Color Contrast an Architecture Formation Style

Hafssa Al Omari and Rand A. Younis

Abstract—Color represents one of the formation elements in exterior surfaces, where colors form with each other according to different formation levels and different colors relationships. The contrast color relationship is considered one of the architecture formation styles. After searching in different studies, we found out a lack of references concerning the contrast color relationship. The study aim is to build theoretical framework to make obvious on how to use color contrast in architecture formation for mass and elevation of building, and to emphasize the properties of color and surface texture as one of the exterior surface formation style. To achieve the research aim, a description analysis study was used for (12) different projects belong to two movements, the post-modern movement and deconstruction movements. Conclusions have been declared, there are different levels in color formation in exterior surfaces, each level combined with special type of color contrast by using materials that different in color and texture.

Keywords—Color, contrast, formation, style

I. INTRODUCTION

With respect to color, we believe that we are self-taught. Of course, we learn from everything we see, but nobody can tell us how to formulate it and what theory we should adopt. Color is being the 'Autograph' of both the architecture and the designer who have created it. A generation of internationally celebrated architects had emerged who developed instantly recognizable styles as witnessed in the work of, for example: Renzo Piano, Jean Nouvel, Frank Gehry, and Michael Graves, in their hands on the architecture becomes an art object—a well-publicized sculptural event on the world stages. As we have moved into the new millennium, this transformation brought a new approach to architectural polychromy—one involving a tactile dimension as well as focus on visual effect. In this manner we have attempted to create a work of art on the scale of buildings, through defining the architecture formatted styles, by using color contrast relationship.

II. COLOR HUE, ACHROMATIC, MODELS

According to Graves, hue is the name of a color, value is the brightness or luminosity of the color, saturation is the strength, intensity, or purity of a color [1]. The human eyes can distinguish among 10,000 color type. It perceives them through their qualities of saturation, brightness and hue. In accordance with various models, the chromatic circle is divided into three groups of primary colors, from which the other colors can be obtained. The first group comprises yellow, red and blue, which when mixed form the other colors. The second comprises yellow green and red. The third group comprises magenta, yellow and cyan. The resulting colors from mixing the primaries are known as secondary colors: green, violet and orange. Tertiary colors are formed from mixing the primary and secondary colors. In line with human perception those colors of the spectrum between red and yellow are known as warm colors, while cold colors are those that range between blue and green. But for white, black and gray they are achromatic colors; and they have no color, despite being perceived as colors. As regarding to achromatic colors, those will always be part of a gray scale, a continual modulation from white to black [2]. Psychologists have attempted to explain our perception of color using simple graphic models. Most of these representations have deliberately ignored the physical composition of light in terms of its wavelength, and it has concentrated instead on psychological and phenomenological aspects of color. Attempts to classify or specify individual colors by dividing, scaling and numbering each of the three dimensions above which have resulted in useful methods of color notation offered for example by the Munsell System (1905), the Ostwald system (1916), and the Natural Color System( 1979) [3].

III. COLOR FORMATION LEVELS IN EXTERIOR SURFACES

To understand the color use on exterior surfaces, it is needed to analyze the formation of elements on them in terms of color applications. On this basis, a classification is composed of four main parts:

A. The Figural Uses of Color

In this category colors is applied on the facade to decorate in two dimensions. Floral or geometrical figures are formed on the surfaces by means of paint coatings or other materials such
as glass or ceramic mosaics.

B. The Uses of Color throughout the Compositional Elements

Each element of the facade is colored separately. Columns, pediments, frames, doors, window sills, balconies and cantilevers are distinguished in different colors than its background. Those elements of the facade are accentuated. Usually all the same elements of the facade are represented by the same color.

C. The Uses of Color throughout the Large Surfaces

In this case the surface is divided into large parts, horizontally or vertically in terms of color compositions [4].

D. Material Truth and Surface of Color texture

Another important factor is a color’s material Truth. In 1849, J. Ruskin (1819-1900) anticipates part of the modern architecture ideal. Which defends the pursuits of the color material and structural as “truth” in architecture. He declares that color outdoors is lawful if it can be perceived as painting and renounces to imitate textures of building materials. He believes that painting “slices the work into two parts and levels, one less durable than the other, which is extinguished as times, goes by and leaves building, unless it has noble qualities, naked and undecorated”. Those colors that are able for the architecture correspond with the construction material color itself, in its natural state, involving a wide range of shades and avoiding the possible falsity of the painting. Ruskin also declares that the true colors of the architecture are the natural stone ones, and I would like to see them thrive as much as possible. This is the fair and true way to build” [5]. As Lois Swinoff implies color can both build form and transform by material choices’. She declares that: “Contemporary architecture is served by new materials, the titanium used by frank Gehry is a kind of skin of which reflects sunlight off his sculptural forms [6]. Rasmussen states that: “It is obvious that there is an inexplicable connection between material and color. We do not experience color independently but only as one of several characteristics of a certain material” [7]. The spaces we design are -of course- not made of color alone-or even colored light. In facts we deliberately contrast areas of color with those of natural materials- timber, stainless steel, glass, concrete (polished and rough), the honed surface of smooth plaster the shine of a chromed finish, the various textures of different stones. In addition to the richness of such juxtaposition, the colored area itself also has its own kind of materiality: its surface texture, its characteristics of luster or absorption [8].

IV. COLOR CONTRASTS

Contrast can be used to identify objects or surfaces. The junction of surfaces which have a different color may allow the junction to be marked and identified. The main means of achieving contrasts are through: Differences in color tones (contrasts in chromatic) differences in saturation (contrasts in color intensity), differences in brightness (contrasts in degree of luminosity). Acknowledgement of color contrasts contributes decisively to predicting color effects appropriately and to implementing a design objective. When combining colors, it is often effective to use several different contrasts, which arise when there are clear differences between two or more colors. Contrast effects exist between objective color properties, as well as between subjective color effects. We distinguish the following color contrasts [9].

A. Chromatic Contrast

Chromatic contrast results from combining chromatic colors. It is most clearly apparent when three or more pure-hued, highly saturated colors come together. The less similar the hues are, the more pronounced and stronger the effects of the contrast are. The greatest possible dissimilarity, and therefore the most pronounced contrast, results from combinations that are located far apart from each other on the color circle, such as yellow, red, and blue.

B. Light-Dark Contrast

Light-dark contrast appears in the difference between colors in relation to their degree of lightness. It is most clearly seen when combining the achromatic colors black, white, and gray. Light-dark contrasts can be made using combinations of chromatic colors, as well as using colors of the same hue, yet with different degrees of lightness values. These are called nuance contrasts. Contrasts in lightness are ideal for creating spatial differentiation.

C. Chromatic–Achromatic Contrast

A chromatic-achromatic contrast results when chromatic and achromatic colors come together. The degree of prominence of chromatic-achromatic contrasts depends on the intensity of hue and on brightness contrast. In a color combination, white weakens, and black increases, a color’s luminosity. The polarity between highly intense hues and achromatic colors plays an important role as a signal in the artificial world of signs, such as pictograms. Chromatic-achromatic contrast is a principle widely used in interior design. White and gray nuances are particularly applied as a neutralizing element and used in association with chromatic hues. Very pure and highly saturated colors, when interacting with a chromatic color, generate intense impressions and spontaneously stimulate attention [10].

D. Complementary Contrast

Complementary contrast can be seen where there is a relationship between two colors that are as different as possible. Each color has only one complement. The relationship between complementary colors can be most clearly perceived in pure and highly saturated colors. They are located diametrically opposite one another on a color wheel and produce a neutral gray when mixed. Every complementary pair has its own special features. Yellow–violet for instance is not only a complementary contrast, but also the strongest light-dark contrast; orange–blue also is the most pronounced cold-warm contrast [11].
V. THE COLOR USE IN BUILDINGS SERVES IN MANY WAYS

Colors in architecture have multiple aesthetic and functional applications. Warm colors can be used to reduce the scale and size of large spaces, making them more intimate. Cool colors visually enlarge a space, making it less confining. Colors can be used to differentiate, contain, unite, equalize, and visually enlarge a space, making it less confining. Colors can be used to modulate a building’s appearance to bring it into harmony with its surroundings, make a building appear pleasant or oppressive, correct proportions, eliminate monotony, and establish individuality among like buildings or building elements [12].

VI. THE APPLICATION

To achieve the research aims, description analysis study was used for (12) different projects belonging to two movements, the (post-modern movement- Michael Graves projects) and (Deconstruction movement - Frank Gehry projects)

The Graves chosen projects:
4) Walt Disney World Dolphin Resort Hotel, 1987-1990; Renovation 2004, United States[16]
6) North Hall, Drexel University, 1997 – 1999, Philadelphia, PA, United States[18]

The Gehry chosen projects:
7) Neuer Zollhof, located at Neuer Zollhof, 1998[19]
8) Experience Music Project /Science Fiction Museum and Hall of Fame (EMP/SFM), 1999[20]
9) IAC Building, located in the vibrant Chelsea neighborhood. Completed in 2007[21]
10) Peter B. Lewis Building, 1999-2002 Located at Case Western Reserve University in Cleveland,[22]
11) MIT Stata Center/Ray and Maria State Center, for Computer, Information, and Intelligence Sciences, 2004[23]
12) Vitra Design Museum, Weil-am-Rhein, Germany, 1990,[24]

VII. CONCLUSION

A. General results

The study reaches to a specific way of formation color by using color contrast relationship. (See table 4). The study achieves its goal by examining the theoretical work on different architecture projects, and the results show: The color contrast help to achieve difference between, elements, massive, and dividing surfaces to horizontal and vertical parts or different forms, and it is also help in ornamentation within geometric shapes. The use of color contrast through the texture of the color surface has a role in forming the exterior surfaces.

B. The results and conclusions of samples for the practical study

The results of the description analysis study show that most of the chosen projects for the architect Graves was used primarily "The use of color throughout the large surfaces" through using cold-warm contrast mostly in red and blue color. Results also show that the architect Frank Gehry has special formation style in using color contrast in his projects. For all his chosen projects, was used primarily "The use of color throughout the mass" (the deconstruction movement depend on dividing the building into many parts) through using chromatic-achromatic contrast.

The results and conclusions for the first parameter/Color Formation Levels: shows a clear similarity using color formation levels in the projects of each architect, but there are difference between the two architect in the way of using these levels. Graves project's shows clearly the dominate of "The use of color throughout the large surfaces", while "The use of color throughout the mass", Graves used it in most of his projects for the purpose of differentiate the main entrance, as an attraction point for the fewer, or using it to focus on the stair mass. While "The use of color throughout the compositional elements", Graves work for the purpose of attraction for some of the secondary entrance of the building "The figural use of color" appears clearly in Graves work in forming the elevations of tourist's hotels. While "the use of color throughout the mass" dominate most of Frank Gehry works, and this goes well by the deconstruction movements. But "The use of the color throughout the composition elements" has been used by Gehry in a limited way, on using specific color in framing windows, or to give importance to the roof of building. Gehry uses "The figural use of color" in a limited way in a simple and organizes designs. "The use of color throughout the large surfaces", was not used by Gehry in any ways.

The results and conclusions for the second parameter/Color Contrast: shows a clear similarity in using different types of color contrast in the projects of each architect, but there are difference between the two architects in the way of using different types of color contrast. Graves projects shows clearly using different types of color contrast. In "The use of color throughout the massive" cold-warm contrast used in a way that matches the aspects of color perception in architecture space, the warm color advance to the foreground, while the cold color recede into the background. In addition Graves used achromatic-chromatic contrast in differentiate masses of the building. Studies shows chromatic, very pure and highly saturated colors, when interacting with a chromatic color, generate intense impressions and spontaneously stimulate attention. Graves used chromatic contrast to focus on entrance.
Studies show, chromatic contrast using pure colors are very striking, vibrant, and powerful. They attract attention. While "The use of color throughout the composition elements", chromatic-achromatic contrast, cold-warm contrast, and light-dark contrast, has been used to emphasize a certain element like window, column, door. But for "The use of color throughout the large surfaces", it appears clearly by using light-dark contrast, studies show that dark color appears heavy in weight, and elements of light color, appears light. Graves use for "The figural use of color", the complementary contrast, which generate intense impression and spontaneously stimulate attention, as in Dolphin hotel. Gehry's projects appear mostly, by using chromatic-achromatic contrast, because of using bright achromatic metal panels in covering the surfaces, beside the chromatic color metal panels.

The results and conclusions for the third parameters/Material Color and Surface Color texture: Similarities appear in both architect works in using different materials. As we can see rough, smooth texture materials in the exterior surfaces of their projects.

**TABLE 1**

<table>
<thead>
<tr>
<th>WALT DISNEY WORLD DOLPHIN RESORT HOTEL</th>
<th>Material</th>
<th>Color Contrast type</th>
<th>Part of Architect Works</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel and fiberglass painted peach wood</td>
<td>Smooth</td>
<td>Complementary</td>
<td>Wall</td>
</tr>
<tr>
<td></td>
<td>Rough</td>
<td>Light-dark</td>
<td>Column</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cold-warm</td>
<td>Balconies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chromatic-achromatic</td>
<td>Roof</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cold-warm</td>
<td>Vertical</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cold-warm</td>
<td>Balconies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cold-warm</td>
<td>Door</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cold-warm</td>
<td>Column</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cold-warm</td>
<td>Window</td>
</tr>
</tbody>
</table>

**TABLE 2**

<table>
<thead>
<tr>
<th>LAUREL HALL EXPANSION, NEW JERSEY INSTITUTE OF TECHNOLOGY</th>
<th>Material</th>
<th>Color Contrast type</th>
<th>Part of Architect Works</th>
</tr>
</thead>
<tbody>
<tr>
<td>aluminum, stucco</td>
<td>Smooth</td>
<td>Complementary</td>
<td>Wall</td>
</tr>
<tr>
<td></td>
<td>Rough</td>
<td>Light-dark</td>
<td>Column</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cold-warm</td>
<td>Balconies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chromatic-achromatic</td>
<td>Roof</td>
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<tr>
<td></td>
<td></td>
<td>Cold-warm</td>
<td>Vertical</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cold-warm</td>
<td>Balconies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cold-warm</td>
<td>Door</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cold-warm</td>
<td>Column</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cold-warm</td>
<td>Window</td>
</tr>
</tbody>
</table>

**TABLE 3**

<table>
<thead>
<tr>
<th>EXPERIENCE MUSIC PROJECT</th>
<th>Material</th>
<th>Color Contrast type</th>
<th>Part of Architect Works</th>
</tr>
</thead>
<tbody>
<tr>
<td>metal skin</td>
<td>Smooth</td>
<td>Complementary</td>
<td>Wall</td>
</tr>
<tr>
<td></td>
<td>Rough</td>
<td>Light-dark</td>
<td>Column</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cold-warm</td>
<td>Balconies</td>
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<td></td>
<td></td>
<td>Chromatic-achromatic</td>
<td>Roof</td>
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<tr>
<td></td>
<td></td>
<td>Cold-warm</td>
<td>Vertical</td>
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<td></td>
<td></td>
<td>Cold-warm</td>
<td>Balconies</td>
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<tr>
<td></td>
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<td>Cold-warm</td>
<td>Door</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cold-warm</td>
<td>Column</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cold-warm</td>
<td>Window</td>
</tr>
</tbody>
</table>

**Color Formation Levels**

- **Complementary**
- **Light-dark**
- **Cold-warm**
- **Chromatic-achromatic**
- **Chromatic**
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Table 4

<table>
<thead>
<tr>
<th>material</th>
<th>Color Contrast type</th>
<th>Color Formation Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth</td>
<td>Complementary</td>
<td>The Use of color</td>
</tr>
<tr>
<td></td>
<td>Light-dark</td>
<td>throughout the mass</td>
</tr>
<tr>
<td></td>
<td>Cool-warm</td>
<td>balconies</td>
</tr>
<tr>
<td></td>
<td>Chromatic-achromatic</td>
<td>door</td>
</tr>
<tr>
<td></td>
<td>Chromatic</td>
<td>column</td>
</tr>
<tr>
<td></td>
<td></td>
<td>window</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Horizontal comp.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vertical comp.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Horizontal vertical</td>
</tr>
<tr>
<td></td>
<td></td>
<td>wall</td>
</tr>
<tr>
<td></td>
<td></td>
<td>column</td>
</tr>
<tr>
<td></td>
<td></td>
<td>balconies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>all</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>The Figural Use of Color</th>
</tr>
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<tbody>
<tr>
<td>part</td>
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<td>all</td>
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<table>
<thead>
<tr>
<th>The Chosen Projects</th>
</tr>
</thead>
</table>

Grave's Projects

St. Coletta School

Laurel Hall Expansion,

Walt Disney World

U.S. Department of

Paul Robeson Center For

North Hall, Drexel

Gehry's Projects

Neuer Zollhof

Experience Music Project

IAC Building, located in

Vitra Design Museum,

MIT Stata Center /Ray and

Peter B. Lewis

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The Role of Architectural Vocabulary in the Creativity of the Rhetorical Structure of Form in the Islamic Architecture

Dr. Hafsa Ramzi Al-Omari\textsuperscript{1} \hspace{1cm} Anwar Mishal Shareef\textsuperscript{2}

Abstract— The strong impact of architectural form lies in its rhetorical structure in which vocabulary is the main element that raises the expressive and the aesthetic value. The current study aims at examining the vocabulary mechanisms and potentials that could be adopted by the architect in formal buildings system, the role of the vocabulary in the rhetorical structure within the linguistic and the architectural studies is examined from different aspects in order to explore treatments made using an analytical view of the palaces and mosques buildings elements in Islamic architecture as a model that reflect the high perfectness and mastering in creating rhetorical structure. It is assumed that there are designing treatments for the architectural vocabulary to acquire additional characteristics and functions. The study is divided into three parts the first of which deals with the importance of vocabulary within the rhetorical structure linguistically and practices adopted to enhance the vocabulary aesthetic in the linguistic structure. The second part deals with the importance of vocabulary within the rhetorical structure architecturally through reviewing mechanisms in the architectural studies. The third part, is a detailed study of formal structure vocabularies in Islamic architecture to sum up with the role of vocabulary through mechanisms that could be adopted on the form and other on the method of arrangements.

Keywords— vocabulary, formal structure, Islamic architecture.

I. DEFINITION OF VOCABULARY:

LINGUISTICALLY, vocabulary is defined as the main item used in linguistic structure. It is the aesthetic means used in forming the literary products as colors are means for painting, tones are means for music and stones are means for sculpture\cite{1}. In architecture, vocabulary represents a distinctive unit that forms a part of the architectural form (a part that belongs to a more comprehensive whole)\cite{2}. It is the main unit that compose the structure of the architectural form. Each type of architecture is represented through group of vocabularies (elements) and their related characteristics with differences in dealing with such elements through various impacts of such type of architecture that could help in formulating the architectural form to realize the distinctive \cite{3}.

I. PART ONE:

1.1 Importance of Vocabulary in Structuring Rhetorical

Ibn Sinan states that vocabulary (word) is the technical tool that make up literary text. Sayed Qutub emphasized the importance of selecting words to be arranged within a certain pattern\cite{4}. He stated that Quran vocabularies are full of images, feelings, colors, pattern and impacts\cite{5} that provide them with the highest aesthetic quantities and if they are to be replaced by other ones, they will lose their eloquence. Al Jurjani recognized the vocabulary's aesthetics despite emphasizing the whole pattern of phrase stating that they are the base for preferring speech included within the rules of rhetoric\cite{6}. He said: "Your knowledge should be equal to that knowing each of threads and each piece of the carved woods and each stone in the building". Al Jurjani stressed that words should be adorable and simple, suitable to other words\cite{7}.

I.1 Processes and Mechanisms of Vocabulary Structure in Language:

Grammarians found that there are various methods adopted by the creative writer to make the vocabulary more flexible in literary creation. Linguists put fundamental procedures and possibilities for using the vocabulary correctly. Wherever vocabularies are used to indicate their original meaning, they will be suitable and ordinary but the creative modification will reveal their poetic and aesthetic values. Changes of the vocabulary (letter within the vocabulary) have been modified. Al Jurjani noticed that deviation of using the vocabulary is based on phonetics to obtain voices harmony as illustrated:

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{fig1.png}
\caption{Deviation Of Using The Vocabulary}
\end{figure}

Al Samaraee in his Word Rhetoric in Quranic Expression stated that each of Quran vocabularies are intentionally used and each of the rhetorical phenomena is deliberately employed. He reviewed some of the changes for the vocabularies, Allah says: (إن المتقين في جنات ونهر) (As for the Righteous, They will be in the midst of gardens and rivers). The word (نهر) (river) is used in singular form indicating a plural one. In another position, Allah says: (ذلك ملكا لى نعيم) (That what were seeking after) where letter (ي) is omitted from the word (نيعيم) (seek after) to achieve a purposeful artistic expression in accordance with Quranic writing and to increase

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