Digital Color as a Paradigm for 3D Modeling

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Abstract. *Johannes Itten wrote in the 1920's that seven distinct possibilities exist for the contrast of color: "Each (is) unique in character and artistic value, in visual, expressive and symbolic effect...together these constitute the fundamental resource of color design" Itten (1973). In either the digital world or in the world of painting, there has never been a more profound statement about color arrangement. Of Itten's seven contrasts, the contrast of hue, value, and saturation, taken together have become a standard description of digital color today.*
As most projects reach the final stage of presentation, color selection becomes a possible paradigm for their development.
It is customary to leave the selection of color to the end of a project — if time permits, then the colors are changed to make the project "appear better", otherwise the selection of color is put in a pile of "good intentions" — overlooked. .Proposed here is an alternative, a method of selecting color "up front". Student projects are used to illustrate just how a building, or even a group of buildings may be better illustrated if one bases a presentation on a successful and understood work of art.
The use of a painting as a source of color is proposed as a specific way of working. Most libraries contain an abundance of examples. The web, too, has many paintings; painters generally have more experience at putting colors together than architects and usually do not mind if their color ideas are borrowed, Done right, the result can be a happy merger of idea, emotion, and color, providing another paradigm for studying digital modeling.

 Keywords. *First color; second: painting; third: Itten fourth: design.*

Selection of a Color

This paper proposes a method of developing a project presentation based on first considering the projects color. This is not a logical beginning for a design, there are better ways to start. Only after one has explored ideas, both with oneself and with a potential client; after one has developed the thought processes applicable to a project's solution to the point where they are beginning to crystallize, then there is a need for many drawings, drawings both for yourself and for your client/customer. I believe at this point it is logical to think of color. If you feel you may begin earlier, then that is your prerogative. Any project if it has depth, if it is to have emotion, should suggest a color to its

designer — this is but a logical analogy for many of the qualities that distinguish greatness in architecture from just another building — as an architect it is for you to define that quality — color can be your servant.

Every good building should bring to mind a color; Goethe made that point when he painted 3 rooms in his home, one in each of the primary colors in order to establish a mood for each room Goethe (1971). Your design, if it has meaning by this point should suggest a color to you, for color can be a window for you into the depth of the building, a preliminary way of expressing what is only dimly hinted at in this point of the development — but it should be there, if the building is later to have substance.

Primary Colors

We are do our designs on computers today, and computers have only three primary colors: red, green, and blue. These are not the traditional subtractive colors that we were probably taught in school, they are the additive colors of the computer screen. When two are mixed they produce the secondary colors: cyan, magenta, and yellow; by mixing all three the computer produces white; when they are absent the screen is black; steps between have numbers, not names for this is the age of the computer.

Now you must find appropriate computer colors for your project. They are not different from what artists and architects have worked with for centuries, though there are more of them on the screen, the phosphors of computers have added considerably to the number of colors available; particularly colors of intense saturation.

Red

If you search first for an appropriate dominant color, red is probably the color that first comes to mind. Red is after all the color of blood, of Christmas and of St Valentine; it might not be appropriate for a school, or a hospital, red is the color of both hell and of love; it is in itself a contradiction.

Red has many meanings; it is the symbol for mars and war, the color of London buses and of paprika. It is the distinctive color of cardinals in the air, in baseball, and in the Roman Catholic Church. We speak of red tape when we imply difficulty, we talk of both the Red Guard and the Khmer Rouge; all the world knows the meaning of a red cape in a bullfight; yet Little Red Riding Hood is one of the most beloved children's classics.

Red is the color of fire and flame, but to the Chinese it stands for happiness; they use it traditionally in weddings. The painter Kandinsky called it "the sound of trumpets"; there is nothing soothing or calming about red.

If you select a red you must decide if it is warm or cool, for it has both properties. The Venetians made it warm as did the American Indians or the Russians in their Flag. But it often appears cool as in scarlet, crimson, maroon, or raspberry. Red has many faces, you must decide which one you want to use, for it is never neutral.

Green

Green is often thought of as the complement of red, even though magenta is its true complement in the six part computer color chart (magenta is frequently interpreted as a cool red). Green is a soothing color, the color of trees and grass; it might better calm the sick than stir the multitudes for it has a calming quality. Green is the color of peacocks and parrots, of pine trees and tractors and copper roofs. A green light always means go, in any language. When Dorothy arrived in Frank Baum's Oz it was to the Emerald City that she went — a green paradise.

On television green is the color of both the Grinch and Mr. Greenjeans. Computers first started graphic design by using green screens and green phosphors for they were controllable, available, and relatively cheap, we first saw the digital world as green. In America green is the color of money.

If you choose a painting that is based on green

tones, then you are dealing with neutral colors that do not excite, that that are fundamentally soothing and like a tropical bird it depends on high saturation for its effect. You avoid the emotions that are inherent in either a red or a blue. As warm tones green can be very calming; as cool tones it develops an almost mystic quality. Like selecting red as a basic color, if you choose to work with green, then you must decide if it is to be a warm green or a cool green, for the effect will be very different.

Blue

Blue is the color of the sky and the sea; it is all about us, yet there are many different blues and they have many aspects from nobility to serenity. You will find no blue in the caves of Lascaux. Theroux (2003). If you receive a blue box from Tiffany & Co. you suspect it of containing something special.

One of the blues is indigo, a color called suiboko in Japan. Theroux (2003). This has become common the world over, due to the proliferation of blue jeans as pants; a fact that gives the color a different and perhaps cheaper meaning than it traditionally held.

Ultramarine blue is everyone's favorite paint; yet in the Renaissance it was very expensive and treasured as a color more precious than gold. It is occasionally called leyden blue or cobalt blue and comes from lapis lazuli, a complex silicate stone of a rich blue color from which it is made. Prussian blue is very different in character, a difference that is difficult to put into words. Then there is Turnsole blue, or solsequiem, a blue that was used historically in illuminating books.

What appears blue is not always blue; witness the Peacock Room, which has a great deal of blue, but is not in itself blue; or the Blue Rider — blue mostly in name. Caeruleus according to Virgil is the color of the sea. Blue is said to be the color of absinthe Theroux (2003), or of gin. Then there is blue in music: the blues.

"The deeper blue becomes, the more urgently it summons man towards the infinite, the more it arouses in him a longing for purity and, ultimately, for the supersensual…. Becoming the infinite penetration into the absolute essence – where there is, and can be, no end." Theroux (2003).

Selection of a Painting

Once you have an appropriate color in mind, a logical next step is choosing an appropriate painting based on that color; this is no easy task. A trip to a good art gallery, a museum, or maybe a public library is suggested. The web, too, has become an excellent source of paintings. One must consider well the choices for there are many; painters generally know colors and color combinations better than architects, for that is their profession. In the case of a contemporary painter this is at best a two-way conversation, the painter discovering considerable about the color contrasts that he has used while you are able to explain something about the painting that the artist not before seen.

To create a mood with color is a difficult design challenge, often one that is foreign to the architect. If that is the case, then there is nothing wrong with borrowing a color scheme from an artist. Most artists (though certainly not all) would be flattered, usually they appreciate your taking their color advice. Be certain you are not violating any copyrights here, for you will need a color copy of whatever you decide to use as a painting. While colors are never copyrighted, paintings and books frequently are.

Determining the color groups

Copying the colors of the painting is probably a step that everyone would like to omit; this is admittedly a tedious process. Most good paintings have many more colors than five or six, in fact they usually contain hundreds if not thousands of colors; likewise an architectural project in detail will contain many colors. But they are coordinated, made minimal and organized into color groups.

Unless you are coloring Times Square, a circus or a gypsy camp, you will seek to organize and minimize your colors. So you begin with the basic five or six colors. Then, as you refine your design, variations of them suggest themselves; but the pattern is set and the source, your chosen artwork, should be ever present.

Color Contrast

Contrast is at the heart of appreciating both art and architecture; we see because of the contrast that exists between the parts of any composition; without contrast we cannot distinguish between those parts, we see only a totality. Contrast is the common thread that binds art and painting with any three-dimensional graphic project; it is what makes this paradigm possible.

Johannes Itten once said that there are only seven color schemes in all the world of art — only seven ways in which anything can logically be colored (Itten. (1973). That is truly a profound statement, for of all the thousands of seeming methods we have for coloring a rendering, if there are really only seven, then his is surely an idea worth examining. Itten says there are but seven means of color contrast: 1) contrast of hue, 2) light-dark contrast, 3) contrast of saturation, 4) cold-warm contrast, 5) complementary contrast, 6) simultaneous contrast, and 7) contrast of extension. The first three of these: contrasts of hue, lightness, and saturation, have become a standard definition of computer color, and the most logical method of identifying and selecting computer colors today. Hue is defined as the "color" of an object — the way red differs from green; light-dark contrast is familiar to everyone through black & white photography; saturation concerns the amount of pigment in a given color. The understanding of these three contrasts has become essential in today's color world if one is to understand and execute computer graphics of any design sophistication; the other four contrasts remain interesting but probably secondary. These

Figure1. The Barcelona Pavilion, by, Dipti Kulkarni

seven contrasts and their combinations remain the objectives on which all art is based — it is difficult if not impossible to find another contrast beyond this list.

Choosing Colors for a Rendering

Once a painting has been selected and a good copy of it is at hand the next part of this analysis can become tedious if you let it; one must determine the major color groups that exist in the picture — not every color for there are probably thousands of them, but five or six major areas of color that set the tone of the picture. Record these — match them exactly in a box on your computer.
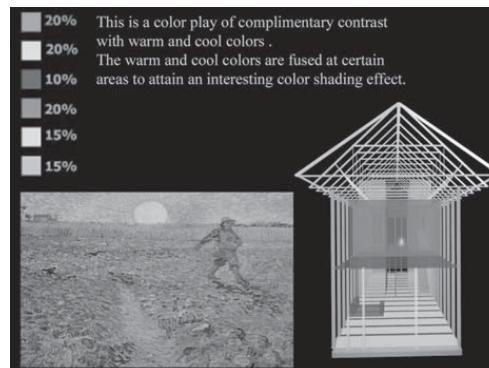

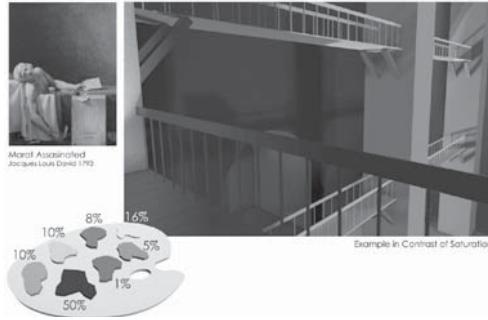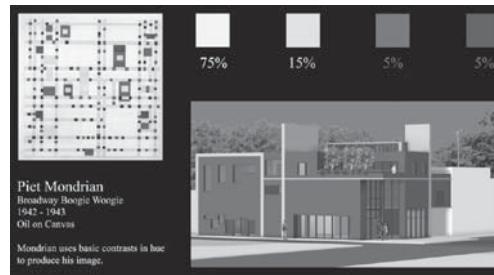*Figure2. A Painting by Vincent van Gogh, by Anindita Mukherjee*

Figure3. Variation on Piranesi's Prison, by Raghavendran Ramachandran

guish between the parts of a painting, as it is used in architecture to distinguish between the parts of a building, it is really a characteristic of seeing; without light-dark contrast we see very little. Illustrated is the Barcelona Pavilion as an example of a building that has gained considerably from consideration of mainly light-dark contrast.

Often there are other and frequently more interesting combinations of colors at play as one studies a painting. Just how they can be used in the architecture? This can be difficult to discover at times, but frequently worth the pursuit; this is perhaps among the most creative moments in the design process. While only value contrasts appear in a black and white reproduction, other more subtle contrasts are possible and increase the interest in the picture.

Then you can make a guess as what percentage of the picture they occupy. You do not want to take 2% of the picture you select, and make it 90% of your project. You needn't be accurate about this, it is not a scientific measurement but only a guess — yet it is an important one.

Determine the color contrast

It is essential to understand the color contrasts that the painter has chosen. Which of the seven contrast of Johannes Itten, have been used in the painting, can you identify them? The painter may not know that he has used Itten's contrasts at all, for he may well not have heard of Itten — if you have selected an historic painting he may have painted it long before Itten existed. But those contrasts will be there; they represent a universal truth. They have always been there, Itten only identified them. Often there is more than on of these contrasts used in a given painting; light-dark contrast, or contrast of value is commonly used to distin-

Apply the colors to the surfaces of the building

As you develop the presentation of your project, use these colors as the basis of your presentation — not just for the building(s) but for the ground, the water and the sky as well. Sure any project has more than the five or six colors you have probably identified in the painting; but then you were looking for major color groups. Figure 2 illustrates an example of a painting by Vincent Van Gogh which naturally contains a great many colors, yet the student has broken this into only 6 major color groups for her original concept, later choosing other colors to enhance her rendering of the project. This seems a logical way to approach the complexity of color, moving from simplicity in which a general pattern of color is established; then elaborating on that scheme toward a full complexity, only after one has a firm base to work from.

Your project, as the artist's painting, probably has hundreds of colors in it when you consider all of the details, yet there are really only five or six major groups of colors in a good architectural project. The rest of the color, as in this painting, is in support of the central idea. Remember the color

Figure4. Mondian and the Rietveld House, by Tim Takacs

principles — when color is close it is saturated, when it is distant it is weak – de-saturated; you must make those color changes as the computer will not do that for you — yet. This has been attempted in the study illustrated in figure 3, where a de-saturation occurs as on moves further into the distance in Piiranesi's famous prison.

It is essential to define the percentage of each color in a given work of art; one only has to see what happens when that principle is ignored, as in figure 4, to understand why.

If one thinks of a design, large or small, as logically falling into approximately three parts: investigation, development, and presentation, then it is in that final third phase, presentation done by computer, that I recommend this procedure. Done right, the result becomes a happy merger of idea, emotion, and color. This is yet another paradigm for the study of digital modeling.

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