in the light and grey areas. Color with usage, red and blue are intentionally used as an association for the metal industry – red as the color of the coating against rust, blue as a cold color of metal products. Creating intervals between unlikely elements respond to a recurring problem in design: how to achieve a good result when forced to work with colors that seem at first to be hopelessly incompatible. Similarly, in the second example (Fig 4-b) here had been employed multiple hues that are not complementary nor close to each other, green-violet – orange, but here yellow spaces of the lower saturation are used to make a pause, an interval for the sequences of contrasting colors. It works together with a secondary level of surface that is used as underline in a similar light-yellow tone, and in the composition is used as a neutral background.

Principle 2: Complementary colors - Historically, color harmony has always been related to the relationship between hues, especially between complementary colors. Complementary schemes are commonplace in various kinds of designs and their applications, so as in contemporary architecture. Red and green, in our analysis appears in two examples, which is good enough to conclude that this old idea is still applicable and visually interesting. The first example is a corporate building (Figure 1-a) that uses the corporate red-green color combination on the façade. Although the color choice is not accidental, the composition does not bring any tension, but a sense of completeness. The second example (Figure 2-c) uses complementary colors at different levels. Here, unlike the first case, there is one dominant color (green) while the image is completed with the detail of the street bench (in red color) in front of the building. This is an excellent example when a tested recipe for success is used "in the last moment" is making the balance. The complementary-color theories of color harmony are supported by the visual experience at the most fundamental level.

Principle 3: Values and Harmony - The principle is used in three of our examples that can be seen in Figures 1-b, 3-a, 3-b, 4-a. While examples at Figures 1-b and 4-a employs small scale intervals, excluding extremes, brightest and darkest tones, in composition whole areas of the same hue tend to meld into a single color. Balance in the composition

in the first case is achieved with an additional neutral entity (grey basis), while in the second case large dark window area contrasts the intense color. In both cases, there is a change in a three-dimensional form that contributes to composition. On the other hand, in the case of examples in Figures, 3-a & 3-b intervals between color(s) are more apparent, which do not allow to be seen as a melted image. Each value is one entity and works as a single in the composition. When the two-dimensional composition is interesting enough, the overall form of the building is very simple.

Principle 4: Intervals & Harmony - This discussion continues the previous one. The same examples that employ the different values of the same hues are used with the even intervals, making the even distances, so the pleasing composition is made with the sense of order despite apparently chaotic and random disposition of the panels. (Figure 3-b)

The principle of equality of values (visible in Fig 4-b) tends to prove the idea that despite the image lacks the "forward and back" impression, associated with the contrast of dark and light, but the presence of many colors offers a different kind of interest and liveliness.

Principle 5: Saturation & Harmony - A muted color appears greyed or dirty, and recedes when it is included in a composition of brilliant colors. This appears in Figure 1-b and similarly in Figure 2-c. Both cases serve as examples where a different level of saturation allows brighter colors to come forward gradually, creating a softer impression rather than a sharply graphic one. It has been argued that muted colors are naturally more harmonious than saturated colors because the eye is at rest in the presence of muted color. This idea, too, fails the definition of harmony. Brilliant colors in combination are exciting and muted tones are calming, but neither is inherently more harmonious than the other. Only the relationship between colors creates color harmony, not the colors themselves. Harmonious compositions are possible with colors at any level of saturation.

Principle 6: Major and Minor Themes - The eye's need for equilibrium in the multi-chromatic composition is easy to achieve if there is even a slight difference between the dominance of colors. The example in Figure 1-a gives the advantage to the red color dominance that is more saturate while in Figure 2-c, by size green color dominates. Although they are in both cases, complementary colors, an additional level of successful composition is in this way achieved. Similarly, the example in Figure 3-a, a small advantage is given to red gamma over a blue in order to avoid the dilemma of color dominance. Here, this is achieved by the usage of more saturated and darker hues of red and less saturated and lighter hues of blue color.

Principle 7: Dissonant Colors - If color harmony is the "good child" of design, its polar opposite is disharmony or dissonance. Dissonant color-ways are disturbing. Colors do not seem to belong to each other. If harmony conveys balance and order, disharmony communicates imbalance, unease, edginess, chaos; a sense of things missing or "off-kilter". This principle, proven in the examples in Figure 1-c, 3-c, and 4-d, shows that this idea is not exclusively for pure modern art, but also applicable in applied fields of arts such as architecture. Although it is visually more disturbing than pleasing, this, nevertheless, makes an impression and draw the attention of the viewers. Although drawing attention is probably the main reason for employing this principle, there are also additional reasons for making such a design decision. So in example 1-c, different colors are used to visually divide different functional zones, or in the case of example 3-c, there is an association with the function of the building (a printing company).

Principle 8: High-impact colors - Some design problems call for colors or combinations that will draw instant attention. Only a few saturated hues are high-impact colors. Working

with high-impact colors is not necessarily an alternative to color harmony, i.e. color combination. Colorings can be both brilliant and harmonious. Brilliant colors used together without some intervening value contrast, are likely to vibrate, so although they draw immediate attention, they are poor candidates for good readability. Still, because these colors often contrast sharply with their surroundings, they are useful in communicating nonverbal warnings. It creates a point of focus that draws attention to itself and away from the composition as a whole. This case of making successful visual effect is visible on all examples of third of our examined groups (Figure 5). All mentioned above are found there; from drawing attention to nonverbal communication (highlighted details are usually entrances). Other examples that also employed this principle (Figure 1-b, 2-a, 2-b and 4-a) have the same goal, but a different scale. Here, attention-seeking is not from the perspective of one building, but from the whole area. Usually, those are industrial zones that are not frequently aesthetically pleasing and colorful.

Principle 9: Surface and harmony - Flat color has its own purpose and place in the design. Where broken color suggests nature, hard-edged, flat colors are dramatic and compelling. They have a discipline that responds to an entirely different human need: the need to control. A surface that is flat, sleek, and flawless offers an impression of precision. The decision to use flat or broken color is a small but meaningful side trip on the road to successful color choices. On the other hand, the natural world is rarely truly colorless. On the contrary, nature is a richly chromatic experience. The main characteristic of the colors of nature is that they are fragmented; they are better described as optical mixes, than as flat color. In our examples, although we did not choose to discuss natural materials and colors so that this principle looks like hard to demonstrate, in a few examples, there is evidence of the texture on the metal-panel surfaces that enriches the overall image. Appropriate for industrial architecture, in two of our examples (Figure 2-b & 3-a) architects use typical metal texture in the first one that is metal mesh in the second, its corrugated sheet metal. Although the colors in both cases are in absolute focus and dominate in the overall composition, this fine texture enriches the compositions in the way that large volumes of those buildings do not look lifeless and non-articulated. This is exactly how and why it is used in building in Figure 5-b. Natural wood is used for the surface that is not much articulated and the stress in the composition is not on it, but still, because of its size, there was the need to avoid making a simple flat surface, but the fully textured instead.

7. CONCLUSIONS

Now it is possible to conclude that despite the dilemmas about the subjectivity of color harmony principles, their universality and therefore objective character are proved. We have found all principles of color combination in the architecture of industrial buildings. This is to prove them as general and universal principles of aesthetics in the visual arts. The fact that in analyzing buildings we have found all given principles of color combining theory and we could not define any additional one is a contribution to the existing color theory that has been proven in this field of art (architecture).

Technological advancements over the last ten years have enabled the use of cheaper, repeatable and more durable materials than ever before, available in an extensive range of colors. This is probably the reason for the increasing appearance of colorful buildings, especially in industrial architecture. Large panel tables that have replaced cheap industrial

cladding popular, so many years brought in an industrial architecture new wave of positive energy into the aesthetics of industries. Nowadays, expressive specification of external color can also alter out pre-conceived ideas certain types of buildings should look; we have come to expect public buildings, in particular, to look in a specific way. The notion of a building as 'artwork on the landscape' can be encouraged by the use of interesting colors. In all projects, it is undeniably the color that has created these unusual dynamics.

To conclude, in the examined buildings, the most common usage of color principle that is most associated with contemporary aesthetic and architecture is creating a visual impact with high-impact colors. This is what seems most connected with the architect's vision of building aesthetics and the impression they want to create. Classical terms of color harmony, like complementary colors, even values of hues and even intervals of values are still not abandoned that speak in favor of everlasting principles or laws of harmony.

Much of the time, colors for buildings are chosen either to appeal to, or to attract the attention of, the widest possible audience. Following the guidelines for color, harmony does not guarantee that a particular color-way will have universal appeal. There is always an element of personal bias in color preference. But there is no way to escape the conclusion that a great deal of what we find harmonious originates as involuntary responses of the eyes and mind.

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UPOTREBA BOJA U ARHITEKTURI –
IZ PERSPEKTIVE INDUSTRIJSKE ARHITEKTURE

Ovaj rad se bavi teorijom boja i njenom primenom u arhitektonskom projektovanju. Još iz peripda Modernizma i modernističkih arhitekata, boje nisu bile u fokusu arhitekture i njenih autora. Zapravo, moderni pokret nas je učio da boja, posebno ona veštačka, je praktično zločin u arhitekturi i da na neki način pokazuje nedostatak ukusa. Ispitivanjem univerzalnih principa harmoneije boja, tj. međusobnog komponovanja boja, ovaj rad diskutuje o problemu i fenomenu korišćenja boja u savremenoj arhitekturi, koja ima svojih korena u modernom pokretu ali je evoluirala kroz tehnološki napredak, posebno u tehnologiji materijala. Industrijska arhitektura je uzeta kao primer, kako bi se suzilo polje istraživanja, ali i iz razloga intenzivne i kreativne upotrebe boja kod ovog tipa zagrada. Ispitano je nekoliko industrijskih objekata koji su sistematizovani u tri kategorije. Sve tri kategorije su analizirane u kontekstu primene generalnih principa haromenije boja. Zatim, diskusija fokusira prilagođavanje ovih principa upotrebe boja u arhitekturi kako bi sistematizovali ove principe, posebno važne za arhitektonsko obrazovanje i nove autore, projektante u arhitekturi. U zaključku je istaknuto da univezalni principi harmonije boja mogu biti primenljivi u arhitketuri, takođe, kao i u drugim vizuelnim umentostima.

Ključne reči: *industrijske zgrade, arhitketonsko projektovanje, harmonija boja, arhitektonska analiza, boje, fasadna artikulacija*