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An Acquaintance with Lighting in Cinematography In Terms Of Applying It in Architecture (Properties and Methods)

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Abstract: *Architecture and cinema, the first one is a kind of art related to beginning of life and human being in this globe and the latter is the product of modern era and 20th century in addition they are the significant branches of art that virtual communication plays an important role on them in perception and transmission concepts and contents. Acquaintance with dimensions of this communication lead to exploring new ways in coherence between these two fields.*

In comparison with architecture, cinema plays an important role in applying lighting techniques. Lighting up the movie environment is just one usage of lighting in cinema whereas we can refer lots of them, such as change the meaning of shot, transmitting concepts(like sorrow, happiness, submission, fear, warmness, coldness, etc.) and distinguishing a scene. A director or cinematographer for achieving these goals uses different properties of light like intensity, distribution, color and movement, in addition by manipulation of these properties has created the methods which assists in giving a meaning to an environment like selective visibility, composition, revelation of form, establishing the mood and reinforcing the form. Our purpose in this paper is studying these techniques in order to utilize them in architecture for maintaining visual perceptions and transmissions. On the whole we reach this point that most of the lighting techniques in cinema can be borrowed and utilized in architecture for better visual transmissions.

Keyword: *Lighting, cinematography, architecture, properties, methods*

1. Introduction

It's interesting to note that among all the living creatures, its birds and men's sight which plays the preponderating part; you know how we are at a disadvantage with the other senses- we hear fairly well, we smell extremely badly and our sense of taste is almost atrophied. But on the other hand, our sight puts us relatively to the animals in a fairly satisfactory position, though it is not the best [1]. Sight gives us twice as much information about our surroundings than does hearing, which is our second most relied upon sense. Around the world, in every culture, fear of darkness is one of the three most common fears [2]. In our everyday lives as human beings, we go around illumination that can vary from the minimum amount on a moonlight night to a maximum of an overhead sun in the Sahara desert, so lighting and illumination is inseparable element in human beings life. It seems that cinema in comparison with other branches of visual arts get along with this element better and maintain it through ages and given the fact that it has much in common with architecture in terms of visual perceptions, we didn't focus on aspects of this similarity as much as needed according to the amount of studies have been done in this field. Studying and expanding the domain of this similarity leads to creating new methods that can be applied in both.

Undoubtedly lighting is the most powerful of the theatrical design elements that reveals what needs to be seen. Its intensity determines how well an object is seen, its direction dictates in what way it is seen, and its color

controls the object's color. Lighting is the cinematographer's primary tool to convey story and emotion. Lighting directs the viewer's eye to the important parts of the frame. ―Bad‖ lighting can direct the viewer's eye to the wrong place or to nowhere specific at all. ―Good‖ lighting takes the viewer's eye and directs it exactly where the cinematographer wants it to go.

Lighting should be used to convey mood that either complements the mood of a given scene or plays counter to it, depending on the requirements and artistic decisions of the creative team. There's really no right or wrong in lighting, as long as there's motivation and thought behind what you do. Are you shooting an interview with a CEO (chief executive officer)? Maybe a little bit of contrast on the face in the ―Rembrandt‖ style will give the CEO a classic, yet strong appearance. Are you shooting a violent fight? Maybe stage it under harsh glare of fluorescents to play counter to the dramatic action and accentuate a kind of harsh realism. Are you shooting a romantic encounter? Try the classic warm candle-lit feel with soft ―keys.‖ Are you shooting product shots (often called ―table top‖)? Better make sure you're working those specular highlights to define the shape and texture of the products [3]. Given the strong impact of lighting, the lighting designer must be a good collaborator with fellow designers as well as with the director. He must be acutely aware of the presence of light: its quality, color, intensity, shadow and direction, warmth or coolness, texture, and movement [7].

2. Light

Everything is perceived through our eyes, is due to light; or, more specifically, the interaction of light with the objects in our world. Without light, the entire world would be nothing but blackness. More than any other, our sense of sight is what leads us through life. We cannot see light itself. Photons and light rays are invisible to human eye. We can only see the effect of light after it interacts with objects in our world-and light interact in three ways when it strikes an object: it is *reflected*, *refracted*, or *absorbed* [3]. Light can be thought of as lots of little balls (photons, to give them their proper name) that arrive from the sun, or a light bulb, or some other source. These balls bounce off the objects around us, the trees, cars, humans, and so on, and some of them just happen to bounce in such a way that their path takes them from the object and through a tiny transparent window in our eye. Inside our eyes, these balls are collected and vision begins [4].

Light is not only an essential prerequisite and the medium by which we are able to see. Through its intensity, the way it is distributed throughout a space and through its properties, light creates specific conditions which can influence our perception [5] and it must be remembered that the role of lighting is not only revealing things, it also be used to create opaque, translucent, transparent scenery, transform the colors or the atmosphere of set and establishes mood.

2.1. Light quality

Aside from intensity and color, the greatest aspect of light that cinematographers have control over is its quality. Light quality is typically defined in two ways: *hard (directed) light* and *soft (diffuse) light*. To understand the difference, you have to look, primarily, at the attributes of the shadows created by the light source, specifically the transition point between light and shadow. A sharp, crisp, short transition between light and shadow is indicative of a hard light source. Hard lights create well-defined shadows; the transition is easily discerned. Soft light, on the other hand, creates a diffuse, long, and wide transition between light and shadow. The transition is more gradual, and the shadows are much less defined. A very soft light source might even cast no shadow from the subject [3].

It must be remembered that both hard and soft light have the same physical properties. Hard light consists of light rays going in straight lines from a very small source to the subject whereas soft light consists of the same light rays emerging from a larger source area going to the subject in straight line from a variety of angles [6].

Perception of the three-dimensional character of our environment involves processes that relate to our physiology and perceptual psychology. The shaping of our environment through light and shade is of prime importance for our perception of spatial forms and surface structures. Modelling is primarily effected using directed light. This has been referred to, but the significance for human perception must be analyzed. If we view a sphere under completely diffuse light we cannot perceive its spatial form. It appears to be no more than a circular area. Only when directed light falls on the sphere – i.e. when shadows are created, can we recognize its spatial quality. The same applies to the way it is perceived surface structures. These are difficult to recognize under diffuse light. The texture of a surface only stands out when light is directed onto the surface at an angle

and produces shadows. Only through directed light are we able to gain information about the three dimensional character of objects. Just as it is impossible for us to retrieve this information when there is no directed light at all, too much shaping can conceal information. This happens when intensely directed light casts such stark shadows that parts of an object are concealed by the darkness [5].

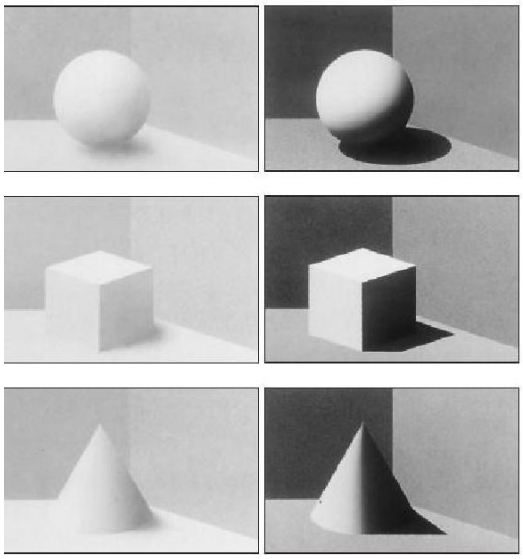

Fig. 1: left: soft (diffuse) light, right: hard (directed) light [5]

2.2. Light properties

The study of light as applied to stage lighting involves four properties: intensity, distribution, color, and movement.

2.2.1. Intensity

Intensity or brightness of light in a space, is the most obvious controllable element. The desired intensity is determined by the designer, achieved by fixture quantity and fixture brightness, verified through calculations, and possibly adjusted on-site using a control system if one is part of the project. The brightness of a space affects our expectations about activity levels and overall experience. High illumination levels usually signal high levels of activity, public spaces, and lower product costs (such as in open office plans, fast food, and discount retailers). Lower illumination levels are subjectively associated with reduced levels of activity, higher levels of service, exclusivity, and higher product costs (such as in private offices, expensive restaurants, and exclusive stores). As we have all experienced, brightness can also draw our interest and focus our attention. Theatre lighting designers use a follow spot to draw our attention to the main character on the stage and hold it there. Brightness draws our attention in an architectural setting, too. For example, research has demonstrated that when given a choice of turning left or right at a ―T‖ intersection, the brighter path is chosen 70 percent of the time or more. While light cannot replace signage, barriers, or architecture in controlling movement, we can use light levels to influence movement and the path that people take through a space [2].

2.2.2. Distribution

Most often we see light as it is reflected off various surfaces. How it is distributed onto these surfaces depends on the source's *direction* and *quality*—attributes completely controlled by the lighting designer.

2.2.2.1. Direction

The visibility of an object greatly depends on the direction of the light striking it. Light can strike an object from behind or from the front, or from one side or the other. In addition, it can come from a variety of heights. To clearly define the direction of a light source, one should specify direction (front, side, back) and height (in degrees). A change in lighting direction or angle can radically alter the perception of the size and/or shape of any form. Highlight and especially shadow are the best indicators of direction and angle. A theatre audience feels

most at ease with light coming from the natural direction of above and in front of the performer. Like intensity, direction has a strong effect on mood and atmosphere [7].

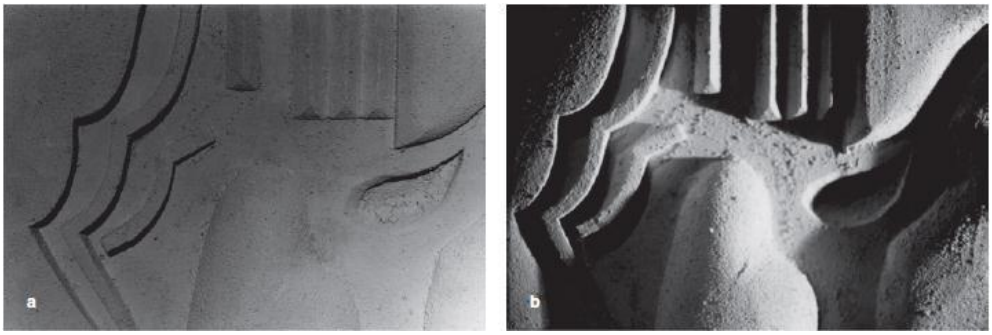

Fig. 2: Changing the distribution of light on a highly textured surface can produce amazingly varied effects.
A: A low-relief sculptural form lit with a single source from the front.
B: The same form lit with two side-angle sources of different intensities or colors.

2.2.2.2. Quality

The concept of quality is closely related to texture and depends on a source's intensity and diffusion. A highly diffuse light tends to have divergent rays, whereas a less-diffuse light has coherent and parallel rays. Diffuse light is perceived as soft and lacking in intensity. More coherent light is harsher and more intense and creates harder edges. In its simplest form, texture in light is the product of a specific type of lighting instrument. Accordingly, one of the considerations in selecting a lighting fixture involves the textural quality of its light. Quality can be altered by adding diffusion filters to a light beam. Blatant texture can be created by introducing pattern into the beam in the form of a template, or gobo (A pattern, normally cut into a thin stainless steel plate, which is placed at the aperture of an ERS to project an image). Creative use of the direction and texture of light introduces highlight, shade, and shadow into the stage composition [7].

Fig. 3: Gobos help to create the atmosphere
A: shot from *Living Together*, part of *The Norman Conquests* trilogy by Alan Ayckbourn
B. Photo from San Diego State University's production of Steinbeck's *The Grapes of Wrath*. Directed by Nick Reid [7]

2.2.2.3. Brilliance

Another feature of directed light alongside its modelling effect is brilliance. Brilliance is produced by compact, point light sources and is most effective when applied with an extremely low proportion of diffuse (soft) light. The light source itself will be seen as a brilliant point of light. A good example of this is the effect of a candlelight in evening light. Objects that refract this light are perceived as specular, e.g. illuminated glass, polished gems or crystal chandeliers. Brilliance is also produced when light falls on highly glossy surfaces, such as porcelain, glass, paint or varnish, polished metal or wet materials. Brilliance can be a means of attracting attention to the light source, lending a space an interesting, lively character. When applied to the lighting of objects brilliance accentuates their spatial quality and surface structure – similar to modelling – because sparkling effects are mainly evident along edges and around the curves on shiny objects [5].

2.2.3. Color

The third property of light is its ability to transmit and reveal color. A forceful element in all areas of theatre design, color may be considered to be the most effective and dramatic quality of light. The use of colored light to enhance the mood of a scene is a common theatrical technique. The lighting designer may use color in a theatrically realistic way to convey time of day or atmospheric conditions; additionally, color choices may be heightened or exaggerated in order to stylize the look of a production. Colored light is commonly created through the use of filters. However, the beginning lighting designer needs to recognize that light sources have an intrinsic color that can vary greatly from one type of source to another. This difference in the **color temperature** of various light sources is a valuable tool for the lighting designer. The ability of colored light to alter the color of a surface it strikes adds to its potential as a powerful design element. Modification of the natural color of a scenic form or costume by colored light is a design technique unique to the theatre. Color modification and the additive mixing of colored light are two rather basic concepts of color as a quality of light that all designers in the theatre must understand [7].

2.2.3.1. Lighting color impressions

It is interesting to note that we also feel better on a sunny day in the middle of a cold winter. Red and yellow give us a cozy feelings, and this is probably occasioned by our mental stimulation with the occasion of the sun.

It's a strange fact that as color temperature increase toward the blue end of the spectrum, we don't necessarily feel warmer and we actually associate blue with cold conditions. Green has a refreshing quality, which is probably occasioned by the response of the eye which is at its peak with the green portion of the spectrum. We view black as a very somber color and associate it with the macabre. We generally associate white with coolness and a feeling of something that is quite unspoiled; it's interesting to note how disturbed we are by snow when it has become muddied, as the thaw sets in. from this short list of examples, it must become obvious that we can associate colors with a sense of stimulation of appreciation within the viewed scene, and many of the effects used in artificial lighting are based upon these feelings [6].

2.2.4. Movement

Although it is not an intrinsic property of light, movement is an extremely important characteristic of stage lighting. Besides the physical movement of a light beam, movement includes a change in intensity, distribution, or color that might be as subtle as a slow progression from predawn to daybreak or as blatant as a blackout. Although movement in light is often controlled by means of dimmers, theatre audiences have long been accustomed to physical light movement in the form of follow-spotting. More recently, physical movement from automated fixtures creates a strong visual impact. Careful use of automated fixtures to direct the audience's attention or create specific moods adds significant tools to the designer's palette. A lighting cue in the form of a shift from one ―look‖ to another encompasses movement. Movement can take and control focus. Movement alters composition [7].

3. Functions of Stage Lighting

The basic obligation of stage design is to give performers *meaning* in their surroundings, providing an atmosphere in which the role may be logically interpreted. Through the manipulation of light in all its aspects—intensity, color, distribution, and movement—the lighting designer assists in creating an environment for the play by achieving *selective visibility,* by providing appropriate *composition* and *revelation of form,* and by establishing *mood* and reinforcing *the theme* [7].

3.1. Selective Visibility

The actor must be seen in order to be heard. *Visibility* cannot be defined as a fixed degree of brightness or an established angle of distribution; rather, it is the amount of light needed for a moment of recognition deemed appropriate for that point in the action of the play. Good theatre lighting guides the audience's eye; selective visibility establishes focus. ―To see what should be seen‖ may mean revealing the mere silhouette of a three-dimensional form, the solidity of its mass, or the full decorative and textural detail of all surfaces. Although visibility certainly relies on intensity, contrast also plays a significant role in achieving good stage visibility.

3.2. Composition

Stage composition begins with the scenic design and floor plan, is further defined by the placement and the movement of actors, and is completed when lit by the lighting designer. More than any other design element, light directs the audience's eye and controls what is and is not seen. Points of visual focus are determined by the blocking and the action. Because light possesses the additional quality of incredible fluidity, stage composition can be altered with relative ease. The study of art can reveal much about composition. For instance, cast shadows and highlights significantly influence the composition of Edward Hopper's *Morning Sun* although light can have composition of its own (projected patterns or light beams in haze), its chief function is to selectively reveal actors and stage forms in the proper relationship to other forms and to the background. Here the complexity of compositional lighting begins. Compositional lighting means lighting one form and not another; controlling shadows, keeping them off the background; lighting three dimensional forms to make them look three-dimensional (not as easy as it seems); and other similar problems, including the most significant—lighting the actor.

3.3. Revelation of Form

A form can be revealed in a variety of ways. The appearance of scenic forms as revealed by light can be varied greatly by the simple movement of several dimmers. However, the three-dimensional form of the actor must be shown in a consistent and predictable manner while moving through space—something best not left to chance. Even in the proscenium theatre, with the audience viewing principally from the front, light is focused on the sides and backs of actors in order to enhance their dimensionality. However, form is often best revealed if the various sources of light playing on it have some degree of contrast—either in intensity or color. Altering form is one of light's greatest powers.

3.4. Establishing the Mood

After reading the script, researching, and talking with the collaborative team, the lighting designer begins to get a feeling for the overall mood of the play. A color impression comes from the mood, as does a suggestion of the intensity and the distribution of light. While color often is equated with mood, the other three qualities of light also have great influence. Bright light supports comedy and a happy mood; high angled distribution, creating long shadows and deep eye sockets suggests tragedy; and movement influences the pace of action (Figure 14-12). Occasionally, a lighting designer allows concern for mood or atmosphere to override all else, sacrificing other functions, including visibility. It should be remembered that mood is only one of five equally important light functions; to slight any one for another must be a conscious decision made by the entire design team and director. Although an abstract mood or a dramatic mood is more impressive and eye-catching than is the realistic visibility of a conventional interior setting, realism is far more difficult to accomplish with light.

Fig. 4: Mood Created Through Lighting Left: Talley's Folly by Linford Wilson at Madison Repertory Theatre Right: Broadway production of Movin' Out. Directed and choreographed by Twyla Tharp

3.5. Reinforcing the Theme

The lighting of a scene must reinforce, or support, the action. The visual expression of theme depends on the collaborative team's interpretation of the script. To tell the story most effectively, the lighting designer must always keep the playwright's message foremost in mind. As always, lighting the actor is key, but thematic lighting requires a concern with compositional revelation of the thematic forms of the setting as well. In the more extreme theme-oriented or documentary plays of Bertolt Brecht, the theme is often stressed by showing the play under a clear, uncolored wash of light, thereby eliminating the theatricality of stage lighting. Projections that take the form of propaganda pictures or subtitles reinforce the theme visually [7].

5. Conclusion

In this paper first we thoroughly studied and discussed the light and properties of it in the field of cinematography and categorized the properties in four groups: intensity, distribution, color and movement, then through studying these properties we have abstracted the points which can be applied in architecture as below:

1- Intensity: by the intensity we can influence movement and the path that people take through a space.
2- Distribution: a change in lighting direction or angle can radically alter the perception of the size and/or shape of any form.
3- Color: enhance the mood of a scene, convey time of a day or atmospheric conditions, heightened or exaggerated in order to stylize the look of a production are the key functions of coloring light, in addition red and yellow give us a cozy feeling, we associate blue with cold conditions, green has a refreshing quality, we view black as a very somber color and associate it with the macabre, we associate white with coolness.
4- Movement: can take and control focus and alter composition.

Finally in the second part we have discussed the method which lighting designer applied in creating an environment through the manipulation of light properties. These methods are: selective visibility, composition, revelation of form, establishing the mood and reinforcing the form.

As we have seen most of the techniques which lighting designer applied in creating an environment and giving the meaning to a space can be applied in architecture too. Both are applying the lighting for improving visual perception and transmission. Expanding the connection between cinema and architecture can develop new areas in this field and surely this review will be relatively brief and, of necessity, incomplete. We hope to give an overview of the different research areas concerned with visual perception in architecture and cinema.

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